On the economic effects of inflation targeting and fiscal rules in developing countries

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ON THE ECONOMIC EFFECTS OF INFLATION TARGETING AND FISCAL RULES IN DEVELOPING COUNTRIES

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À mes parents, Bambe Lamtouin et Justine Goipaye
À ma famille
À ma tendre Gloria Dingao

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Résumé

Cette thèse examine quelques conséquences du cadre de ciblage de l'inflation et des règles budgétaires, particulièrement dans les pays en développement. Elle s'appuie sur des méthodes économétriques avancées comme instruments de test des hypothèses émises, examine empiriquement les mécanismes économiques sous-jacents aux résultats obtenus, discute les implications de politiques économiques des principaux résultats, et propose quelques perspectives de recherche futures. La thèse se compose de deux parties. La première partie examine l'influence de la politique de ciblage de l'inflation sur la performance du secteur privé dans les pays en développement (Chapitres 1 et 2) et cherche à savoir si le degré d'ouverture financière améliore l'efficacité du ciblage de l'inflation (Chapitre 3). Plus précisément, dans le Chapitre 1, nous examinons l'effet du ciblage de l'inflation sur l'investissement domestique du secteur privé dans les pays en développement. Nous trouvons qu'en favorisant une plus grande stabilité macroéconomique, le cadre de ciblage de l'inflation contribue à promouvoir les décisions d'investissement du secteur privé. Un autre résultat important est que l'effet favorable du ciblage de l'inflation est fortement atténué lorsque la banque centrale tend à dévier de sa cible d'inflation. Le Chapitre 2 étend le premier chapitre en examinant l'effet du cadre monétaire à un niveau plus désagrégé, c'est-à-dire sur la performance des firmes dans les pays en développement. Nous trouvons des résultats très similaires à ceux mis en évidence dans le chapitre précédent : le ciblage de l'inflation améliore la performance des firmes (mesurée par la croissance des ventes et de la productivité), l'effet étant atténué lorsque la banque centrale dévie de sa cible. Ces résultats ont une implication importante pour les pays en développement, qui sont en général sujets à de fortes instabilités macroéconomiques. Un cadre monétaire orienté vers la stabilité des prix, tel que le ciblage de l'inflation, peut non seulement contribuer à stabiliser l'environnement macroéconomique, mais également leur permettre d'accroitre la contribution du secteur privé aux objectifs de développement. Enfin, le Chapitre 3 examine dans quelle mesure l'ouverture financière peut contribuer à améliorer l'efficacité du ciblage de l'inflation, mesurée par les déviations d'inflation par rapport à la cible de la banque centrale. Nous montrons que la mobilité des capitaux, en disciplinant les politiques macroéconomiques domestiques, favorise la convergence

de l'inflation vers l'objectif annoncé, y compris dans les pays en développement.

La deuxième partie de la thèse examine l'impact des règles budgétaires et propose un indicateur d'efficience des dépenses publiques. Dans le Chapitre 4, nous montrons qu'en favorisant la discipline budgétaire, les règles budgétaires permettent d'accroitre la probabilité d'émettre des dettes en monnaie locale, ce qui réduit significativement la part de la dette en devises étrangères dans les pays en développement. L'implication principale de ce chapitre est que des cadres budgétaires contraignants, tels que les règles budgétaires, peuvent permettre non seulement aux pays en développement d'améliorer leur discipline budgétaire, mais aussi d'atténuer ce que la littérature économique appelle le péché originel. Dans le Chapitre 5, nous fournissons un indicateur permettant de mesurer l'efficience des dépenses publiques, c'est-à-dire la performance du secteur public dans l'offre des biens et services publics compte tenu des ressources utilisées. L'indicateur couvre un panel de 158 pays avancés et en développement sur la période 1990-2017 et inclut plusieurs dimensions du secteur public (éducation, santé, infrastructure, et administration), y compris les fonctions musgraviennes de l'État (allocation, distribution, et stabilisation). Nous examinons ensuite une série de déterminants des scores d'efficience calculés et montrons que la qualité des institutions, l'ouverture commerciale, et la productivité des facteurs sont des déterminants importants. Dans la continuité de l'analyse des déterminants de l'efficience des dépenses publiques, le Chapitre 6 montre qu'en favorisant la discipline budgétaire, les règles budgétaires permettent également de réduire le gaspillage dans l'usage des dépenses publiques, conduisant à une plus grande efficience des dépenses, y compris dans les pays en développement.

Mots-clés Réformes monétaire et budgétaire · Ciblage d'inflation · Règles budgétaires · Investissement domestique · Performance des firmes · Dette publique · Discipline budgétaire · Efficience des dépenses publiques · Pays en développement · Économétrie appliquée

Codes JEL: C2; E22; E3; E5; E6; F38; F61; F62; F63; H3; H5; H6

Abstract

This thesis examines some consequences of the inflation-targeting framework and fiscal rules, in particular in developing countries. It draws on advanced econometric methods to test our hypotheses, empirically examines the economic mechanisms underlying the results obtained, discusses the economic policy implications of our main results, and provides a series of perspectives for future research. The thesis consists of two parts. The first part examines the influence of the inflation targeting framework on the private sector performance in developing countries (Chapters 1 and 2) and investigates whether the degree of financial openness improves the effectiveness of inflation targeting (Chapter 3). More specifically, in Chapter 1, we examine the effect of inflation targeting on private domestic investment in developing countries. We find that by promoting macroeconomic stability, the inflation-targeting framework contributes to fostering private-sector investment decisions. Another important result we highlight is that the favorable effect of inflation targeting is strongly attenuated when the central bank tends to deviate from its inflation target. In Chapter 2, we extend the first chapter by examining the effect of the monetary framework at a more disaggregated level, i.e., on firm performance in developing countries. We find very similar results to those highlighted in the previous chapter: inflation targeting significantly improves firm performance (measured by sales growth and productivity growth), and the effect is attenuated when the central bank deviates from its target. These results have key implications for developing countries, generally subject to strong macroeconomic instabilities. A monetary framework geared towards price stability, such as inflation targeting, can enable them to both promote macroeconomic stability and increase the private sector's contribution to development objectives. Lastly, Chapter 3 examines to what extent financial openness may contribute to improving the effectiveness of the inflation-targeting framework, measured by inflation deviations from the central bank's target. We show that by disciplining domestic macroeconomic policies, capital mobility improves

the effectiveness of inflation targeting, i.e., the convergence of inflation towards the announced target, including in developing countries.

The second part of the thesis examines the impact of fiscal rules and provides an indicator of public expenditure efficiency. In Chapter 4, we show that by promoting fiscal discipline, fiscal rules increase the likelihood of issuing debt in local currency, thereby significantly reducing the share of foreign currency debt in developing countries. The main implication of this chapter is that binding fiscal frameworks, such as fiscal rules, matter not only for fiscal discipline, but also in controlling what the literature calls original sin. In Chapter 5 we provide an indicator for measuring public expenditure efficiency, i.e., government performance in providing public goods and services given the resources used. The indicator covers a panel of 158 advanced and developing countries over the period 1990-2017, and includes several dimensions of the public sector (education, health, infrastructure, and administration), as well as the Musgravian functions of the government (allocation, distribution, and stabilization). We then examine various determinants of the calculated efficiency scores and show that institutional quality, trade openness, and factor productivity are important determinants. Extending the analysis of the determinants of public spending efficiency, Chapter 6 shows that by promoting fiscal discipline, fiscal rules also help to reduce fiscal waste, thus leading to greater efficiency in public spending, including in developing countries.

Keywords: Monetary and fiscal reforms · Inflation targeting · Fiscal rules · Domestic investment · Firm performance · Public debt · Fiscal discipline · Public spending efficiency · Developing countries · Applied econometrics

JEL Codes: C2; E22; E3; E5; E6; F38; F61; F62; F63; H3; H5; H6

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Chapter 0

General Introduction

"We need to reflect on interactions between monetary and fiscal policies. When central banks have to use balance sheet policies extensively, there is an inevitable strengthening of the interplay between monetary and fiscal policies. This interaction works both ways." Lagarde (2020)

0.1 Background

The democratic decision-making process can lead to fiscal drifts or what the literature has called deficit bias, whereby governments deviate from optimal fiscal policy by overspending or running excessive fiscal deficits. The first drift comes from electoral cycles, during which governments tend to make fiscal stimuli before elections to maximize their chances of being re-elected, thus creating fiscal procyclicality and worsening fiscal deficits (Nordhaus, 1975; Brender and Drazen, 2005; Gootjes et al., 2021). Fiscal procyclicality may result from political factors, but may be accentuated by constraints on international financial markets, especially in emerging and developing economies (Bova et al., 2014). The second drift stems from the electoral competition: anticipating the possibility of being replaced, governments may be incited to reduce their successor's room for maneuver by overspending through the strategic issuance of public debt (Persson and Svensson, 1989; Alesina and Tabellini, 1990). The third drift stems from the common pool problem: since many decision-makers are involved in the budgeting process, each of them may be subject to pressure from, or dependent on, specific interest groups, and fail to internalize the current and future costs of their choices. This results in a high probability of spending and deficits as the number of decision-makers increases (Von Hagen and Harden, 1995; Velasco, 2000).

On the monetary policy side, the literature establishes that the discretionary regime leads to an inflationary bias, as the central bank tends to create inflation surprises to

support economic activity, given society's preferences about inflation and employment (Kydland and Prescott, 1977; Barro and Gordon, 1983). Moreover, government behavior does impact the conduct of monetary policy. The unpleasant monetarist arithmetic theory (Sargent and Wallace, 1981) states that a lax fiscal policy can lead to time inconsistency on the part of central banks, as governments running persistent deficits sooner or later have to finance their deficits through money creation, thereby generating inflation.[1] The important role of fiscal dominance in episodes of high inflation has been highlighted in numerous studies. Sargent (1982) refers to the excessive use of monetary financing of deficits as the source of German hyperinflation. Similar conclusions are provided to explain hyperinflation episodes in Argentina, Brazil, Peru, and Bolivia in the 1980s, or Zimbabwe in the 2000s (Kiguel and Liviatan, 1995; Coomer and Gstraunthaler, 2011). Experience also shows that inflation resulting from fiscal dominance has been particularly high in developing countries. This is mainly due to several structural characteristics, such as weak central bank independence, concentrated and unstable sources of tax revenue, poor tax collection procedures, asymmetric income distribution, more limited access to external borrowing, and political instability (Cukierman et al., 1989; Masson et al., 1997; Kumhof et al., 2010).

The main (potential) implication of the literature dealing with the interaction between fiscal and monetary policies is that central bank independence is not a sufficient condition to ensure price stability, but must be complemented by reforms aimed at ensuring the sustainability of public finances, such as fiscal rules. Conversely, to reduce deficits, fiscal rules need to be combined with a constraining monetary framework. As such, in the quest for mechanisms to influence policymakers' behavior and improve economic performance, the 1990s witnessed the emergence of new monetary and fiscal reforms due to surging inflation and growing deficits in many countries. Rule-based fiscal frameworks and inflation-targeting regimes have also emerged, and have now become popular tools for the conduct of fiscal and monetary policy in many countries, including in emerging and developing economies. Fiscal rules are long-lasting constraints on fiscal policy, which may be numerical or procedural. They may relate to debt, deficits, expenditure, or revenues, and are designed to "tie governments' hands" to ensure sound fiscal policy. Inflation targeting, meanwhile, involves the explicit announcement by the central bank of a quantitative level of

[1] A related analysis, the fiscal theory of the price level (Leeper, 1991; Woodford, 1995), considers that in a non-Ricardian regime, where the government is not committed to its intertemporal budget constraint, the return to equilibrium will be achieved through price increases, not budget surpluses. In other words, the government generates inflation to erode the real value of public debt.

inflation and its commitment to achieving this target, for instance by improving the transparency of its policy and strengthening its communication with the public. The explicit announcement of an inflation target enables the central bank to provide the public with a guideline for monetary policy stance. This may help to anchor inflation expectations and improve the credibility of monetary policy, a key factor in controlling inflation.

0.2 Inflation targeting and fiscal rules in developing countries

Experiencing high inflation and fiscal deficits in the 1970s and early 1980s, New Zealand was the first country to adopt an explicit inflation-targeting framework in 1990. The monetary regime was then adopted by other advanced countries, before being popularized in emerging and developing economies from the late 1990s onwards. Many Asian and Latin American countries directly affected by the 1997 financial crisis chose to target inflation shortly afterward. These include South Korea (in 1998), Brazil (in 1999), Mexico (in 1999), Thailand (in 2000), and the Philippines (in 2002). More recently, Kazakhstan, Russia, and Ukraine have also joined the growing group of inflation-targeting countries, between 2015 and 2017, reflecting their willingness to address macroeconomic instabilities and promote a more transparent economic environment. For example, the National Bank of Kazakhstan and the Central Bank of Russia chose to target inflation in the wake of the 2014 oil crisis, which led to the collapse of their currencies. Today, around 40 countries are operating under an inflation-targeting framework, including 18 emerging economies and 6 low-income countries. Of the almost 40 inflation-targeting countries, all operate under full or formal/hard inflation targeting, which refers to the date declared by academics as the effective adoption date of the monetary framework, while soft inflation targeting refers to the date declared by the central bank itself. Under a hard inflation-targeting framework, the central bank is formally committed to achieving its inflation target (Carare and Stone, 2006), while in a soft inflation-targeting framework, the central bank's response to inflation deviating from the target is slower. The inflation-targeting regime remains of interest in many developing economies. For instance, in Africa, Zambia, Mauritania, Burundi, and Angola are planning to adopt an explicit inflation-targeting framework shortly.

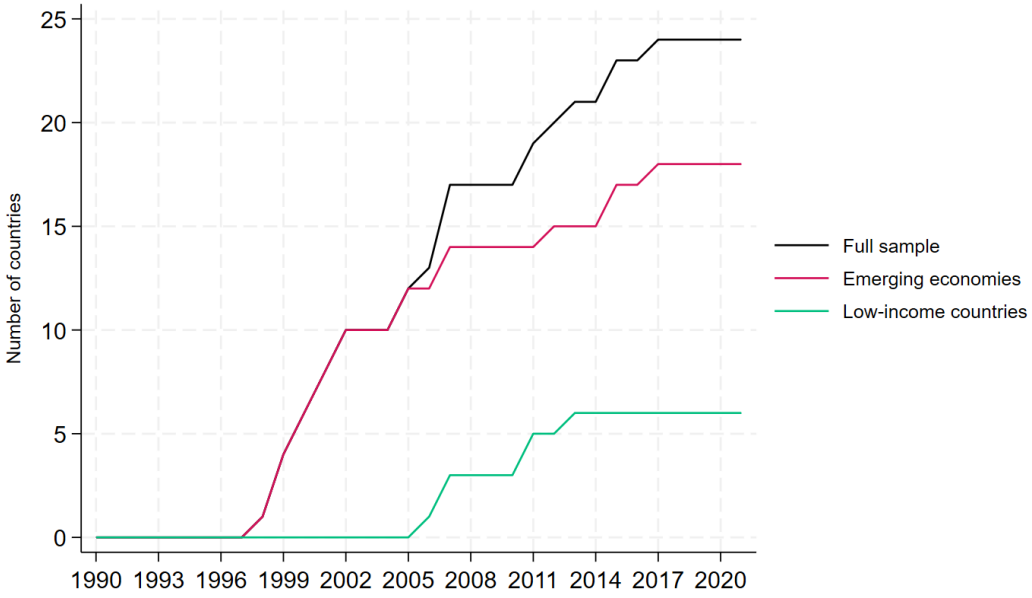
Fiscal rules also became increasingly popular from the 1990s onwards to promote greater fiscal discipline, thus reflecting governments' desire to promote the credibility

of domestic policies. The increase in the number of countries with fiscal rules in early 1990 was largely driven by supranational rules within the EU, which include a deficit limit of 3% of GDP and a debt limit of 60% of GDP introduced by the Maastricht Treaty in 1992 and revised through the six and two-pack legislation. In the 2000s, many emerging economies also introduced national rules as part of other fiscal adjustment packages or reforms aimed at reducing excessive deficits or procyclical spending due to the volatility of natural resource prices. Similarly, many low-income countries introduced supranational rules in the 2000s. According to the latest IMF Fiscal Rules Dataset (Davoodi et al., 2022), about 105 countries had national and supranational numerical fiscal rules at the end of 2021, including 22 emerging economies and 49 low-income countries. 53 countries had supranational rules, including 30 emerging and developing economies. Deficit rules, which set a ceiling or numerical target for the budget balance, are the most popular, implemented by 92 countries in 2021. Debt rules, which set an explicit limit on outstanding public debt to ensure convergence towards a debt target, were implemented by 84 countries in 2021, followed by expenditure rules (55 countries), which directly target the size of government, by limiting total, primary, or current spending. Revenue rules, on the other hand, were implemented by 17 countries in 2021. Revenue rules either set a numerical ceiling on government revenue as a percentage of GDP, to prevent further tax increases (particularly in advanced economies), or set a minimum threshold to encourage domestic revenue mobilization, especially in low-income countries. Lastly, among the 105 countries with fiscal rules, around 70% had both deficit rules and debt rules, and about 43% had both deficit rules, debt rules, and expenditure rules.

Fiscal rules have been complemented by many independent fiscal councils over the past decade. Their official mandate is to monitor compliance with the rules, assess fiscal policy, the credibility of budgets, and the quality of public policies (Hemming and Joyce, 2013; Beetsma et al., 2019). In 2021, there were 51 fiscal councils in 49 countries, i.e., around twice the number in 2010. Similarly, around 60 countries had implemented formal enforcement procedures in 2021, which often require fiscal rules to be integrated into the preparation of the annual and medium-term budget framework, and for the government to account for compliance ex-post. Many countries also introduced escape clauses in the aftermath of the 2008-09 global financial crisis (around 66 in 2021), to allow temporary suspension of the rules, as a means of flexibility in response to adverse external shocks. More than 30 countries activated escape clauses during the COVID-19 pandemic, as a means of flexibility in implementing support programs for households and enterprises. As a result, the rise

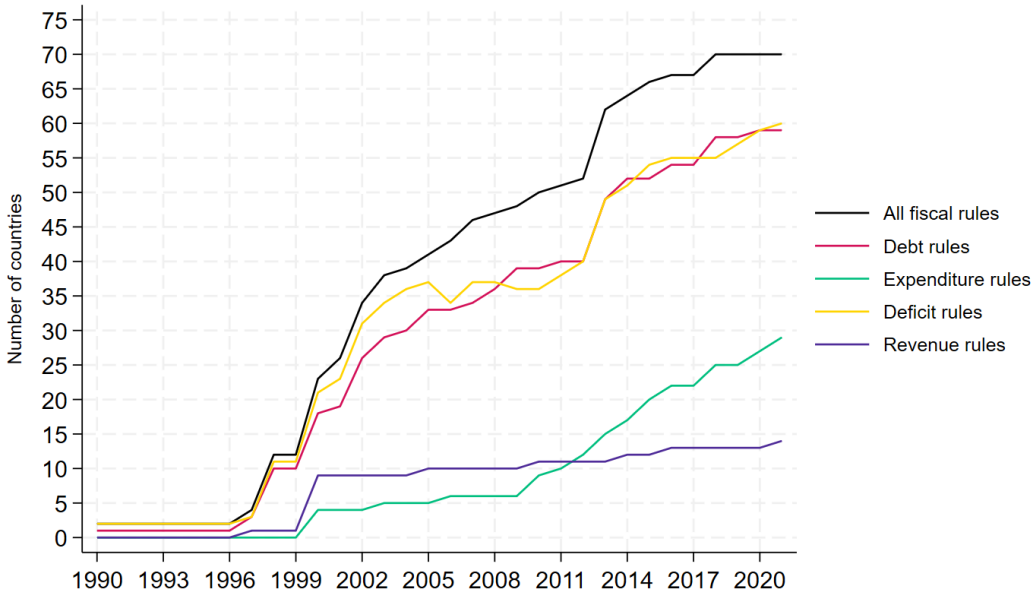
in debt and deficits during the pandemic led to significant deviations from the limits set by the fiscal rules in many countries. For example, Davoodi et al. (2022) find that about 90% of countries exceeded deficit limits set by the rules in 2020, and over 50% exceeded debt limits. Many other countries without escape clauses chose to temporarily suspend the rules during the pandemic (Azerbaijan, Colombia, Iceland, Indonesia, Peru, Russia) or modify the limits of the fiscal rules (Chile, Ecuador, Malaysia, Mexico, Mongolia, Namibia, Panama, Vietnam). Davoodi et al. (2022) provide a comprehensive analysis of the fiscal rules framework and their trends.

Figure 1: Inflation targeting in developing countries



Notes: The adoption date refers to hard inflation targeting, i.e., the date declared by academics as the actual adoption date of the monetary framework.Sources: Rose (2007); Jahan (2012); Ciżkowicz-Pękała et al. (2019); Apeti et al. (2023g)

Figure 2: Fiscal rules in developing countries



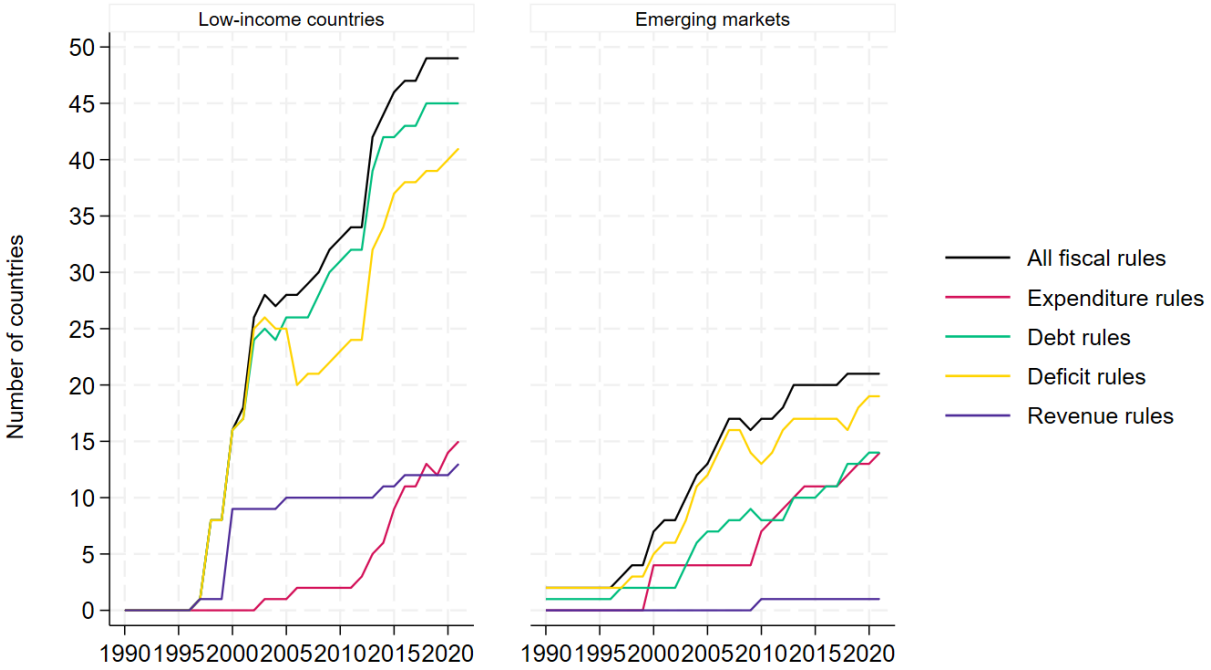
Source: IMF Fiscal Rules Dataset

0.3 Brief review of the empirical literature

0.3.1 Macroeconomic experience of inflation targeting

Assessing the genuine impact induced by the implementation of economic reforms or policies is not straightforward, due to a potential selection problem. Indeed, inflation targeting may be correlated with unobservable factors or a series of alternative measures that may also affect the overall performance of the economy and thus, potentially, the causal effect we are trying to isolate. In this respect, a substantial body of literature examining the macroeconomic effects of inflation targeting uses the matching approach, in particular, propensity score matching methods (e.g., see Vega and Winkelried, 2005; Lin and Ye, 2009; Lin, 2010; Lucotte, 2012; Minea and Tapsoba, 2014;Balima, 2017; Ardakani et al., 2018; Ogrokhina and Rodriguez, 2018; Gong and Qian, 2022; Apeti et al., 2023g; Apeti et al., 2023e), which are more effective in dealing with selection issues than ordinary least squares and difference-in-difference methods (Lin and Ye, 2007). Numerous studies focusing on emerging and developing economies suggest that, by strongly anchoring public expectations, the inflation-targeting framework contributes to enhancing the credibility of monetary policy, thus reducing

Figure 3: Fiscal rules in developing countries: Emerging markets versus low-income countries



Source: IMF Fiscal Rules Dataset

inflation and its volatility, interest rates, exchange rate, and output volatility (Minella et al., 2003; Vega and Winkelried, 2005; Rose, 2007; Gonçalves and Salles, 2008; Lin and Ye, 2009; Lin, 2010; López-Villavicencio and Pourroy, 2019; Fratzscher et al., 2020; Arsić et al., 2022). Other studies have examined the inflation-targeting effects on various real and monetary sector aggregates, showing that inflation targeting reduces growth variability (Gonçalves and Salles, 2008), output gap volatility (Batini and Laxton, 2007), improves the synchronization between domestic and foreign cycles (Flood and Rose, 2010), reduces financial dollarization (Lin and Ye, 2013), the risk of financial crises (Gong and Qian, 2022), or improves external competitiveness by reducing exchange rate misalignments (Aman et al., 2022). Another strand of the literature has looked at the influence of inflation targeting on government behavior. Evidence is found in the literature that by reducing seigniorage, i.e., the monetary financing of public deficits, inflation targeting contributes to promoting greater fiscal discipline in advanced and developing countries (Minea and Villieu, 2009; Lucotte,

2012; Minea and Tapsoba, 2014; Combes et al., 2014; Minea et al., 2021). Along the same lines, studies show that inflation targeting improves sovereign debt ratings (Thornton and Vasilakis, 2016; Balima, 2017), reduces foreign currency public debt (Ogrokhina and Rodriguez, 2018), fiscal policy volatility (Apeti et al., 2023e), or fosters pro-growth spending by causing a stronger contraction in public consumption compared to public investment (Apeti et al., 2023g).

In contrast to the studies mentioned above, other research has found mixed results or non-significant differences in inflation performance between inflation-targeting and non-inflation-targeting countries, including Levin et al. (2004) for emerging economies and Brito and Bystedt (2010) for developing countries. Lee (2011) also notes that while inflation targeting has been effective for some emerging countries, not all of them have benefited from the monetary framework. Looking at developed countries, in an early study, Bernanke (1999) failed to find clear differences between inflation-targeting and non-inflation-targeting countries. Other subsequent studies have led to similar conclusions (for example, see Ball and Sheridan, 2004; Ball, 2010; Samarina et al., 2014). However, aside from the few exceptions mentioned above (Levin et al., 2004; Brito and Bystedt, 2010), even studies that do not find conclusive results in developed countries generally suggest that inflation targeting has some positive impact in developing countries. For example, Ball (2010) finds no robust results in developed countries, but suggests that inflation targeting stabilizes inflation and output in developing countries. Lin (2010) and Samarina et al. (2014) find broadly similar results. Minea and Tapsoba (2014) reveal that only developing countries benefit from greater fiscal discipline after the adoption of inflation targeting. Lastly, reviewing the empirical evidence on inflation targeting, Ardakani et al. (2018) find no significant differences in inflation volatility between inflation-targeting and non-targeting countries. However, the authors find strong evidence that inflation targeting reduces interest rate volatility and the sacrifice ratio in developed countries, and strengthens fiscal discipline in both developed and developing countries. Lastly, using 113 studies, Balima et al. (2020) employ meta-regression analysis (MRA) to assess the impact of publication selection bias on the macroeconomic effects of inflation targeting. The authors find that inflation targeting is correlated with lower inflation and higher real GDP growth, although the relationship between the impact of the monetary framework on inflation volatility is somewhat less clear.

0.3.2 Macroeconomic experience of fiscal rules

A growing literature examines the impact of fiscal rules on fiscal outcomes. In an early paper, Alesina et al. (1999b) found that "hierarchical" and transparent rules are associated with greater fiscal discipline in Latin America. Subsequent studies have reached similar conclusions regarding the favorable impact of fiscal rules on fiscal discipline, through lower debt or deficits (see, among others, Kennedy et al., 2001; Kopits, 2001; Primo, 2006; Hallerberg et al., 2007; Debrun and Kumar, 2007; Debrun et al., 2008; Lledo et al., 2010;Gollwitzer, 2011; Hatchondo et al., 2012; Tapsoba, 2012a; Luechinger and Schaltegger, 2013: Reuter, 2015; Grembi et al., 2016; Badinger and Reuter, 2017; Combes et al., 2018; Asatryan et al., 2018; Heinemann et al., 2018; Caselli and Reynaud, 2020; Barbier-Gauchard et al., 2021; Caselli and Wingender, 2021; Vinturis, 2022; Afonso et al., 2022b; Gomez-Gonzalez et al., 2022).[2]

Other studies have shown that fiscal rules can trigger important changes in the composition of public spending, the cost of accessing international financial markets, or the cyclical behavior of government. Regarding the former, studies reveal that fiscal rules tend to protect productive or growth-enhancing spending, specifically public investment, compared to current expenditure (Ardanaz et al., 2021). Regarding the second, it has been shown that effective fiscal rules that promote fiscal discipline also improve governments' credibility on international markets, thus reducing borrowing costs for policymakers or improving credit ratings (Feld et al., 2017; Thornton and Vasilakis, 2018; Thornton and Vasilakis, 2020; Sawadogo, 2020). Regarding the latter, it has been shown that fiscal rules reduce fiscal procyclicality (Combes et al., 2017; Guerguil et al., 2017; Gootjes and de Haan, 2022a), or help to limit political budget cycles (Rose, 2006; Bonfatti and Forni, 2019; Gootjes et al., 2021). Other studies show that fiscal rules can also exert important side effects on the real sector, with favorable impacts on economic growth (Castro, 2011; Afonso and Jalles, 2013).

[2]Many studies examining the macroeconomic effects of fiscal rules also use the matching approach (e.g., see Tapsoba, 2012a; Guerguil et al., 2017; Sawadogo, 2020; Barbier-Gauchard et al., 2021; Caselli and Wingender, 2021; Vinturis, 2023).

0.4 Recent trends in inflation and fiscal deficits in developing countries

The global economy has experienced a significant decline in inflation over recent decades, including in emerging and developing economies. This trend has been coupled with a decline in the volatility of inflation and output, a period described by former Federal Reserve Governor, Ben Bernanke, as the "Great Moderation" (Bernanke, 2004). Average inflation in emerging economies fell from 21.78% in the 1980s to 4.68% in 2019, and from 17.21% to 6.70% in low-income countries, over the same period. The downward trend in inflation in emerging developing economies from the mid-1990s onwards is mainly due to a series of institutional and economic reforms, including the introduction of inflation targeting, improved fiscal balances, greater exchange rate flexibility, and macroeconomic stabilization programs (Summers et al., 2005; Mishkin, 2007; Aizenman et al., 2008). Global inflation surged during the COVID-19 pandemic, due to supply chain disruptions. Average inflation in emerging and developing economies reached 10% in 2020, compared with a pre-pandemic average (2010-2019) of around 6%. In 2020, Ethiopia, Angola, Haiti, and South Sudan reported inflation levels above 20%, Iran and Suriname reported rates above 30%, Lebanon and Sudan above 80% and 160%, respectively, while Venezuela and Zimbabwe have been experiencing the highest inflation levels in the world for several years, reaching over 2000% and 550%, respectively, in 2020. On the fiscal side, debt levels, which were already on the rise, increased further during the COVID-19 pandemic and the energy (and food) crisis from 2022 following the Russian invasion of Ukraine (Liadze et al., 2023). Public debt reached 65.18% of GDP in 2020 in developing economies, compared to a pre-pandemic average (2010-2019) of 47.11% of GDP. As a result, deficits rose to 4.58% of GDP, compared with a pre-pandemic average (2010-2019) of 1.08% of GDP. In 2020, many developing countries reported debt ratios above 100% of GDP (Belize; Congo, Rep; Argentina; Montenegro; Jamaica; Dominica; Mozambique; Bhutan; Bahrain; Angola; Zambia; Cabo Verde; etc.). Debt levels were above 150% of GDP in Lebanon and the Maldives in 2020; above 275% of GDP in Sudan; and close to 328% of GDP in Venezuela.

Inflation is not a problem of the past, as the experience of the recent crises clearly shows. Rather, monetary policy has an important role to play in macroeconomic stabilization. Better anchoring of expectations is crucial to controlling inflation and stabilizing it on a downward path over the next few years. This implies that central banks have an important role to play, in terms of communicating their inflation

target and making their policies transparent (Kose et al., 2019; Takes, 2020; Gelos et al., 2020). Meanwhile, high debt levels and deficits compromise the sustainability of public finances and future economic prospects. Yet the importance of fiscal policy in financing development and ensuring macroeconomic stability —through automatic stabilizers— is crucial, particularly for developing countries, which have limited national revenues and strong investment demand. In other words, decision-makers in developing countries have to make a difficult trade-off between financing their economies and preserving medium-term fiscal sustainability, especially as debt crises are very costly and lead to major economic imbalances. An appropriate fiscal framework and better management of fiscal policy are therefore important to ensure the sustainability of public finances and promote credibility in developing countries.

0.5 Contributions and results of the thesis

Overall, the literature shows that the inflation-targeting framework and fiscal rules have been successful in fostering macroeconomic stability and fiscal discipline in emerging and developing economies, at least so far. The latter are characterized, among other things, by low per capita incomes compared to their industrialized peers, limited structural transformation, poor access to financial markets, strong macroeconomic instability, and low institutional quality. Moreover, while fiscal deficits have widened in many economies in recent decades, the challenge is all the greater for policymakers in emerging and developing countries, who face a difficult trade-off between financing their economies and preserving medium-term fiscal sustainability. In short, there are strong reasons to believe that developing countries do not behave like their developed counterparts. Hence, this thesis examines several issues related to inflation targeting and fiscal rules, with a particular focus on emerging and developing countries.[3] Specifically, we examine some issues not previously addressed in the literature, but which are of crucial importance to these economies. However, as even within developing countries there is still some heterogeneity, the thesis examines various heterogeneity analyses based on economic, institutional, and structural characteristics. In addition, some chapters of the thesis include a broader sample, also including advanced countries, for example when looking at the determinants of public expenditure efficiency (Chapters 5 and 6). As

[3]Our classification of advanced and developing economies comes from the IMF, which considers criteria such as the level of per capita income, the export base, and the integration of the financial sector into the global financial system.

efficiency is a relative measure, we judged it important to consider a broader sample of countries to provide an international comparison. Similarly, in Chapter 3, which examines the impact of capital mobility on inflation deviations from the target, we have also considered advanced countries, since deviations are also a crucial issue for central banks in these economies. However, here again, several heterogeneity analyses are examined, including a distinction between advanced and developing countries.

We believe that the contributions of this thesis are important. In Chapters 1 and 2, we examine the effect of inflation targeting on private domestic investment and firm performance in developing countries, respectively. In contrast to a large body of literature that examines the effect of the monetary framework on monetary or fiscal outcomes, these two chapters analyze the side effects of the monetary regime, focusing on the private sector. This is all the more relevant as the private sector in developing countries is hampered by numerous obstacles, including the frequent macroeconomic instabilities these economies face. We, therefore, believed it was important to examine the extent to which this sector could benefit from the favorable effects of a price stability-oriented framework such as inflation targeting. Furthermore, in Chapter 2, we combine country-level data with firm-level data, thus complementing a large body of literature that focuses on macroeconomic analyses. Next, although the literature shows that, overall, inflation targeting has favorable effects on macroeconomic stability, particularly in developing countries, we find that inflation deviations from the target are frequent in both advanced and developing countries. These deviations reduce the anchoring objective, and hence the effectiveness of the monetary regime. For example, in Chapters 1 and 2, we find that inflation deviations from the target dampen the favorable effect of inflation targeting on private investment and firm performance. While it is crucial to identify mechanisms that can reduce such central bank time inconsistencies, we found that the literature on this issue is largely unexplored. In the search for mechanisms that can promote inflation convergence towards the central bank's target, de Mendonça and da Silva Veiga (2014) examine the role of financial openness, given the favorable benefits of capital mobility on the credibility of domestic macroeconomic policies. For example, a substantial body of literature shows that financial openness contributes to disciplining domestic macroeconomic policies and, to a certain extent, leads to disinflation. The underlying idea is that, in the presence of capital mobility, households, and firms can substitute domestic currency for foreign currency if they lack confidence in the monetary authorities. Furthermore, greater capital account openness implies a higher risk of

losing international capital in the presence of an inflationary policy, due to strong competition between countries to attract foreign investors. The literature also establishes that capital mobility encourages governments to discipline their fiscal policy, for fear of being penalized by the international capital market, but also because greater capital mobility makes it more difficult to tax capital due to tax competition. This, in turn, can have important side effects on monetary policy, especially as one of the sources of central bank inconsistencies stems from persistent government fiscal deficits. While de Mendonça and da Silva Veiga (2014) examine the effect of financial openness on inflation deviations from the target, focusing on one inflation-targeting country, Brazil, Chapter 3 of the thesis extends the analysis on several fronts. First, we provide a detailed analysis of the impact of financial openness on inflation deviations from the central bank target, including a sample of 36 advanced and developing inflation-targeting countries over the period 1990-2021. Second, we conduct a series of heterogeneity analyses, distinguishing the effect according to the type of capital flows, the size of deviations, and several economic and institutional characteristics. Third, we empirically examine some mechanisms underlying the results obtained.

The remaining three chapters of the thesis deal with fiscal policy, in particular the impact of fiscal rules. While the literature on fiscal rules mainly examines their effects on discretionary factors such as debt, deficits, or spending, in Chapter 4 we look at their influence on foreign currency public debt in developing countries. This is crucial for the latter, which, given their huge borrowings in foreign currencies, suffer from what the literature calls original sin: in the event of shocks, the depreciation of their currency increases the cost of debt, sometimes exposing them to the risk of insolvency. This chapter therefore examines whether, by promoting fiscal discipline, fiscal rules increase the likelihood of issuing debt in local currencies, thereby alleviating the original sin problem. In the same vein, while the prevailing literature shows that fiscal rules generally reduce deficits, a different but equally important question is whether improved fiscal discipline is associated with better management of public spending, for example through reduced budget waste. Chapter 6 answers this question, by examining the effect of fiscal rules on public expenditure efficiency, i.e., the performance of the public sector in delivering goods and services given the resources used. In addition, in Chapter 5, we provide an original indicator of public expenditure efficiency, which covers a panel of 158 advanced and developing countries over the period 1990-2017, and examine a series of determinants of the calculated scores. The indicator is accessible on the Oxford platform (Oxford Economic Papers)

and can be used by other researchers.

The thesis builds on hypotheses derived from theoretical reasoning to identify the channels through which inflation targeting, and fiscal rules may affect the outcome variables, and empirically tests the main channels discussed. The empirical exercise uses suitable econometric methods to deal with endogeneity issues. Indeed, identifying the effect induced by the adoption of economic policies is subject to what the literature calls selection bias. In other words, the differences in performance between policy-adopting countries and their peers could be influenced by unobservable factors, especially as the adoption of economic reforms may be associated with a whole range of alternative measures. Therefore, in Chapter 1, we follow previous studies and apply the propensity score matching method, which is appropriate for mitigating selection problems, compared with the ordinary least squares or difference-in-difference methods. The approach consists of matching the group of inflation-targeting countries with that of non-inflation-targeting countries, based on the same observables summarized in the propensity scores or a country's probability of adopting the policy. Then, after matching, the difference between the outcome of a treated country (a country that has adopted the policy) and a matched counterfactual can be attributed to the reform. That said, the matching process makes it possible to mimic a randomized experiment, using a control group. Chapters 2, 4, and 6 differ from Chapter 1 in that they employ a relatively more recent matching approach, entropy balancing. This method is increasingly used in the literature on economic policy evaluation, given its advantages over more traditional methods. For example, unlike propensity score matching, entropy balancing is a non-parametric approach, requiring no specification of the functional form of the empirical model or the treatment assignment procedure, thus avoiding mis-specification problems. In addition, linear regression in the second stage makes it possible to exploit the panel structure of the data by including fixed effects to account for unobserved heterogeneity. Moreover, in Chapters 4 and 6, for robustness, we take advantage of recent literature (Caselli and Reynaud, 2020) and instrument fiscal rules by the number of rules in neighboring countries. The underlying idea is that countries can often be induced to adopt the same reforms as their neighbors, whether as a result of peer pressure effects or a simple imitation to send a credibility signal on international markets. In the same vein, in Chapter 3, we strengthen our robustness by conducting several tests, including by instrumenting financial openness with the average openness in neighboring countries. We show that the instrument is robust and provides exogenous variation, thus mitigating endogeneity problems.

In Chapter 5, the efficiency scores are calculated using one of the most recent parametric (Stochastic frontier analysis—SFA) approaches, proposed by Kumbhakar et al. (2015). Unlike non-parametric methods, the approach we adopt captures the influence of stochastic shocks and takes into account unobserved country-specific and time-invariant features (culture, ideology, exogenous shocks, etc.) that could affect efficiency, independently of public sector management. Lastly, the conclusion discusses the main policy implications arising from our results and provides several perspectives for future research. In addition, we believe that the approach adopted in Chapter 2, which combines country-level data with micro-level data, is an interesting avenue for future research, and that the novel efficiency indicator we provide in Chapter 5 will be widely exploited by other researchers.

Our results reveal favorable effects of the inflation-targeting framework on private domestic investment and firm performance (measured by sales growth and productivity growth) in developing countries. The analysis also highlights the importance for central banks to converge towards their announced targets, as inflation deviations from the target tend to mitigate the beneficial effect of inflation targeting on private sector performance. Furthermore, in the quest for mechanisms to improve the effectiveness of the monetary framework, we find that capital mobility may play a role, by promoting the convergence of inflation towards the central bank's target, including in developing countries. On the fiscal side, we find that well-designed fiscal rules, by improving the credibility of domestic macroeconomic policies in developing countries, can also mitigate the original sin issue and improve public expenditure efficiency. We also provide a novel indicator to measure public expenditure efficiency, i.e., the government's performance in providing public goods and services given the resources used, and show that trade openness, factor productivity, and institutional quality positively impact efficiency in both advanced and developing countries. The indicator covers a panel of 158 advanced and developing countries from 1990-2017, accessible on the Oxford website (Oxford Economic Papers), and can be used by other researchers. We believe that this thesis offers a valuable contribution to the literature on monetary and fiscal policy, and that the policy implications arising from our analyses may improve the conduct of economic policy in developing countries.

0.5.1 Part I: The inflation-targeting effects in developing countries

The private sector is essential to achieving development goals, as it is a key driver of investment, job creation, and other important aspects of the economy. However,

the latter faces several challenges in developing countries, including the strong macroeconomic instabilities these economies face. For example, the literature shows that by generating uncertainty, inflation adversely affects firm investment, growth, and productivity in developing countries. Consequently, the first part of the thesis contributes to the mainstream literature by examining to what extent the private sector in developing countries can benefit from the positive effects of a monetary framework geared to price stability, such as inflation targeting. More specifically, in Chapter 1, we examine the impact of inflation targeting on private sector investment in developing countries. As discussed above, identifying the genuine effect induced by economic reforms is not straightforward, as inflation-targeting adoption may be correlated with unobservable factors that may also affect the overall performance of the economy, including domestic investment. To reduce selection issues associated with policy adoption, we employ various propensity score matching methods, which consist, first, of matching inflation-targeting countries (or, more precisely, the country-year observations of treated countries) with those of non-inflation-targeting countries, based on the same observables summarized in propensity scores or a country's probability of adopting the policy. Then, after matching, the difference between the outcome of a treated country and a matched counterfactual can be attributed to inflation targeting. The analysis conducted on a panel of 62 developing countries over the period 1990-2019 reveals that inflation targeting promotes private sector investment, with statistically and economically significant effects ranging from 2.80 to 3.26 percentage points. We then conduct a series of heterogeneity tests and show that, although the inflation-targeting framework has favorable effects on investment decisions, inflation deviations from the target mitigate this effect. We also find that countries with sound fiscal discipline benefit more from the positive effect of inflation targeting on domestic investment, probably because the risks of fiscal dominance are lower in these countries. Second, we empirically examine the underlying mechanisms and show that improved macroeconomic stability following the adoption of the monetary framework (i.e., a reduction in inflation and its volatility, interest rate, and exchange rate volatility) is the key channel through which the effect of inflation targeting transits. Our results have important implications for developing countries: a monetary framework geared to price stability, such as inflation targeting, can enable them to increase the contribution of the private sector to their development objectives.

Chapter 2 extends the previous analysis by examining the effect of the inflation-targeting framework on the private sector at a more disaggregated level, i.e., on

firm performance. The hypotheses discussed are similar to those in the previous chapter: given its beneficial effects on macroeconomic stability, inflation targeting may boost firm performance in developing countries. To deal with endogeneity issues associated with policy adoption, this chapter differs from the first by using a relatively more recent impact analysis method, i.e., entropy balancing. This method is increasingly used in the literature on policy evaluation, given its advantages over older methods. For example, unlike propensity score matching, entropy balancing is a non-parametric approach, hence requiring no specification of the treatment assignment procedure, thus avoiding mis-specification issues. Similarly, the second stage exploits the panel structure of the data by including fixed effects, thus accounting for unobserved heterogeneity. The analysis conducted on a sample of 31,027 firms surveyed in 47 developing countries over the period 2006-2020 suggests that inflation targeting improves firm performance (measured by sales growth and productivity growth) in developing countries, with statistically and economically significant effects. Specifically, inflation targeting increases sales growth by 3 percentage points and productivity growth by 13 percentage points compared with non-inflation-targeting countries. These results therefore corroborate those of the previous chapter. We also find that the beneficial effect of the monetary framework on firm performance is attenuated when the central bank deviates from its target, and amplified in countries with strong institutions and sound fiscal discipline. Another important result is that the positive effect of inflation targeting increases over time, probably because the credibility of monetary policy tends to strengthen with the experience of the monetary regime. Lastly, the transmission channel analysis reveals that improved macroeconomic stability resulting from inflation-targeting adoption is the main channel through which the effect of the monetary framework transits, corroborating the mechanisms highlighted in the first chapter. The main novelty of this study is that it combines country-level and firm-level data to examine the inflation-targeting effects, contributing to a literature that mainly employs macroeconomic data. We believe that exploring the multiple and complex consequences of the inflation targeting framework at a more disaggregated level is an interesting avenue for future research.

The previous chapters reveal that the beneficial effect of the inflation-targeting framework on the private sector is strongly attenuated when the central bank deviates from its target. In other words, this result suggests that although the explicit announcement of an inflation target is important for anchoring inflation expectations, inflation deviations from the target weaken the desired anchoring

objective. An important question, then, is which mechanisms are likely to reduce such time inconsistency on the part of the central bank. A large body of literature shows that financial openness helps to discipline domestic macroeconomic policies and leads somewhat to disinflation. Chapter 3 provides a detailed analysis of the impact of financial openness on inflation deviations from the central bank target, including a sample of 36 inflation-targeting countries, both advanced and emerging economies, over the period 1990-2021. We show that a one-unit increase in the Chinn and Ito (2008) index results in a 0.65 percentage point reduction in inflation deviations from the target, and that the effect is both statistically and economically significant and robust. We strengthen the analysis by conducting a series of heterogeneity tests. First, the results suggest that the favorable effect of financial openness on the effectiveness of the monetary framework is mainly due to capital outflows, rather than inflows. Second, capital mobility tends to reduce positive deviations (above the target) rather than negative deviations, probably due to the disinflation effect of financial openness. Third, the favorable effect of capital mobility is amplified when inflation deviations are large, and in countries with sound fiscal discipline and a more independent central bank. Lastly, we empirically examine the main underlying mechanisms and find that the disinflation effect of capital mobility, coupled with improved fiscal discipline, are important channels through which the favorable effect of capital mobility transits. This chapter shows that financial liberalization can contribute to some extent to the effectiveness of the inflation-targeting framework, including in developing countries.

0.5.2 Part II: The macroeconomic effects of fiscal rules

Several studies have examined the effect of fiscal rules, focusing on discretionary factors such as debt, deficits, or public expenditure. We differ from the literature by taking a slightly different approach, i.e., by examining some side effects closely related to the effectiveness and discipline objectives of fiscal rules. Chapter 4 examines the effect of fiscal rules on foreign currency debt in developing countries. We conduct the analysis on a panel of 59 developing countries over the period 1990-2020 and apply the entropy balancing method to mitigate selection issues. We find that by promoting fiscal discipline, fiscal rules are associated with a greater likelihood of issuing public debt in local currency and, consequently, contribute to reducing foreign currency debt. More precisely, the introduction of fiscal rules reduces the share of foreign currency in government debt in developing countries by 2.9 percentage points compared to other developing countries that did not introduce fiscal rules,

and the effect is both statistically and economically significant. Furthermore, we conduct various heterogeneity analyses and highlight a few additional results. First, we find that debt and expenditure rules have a slightly greater effect than deficit rules. Second, stronger rules (captured by the strength of the rules), improved fiscal discipline before reform adoption, financial development, financial openness, exchange rate regime flexibility, and institutional quality amplify the beneficial effect of fiscal rules in reducing foreign currency debt. Lastly, we empirically examine the underlying mechanisms and show that improved credibility of fiscal and monetary policies resulting from the adoption of fiscal rules (i.e., improved fiscal discipline and reduced inflation and inflation volatility) is an important mechanism through which fiscal rules reduce foreign currency borrowing. Our results have a key implication for developing countries: by promoting fiscal discipline, credible and well-designed fiscal rules can enable them to reduce the original sin problem they often face.

Public spending has risen sharply worldwide since the 1990s, to promote growth and meet socioeconomic needs, and surged further during the COVID-19 pandemic and the war in Ukraine, as many governments introduced social measures to support households. Although public spending can help to promote growth and improve socioeconomic conditions, the literature teaches us that its inappropriate use can lead to inefficiency, for instance through waste. In other words, the appropriate increase in spending for the provision of public goods and services is constrained by the need to avoid waste. Against this background, a growing literature examines public expenditure efficiency scores, which measure the performance of the public sector in providing public goods and services given the resources used. Chapter 5 contributes to this literature by providing public expenditure efficiency scores for a panel of 158 advanced and developing countries over the period 1990-2017. The analysis employs one of the most recent SFA (Stochastic frontier analysis) approaches, that proposed by Kumbhakar et al. (2015). The latter allows us to capture the influence of stochastic shocks and to account for unobserved country-specific and time-invariant characteristics (culture, ideology, exogenous shocks, etc.) that could affect efficiency, independently of public sector management. We then examine several determinants of the scores obtained and conduct several heterogeneity analyses. First, we find that trade openness, factor productivity, and institutional quality positively impact efficiency in both advanced and developing countries, while taxation plays negatively in advanced countries. Second, factor productivity and the level of democracy positively impact efficiency in all the groups considered (Africa, Asia, Latin America, and Europe), while the positive impact of trade openness holds only for Asian

and European countries. Similarly, the negative impact of taxation holds only for Latin American and European countries. We believe that this chapter provides a novel contribution to the literature dealing with public sector efficiency with clear policy implications. It also provides a rich and accessible database that can further extend the literature, particularly in a post-COVID era where concerns about public expenditure management are at the forefront of political and economic discussions.

Chapter 6 examines whether, by promoting fiscal discipline, fiscal rules are associated with lower fiscal waste and greater performance in the provision of public goods and services. In other words, we assess the impact of fiscal rules on public expenditure efficiency. The analysis is conducted on a panel of 158 advanced and developing countries over the period 1990-2017, using the efficiency scores provided in the previous chapter and applying the entropy balancing method to mitigate selection issues. The estimates suggest that the introduction of a fiscal rule increases expenditure efficiency, by approximately 3.8 percentage points, and that the effect is statistically and economically significant. We then conduct a series of heterogeneity analyses, distinguishing between the types of rules and examining the role of a range of macroeconomic, institutional, and structural factors. First, we find that the effect of deficit rules and debt rules is greater than that of expenditure rules. Second, monitoring and enforcement procedures, broader coverage of the rule, the level of economic development, and institutional quality amplify the positive effect of fiscal rules on expenditure efficiency. Furthermore, fiscal rules are more effective when adopted by countries with weak fiscal discipline. Third, we find that the positive effect of fiscal rules tends to strengthen over time. Lastly, we examine some transmission channels and find that improved fiscal discipline and institutional quality after reform adoption are important channels through which fiscal rules promote expenditure efficiency. The main implication of our findings is that reforms such as fiscal rules can both promote fiscal discipline and public sector performance in using expenditure, including in developing countries.

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Chapter 1

Inflation Targeting and Private Domestic Investment in Developing Countries

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Abstract

Does inflation targeting foster private domestic investment in developing countries? A few studies have attempted to examine this issue, with mixed results. Here we argue that by anchoring public expectations firmly, the inflation targeting framework should enhance monetary policy credibility and macroeconomic stability, thereby promoting investment incentives. Using data from 62 countries over the period 1990-2019 and applying propensity score matching methods, we find that inflation targeting significantly increases domestic investment. However, inflation deviations from the target reduce the favorable effect of inflation targeting on investment. Furthermore, the positive effect of inflation targeting on investment is amplified in emerging economies and countries with sound fiscal discipline. Finally, we explore the underlying mechanisms and show that macroeconomic stability, i.e., the reduction in inflation and its volatility, interest rate, exchange rate, and output volatility, is the main channel through which the monetary framework promotes domestic investment.

Keywords: • Inflation targeting • Private domestic investment • Developing countries • Propensity score matching • Monetary policy credibility

JEL Classification: E5, E6, E22

1.1 Introduction

Since its adoption by New Zealand in 1990, the inflation targeting framework has been adopted by a growing number of developing countries to ensure macroeconomic stability. Today, nearly 40 countries have an inflation target, and more than half are emerging economies. Most of the studies focusing on developing countries suggest that a monetary framework that can strongly anchor public expectations, such as inflation targeting, significantly increases monetary policy credibility, thus reducing inflation and its volatility, interest rate, exchange rate, and output volatility (Minella et al., 2003; Calderón et al., 2004; Vega and Winkelried, 2005; Rose, 2007; Gonçalves and Salles, 2008; Lin and Ye, 2009; Lin, 2010; López-Villavicencio and Pourroy, 2019; Fratzscher et al., 2020).

The empirical literature examining the inflation targeting effects has mainly focused on macroeconomic volatility or fiscal discipline (e.g., see Lucotte, 2012; Minea and Tapsoba, 2014; Combes et al., 2018; Ogrokhina and Rodriguez, 2018; Minea et al., 2021). A few studies have examined the inflation targeting effect on private investment, with mixed results. For instance, Mukherjee and Bhattacharya (2011) find that inflation targeting did not have a significant direct impact on either investment or the responsiveness of investment to interest rate movements in emerging market economies over the period 1990 to 2009. In the same vein, applying the synthetic control method to a panel of developing and developed economies over the period 1984-2017, McCloud (2022) finds that inflation targeting adoption did not affect domestic investment in 21 out of 29 treated countries. Moreover, the author observes a decrease in domestic investment following the introduction of inflation targeting in Paraguay, Mexico, the Philippines, Colombia, Guatemala, and Ghana, while investment increased in Australia in the post-inflation targeting period. In this paper, we argue that the inflation targeting effect on domestic investment may depend on the credibility of the monetary framework, captured by inflation deviations from the target. By reaching or approaching the targets set, central banks should more strongly anchor public expectations, hence promoting monetary policy credibility, which could lead to a more conducive environment for investment. As developing countries are generally subject to high macroeconomic instability (Loayza et al., 2007), we examine to what extent these economies may benefit from the side effects of a price stability-oriented monetary framework, such as inflation targeting.

Using data from 62 developing countries over the period 1990-2019, we examine

the inflation targeting effect on domestic investment. Results from propensity score matching methods suggest that the adoption of inflation targeting leads to a statistically and economically significant increase in private investment from 2.80 to 3.26 percentage points. The strength of the results is checked by a rich robustness analysis, including sample changes, additional controls, placebo tests, and alternative estimation strategies: the bias-corrected matching estimator, the Inverse Probability Weighting estimator, and a nonparametric kernel regression. As discussed earlier, the inflation targeting effect may be heterogeneous, depending on inflation deviations from the target. Therefore, we mainly differ from Mukherjee and Bhattacharya (2011) and McCloud (2022) by considering heterogeneity over time, in order to examine to what extent inflation deviations from the target affect the regime's effectiveness. Considering this heterogeneity over time is important as, although the explicit announcement of an inflation target plays an important role in coordinating expectations, inflation deviations from the target may, in turn, reduce monetary policy credibility, thereby weakening the anchoring objective. Results from a control function regression suggest that the monetary regime is less effective when the central bank tends to deviate from its target, with pronounced ineffectiveness in cases of extreme deviations. Moreover, our data suggest that Mexico, Colombia, and Ghana, which are half of the countries identified by McCloud (2022) in which domestic investment declined after inflation targeting adoption, also report inflation deviations from the target well above the sample average. Hence, we contribute to the existing literature, by providing some mechanisms to explain why some countries do not seem to benefit from the positive effects of the monetary framework. We also find that the inflation targeting framework is more effective in countries with sound fiscal discipline and is more beneficial to emerging economies. Finally, we investigate the main channels through which inflation targeting may operate and show that enhanced credibility resulting from the adoption of the policy, leading to a more stable environment, is an important channel through which inflation targeting affects domestic investment.

The remainder of the paper is organized as follows. The following section presents our theoretical framework. Section 1.3 describes our data, reports some stylized facts, and discusses the identification strategy. The main findings are presented in Section 1.4. Section 1.5 analyzes the sensitivity of our results. Section 1.6 deals with the main transmission channels. A final section concludes.

1.2 Theoretical framework

1.2.1 Investment under uncertainty

There is a large literature on the link between uncertainty and investment. Older theoretical models developed by Lucas Jr (1967) or Nickell (1974) suggest that uncertainty reduces investment in the presence of adjustment costs, or when there is irreversibility in the production process. Indeed, investment involves irreversible costs that affect firm profits or expected profitability (Carruth et al., 2000). Hence, when faced with uncertainty, households and investors tend to adopt a *«wait and see»* strategy, as this gives them the opportunity to process new information before making an investment decision (Bachmann and Bayer, 2013; Stokey, 2016). From an empirical perspective, Pindyck (1986) has shown that increased uncertainty reduces investment. Other subsequent studies have found similar results. For instance, using a panel of 42 developing countries, Aizenman and Marion (1999) show that higher volatility reduces the average rate of investment, with effects proportional to the magnitude of variability in different macroeconomic indicators. Similar evidence is provided by Gavin and Hausmann (1998) for Latin American economies. There is also evidence in the literature that uncertainty undermines firm investment and performance (e.g., see Bloom et al., 2007; Chong and Gradstein, 2009; Bloom et al., 2018). Finally, in the same vein, studies suggest that exchange rate uncertainty has a negative impact on investment decisions (e.g., see Serven, 1998; Bleaney and Greenaway, 2001; Belke and Gros, 2001; Servén, 2003).

1.2.2 Credibility as a transmission channel of the monetary regime on domestic investment

Evidence is found in the literature that the explicit announcement of an inflation target plays an important role in coordinating expectations and significantly increases monetary policy credibility in developing countries, thus reducing inflation and its volatility, interest rate, and exchange rate volatility (Minella et al., 2003; Calderón et al., 2004; Vega and Winkelried, 2005; Rose, 2007; Gonçalves and Salles, 2008; Lin and Ye, 2009; Lin, 2010; López-Villavicencio and Pourroy, 2019). Another part of the literature provides some evidence of the side effects of the inflation targeting framework. For example, using data on the Brazilian economy, De Mendonça and Lima (2011) find that a successful inflation targeting framework provides a stable macroeconomic environment that encourages private investment. Similarly, Montes (2013) finds that inflation targeting has been an important strategy for investment

and job creation in Brazil. Finally, interest rate volatility is also a key factor in the transmission of monetary policy shocks. For instance, in the presence of a high inflation rate, a central bank following the Taylor rule will pursue a restrictive monetary policy by raising interest rates. Yet, high interest rates in turn limit access to credit and depress investment, as suggested by the traditional neoclassical framework (Harrison et al., 2004; Beck et al., 2005).[1] However, achieving a relatively low inflation target under the inflation targeting framework may crowd out interest rate hikes to converge inflation toward the target. Against this background, empirical evidence is provided by De Mendonça and Souza (2009) for the Brazilian economy, that higher credibility implies smaller changes in the interest rate to control inflation. This result is worth paralleling that of Montes (2013), who provides evidence that changes in the short-term interest rate significantly impact the real cost of capital and firm investment decisions.

To summarize, in line with the existing literature, we believe that enhanced monetary policy credibility resulting from inflation targeting adoption, leading to greater macroeconomic stability, is the main channel through which the monetary framework may affect domestic investment.[2]

1.3 Data and Methodology

1.3.1 Data

Our dataset consists of 62 developing countries, 23 inflation-targeting, and 39 non-inflation-targeting, over the period 1990-2019. We consider country-year observations and examine 251 treated and 921 untreated observations.[3] The choice of this time horizon was conditioned by data availability, since numerous countries in the sample

[1]Interest rate movements are also highly correlated with asset prices, such as stocks, bonds, or real estate, through a wealth effect. However, in the context of this study, this channel is probably not very relevant as the participation of firms from developing countries in stock markets is generally low.

[2]Another potential channel for the impact of the inflation targeting framework on investment may be the fiscal discipline effect induced by the adoption of the regime (Lucotte, 2012; Minea and Tapsoba, 2014; Combes et al., 2018; Minea et al., 2021; Apeti et al., 2023g). However, we believe that this is rather an indirect channel. Here we focus on the key channels.

[3]In our sample, observations relating to a country that is not yet treated (but will be) are included in the control group, as our sample consists of a time dimension. That said, our approach may match some observations for certain treated countries to these same countries at a time when the country is not treated. Results are robust when we exclude from the control group observations for a country that is not yet treated but will be (see subsection A.3 of the Appendix).

did not have sufficient observations before the year 1990. The dependent variable is measured as the share of private-sector gross fixed capital formation to GDP, and is drawn from the IMF's Investment and Capital Stock database (we use the latest dataset covering the year 2019). The variable of interest, inflation targeting, is captured by a binary variable equal to 1 if a country i in the year t was targeting inflation, and zero otherwise. From the control group, to be a good counterfactual for the treatment group, we exclude countries whose real GDP per capita is lower than that of the poorest treated country in the sample, and those with a smaller population than the smallest treated country in the sample, as in Lin and Ye (2009). A distinction is made between two major starting dates: soft or informal inflation targeting, and full-fledged or hard inflation targeting. Soft inflation targeting refers to the date declared by the central bank itself, while hard inflation targeting relates to the date declared by researchers, considered to be the confirmed date from which the central bank operates under inflation targeting.

Table 1.1 details the definitions and sources of our main variables. Table 1.2 reports the descriptive statistics of the main variables used in the study. Section B (Appendix) presents the composition of the sample in more detail.

1.3.2 Stylized facts

We report some correlational evidence between inflation targeting and the average private domestic investment rates in the countries in our sample over our study period (1990-2019). Figure 1.1 shows, on average, a higher domestic investment rate (in percentage of GDP) in inflation-targeting compared to non-inflation-targeting countries (15.65% versus 11.83%). Moreover, the investment gap between the two groups is statistically significant (t = -11.87; p-value: 0.00).

1.3.3 Methodology

We follow the program evaluation methodology, which consists in estimating the average treatment effect on the treated (ATT), defined as follows:

$$ATT = E[(Y_{i1} - Y_{i0})|T_i = 1] = E[(Y_{i1}|T_i = 1)] - E[(Y_{i0}|T_i = 1)] \quad (1.1)$$

T_i (treatment) is a dummy variable equal to 1 for a country i that has adopted inflation targeting, and zero otherwise. Y_{i1} captures the private domestic investment rate when the country adopts inflation targeting, and Y_{i0} is the private domestic

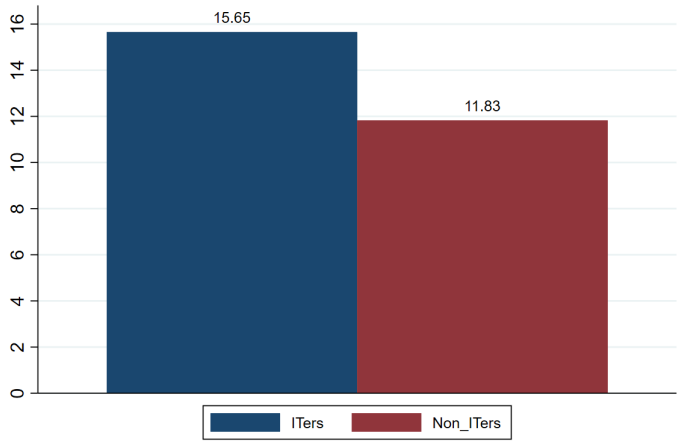


Figure 1.1: Average private investment rates (%GDP) in inflation-targeting and non-inflation-targeting countries (1990-2019)

Notes: This figure presents the average private domestic investment rates between inflation-targeting and non-targeting countries over the period 1990-2019. The statistics cover 251 treated and 921 untreated observations. These statistics relate only to the 62 developing countries considered in our study.

investment rate that would have been observed if the country had not adopted the policy. The problem is that we cannot observe Y_{i1} and Y_{i0} simultaneously. We are therefore faced with a counterfactual dilemma. One solution would be to compare the average levels of private investment between inflation-targeting and non-inflation-targeting countries. However, this approach assumes that the treatment assignment is random. Such an assumption would be ad hoc, since the treated countries may have chosen to implement an inflation targeting policy after a crisis or a series of high inflation episodes. Therefore, inflation targeting adoption may be correlated with unobservable factors that also affect the overall performance of the economy, including domestic investment. In this case, a simple difference in the outcome variable between the two groups of countries would bias the estimates, given the potential selection issue associated with policy adoption. To solve this problem, we follow previous studies (e.g., see, among others, Lin and Ye, 2007; Lin and Ye, 2009; Lucotte, 2012; Minea and Tapsoba, 2014; Balima et al., 2017; Minea et al., 2021; Gong and Qian, 2022) and implement the propensity score matching (PSM) method developed by Rosenbaum and Rubin (1983). As previously discussed, intuitively, if there is a selection bias in inflation targeting adoption, we would expect treated observations to differ from untreated ones, which could strongly influence the average difference in investment between targeting and non-targeting countries. The PSM method consists in matching the group of inflation-targeting to non-targeting countries, based on the same observables summarized in the propensity scores or a

country's probability to adopt the policy. Hence, the matching approach controls for observable differences between inflation-targeting and non-inflation-targeting countries that could affect the outcome variable. Thus, after matching, the difference between the outcome of a treated country and a matched counterfactual can be attributed to inflation targeting. The propensity score, i.e., the probability of treatment assignment, is based on the Conditional Independence Assumption, which means that conditional upon the vector of covariates X, inflation targeting adoption must be independent of the outcome (private investment rate). Under the CIA, in Equation (1.1) we can replace the unobservable term $E\left[(Y_{i0}|T_i = 1)\right]$ with the observable term $E\left[(Y_{i0}|T_i = 0, X_i)\right]$ to get Equation (1.2).

$$ATT = E[(Y_{i1}|T_i = 1, X_i)] - E[(Y_{i0}|T_i = 0, X_i)] \tag{1.2}$$

We impose the common support to ensure that for each treated observation, there is at least one untreated counterfactual that is as similar to it as possible, to allow for matching. Therefore, we rewrite the ATT as follows:

$$ATT = E[(Y_{i1}|T_i = 1, p(X_i)] - E[(Y_{i0}|T_i = 0, p(X_i)] \tag{1.3}$$

where $p(X_i)$=$P_r(IT_i$=$1|X_i)$ provides, conditional on the set of covariates X, the probability of a country adopting inflation targeting. Finally, subsection A.1 of the Appendix examines the Conditional Independence Assumption and the hypothesis of common support.

1.4 Results

1.4.1 Propensity score estimates

We estimate the propensity scores from a probit model,[4] using as dependent variable a binary equal to 1 if a country i in the year t was targeting inflation, and zero otherwise. As commonly found in the literature (e.g., see Lin and Ye, 2009; Lucotte, 2012; Minea and Tapsoba, 2014; Ogrokhina and Rodriguez, 2018), we control via two categories of variables. The first category includes variables that could explain the likelihood of a developing country adopting inflation targeting. For this first

[4]Estimates from a logit model remain comparable to those obtained from the probit, suggesting that the normality assumption of the probit model is not compromised.

category, we include the following precondition variables: lagged inflation rate,[5] broad money growth, real GDP per capita growth, and domestic credit to the private sector (used as a proxy for financial development). Lagged inflation rate and broad money growth are generally found to be negatively correlated with the probability of adopting inflation targeting, since a country is more likely to adopt an inflation targeting policy when its inflation rate is at a reasonably low level, preferably after successful disinflation (Masson et al., 1997; Truman, 2003; Balima et al., 2017). Indeed, a relatively low inflation rate can make the announced targets credible and promote the effectiveness of the regime. In this context, Lin and Ye (2007) find that the lagged inflation rate negatively affects the targeting decision in industrial countries. Although Masson et al. (1997) find this result for developed countries, they stress that the environment of central banks in developing countries differs radically from that in advanced economies. Indeed, many developing countries are characterized by a much higher use of seigniorage than in advanced economies, due to a number of structural characteristics, such as concentrated and unstable tax revenue sources, poor tax collection procedures, asymmetric income distribution, and political instability (Masson et al., 1997). Hence, the ability of the central bank to conduct independent monetary policy in developing economies may be hampered by a heavy reliance on seigniorage. However, there is evidence in the literature that the negative relationship between lagged inflation and inflation targeting adoption seems to hold for developing countries as well (e.g., see, among others, Lin and Ye, 2009; Lucotte, 2012; Balima et al., 2017). Lin and Ye (2009) and Minea and Tapsoba (2014) find evidence that lower broad money growth is a key driver of inflation targeting adoption. The correlation between GDP per capita growth and inflation targeting adoption is generally ambiguous. From a theoretical point of view, one can assume that countries with good macroeconomic performance are more likely to adopt a credible inflation targeting policy, as well as the notion that a better economic situation can crowd out the adoption of reforms such as inflation targeting. Financial development is found to positively affect a country's likelihood of adopting inflation targeting by limiting the monopoly of seigniorage by the central bank (Minea et al., 2021). Moreover, a developed financial system promotes financial inclusion and better tax revenue mobilization. This should compensate for the loss of seigniorage income due to inflation targeting adoption, and, therefore, allow the government to avoid exerting pressure on the central bank to finance its deficits, an

[5]As argued by Lucotte (2012), the lag in inflation avoids a simultaneity bias between inflation targeting and the variable.

essential condition for ensuring a credible targeting policy.

The second category of controls includes variables that could affect the likelihood of adopting exchange rate targeting as an alternative framework for monetary policy. Referring to previous studies, we consider for this second category trade openness and the fixed exchange rate regime. Since inflation targeting is implemented under a flexible exchange rate regime, it is negatively correlated with the adoption of the fixed exchange rate regime. In the same way, empirical studies show a negative correlation between trade openness and the inflation targeting regime. The explanation commonly provided in the literature is that countries more open to trade are more likely to target the exchange rate to guard against external shocks (Brenner and Sokoler, 2010). Finally, we also control for institutional quality, proxied by the International Country Risk Guide (ICRG)'s corruption control index, which ranges from 0 (highest perceived corruption) to 6 (highest perceived probity). Since better institutional quality may reflect the central bank's ability to implement a credible targeting regime, this variable may be positively correlated with a country's probability of adopting inflation targeting.

Table 1.3 reports propensity score estimates from a probit model. The baseline model results that refer to conservative dates (hard inflation targeting) are reported in column [1].[6] The findings support most of our assumptions. Consistent with previous work (see Lin and Ye, 2009; Lucotte, 2012 Minea and Tapsoba, 2014), lagged inflation rate, broad money growth, trade openness, and the fixed exchange rate regime reduce the likelihood of a country adopting inflation targeting. Conversely, financial development is positively correlated with inflation targeting adoption, in line with Lucotte (2012). Our baseline model also suggests that better corruption control enhances a country's probability of adopting the monetary regime. Finally, the overall fit of the regression, with a Pseudo-R^2 of 0.31 for our baseline model, is reasonable and comparable to that of previous studies (e.g., see Lin and Ye, 2009; Lucotte, 2012; Minea and Tapsoba, 2014).

[6]Our results, available on request, remain robust when referring to soft inflation targeting.

Table 1.1: List of variables and their sources

Variables	Nature	Sources
Dependent variable		
Private domestic investment (% GDP)	Continuous	IMF Investment and Capital Stock dataset
Treatment variable		
Inflation Targeting	Dummy	Rose (2007); Roger (2010); Jahan (2012)
Baseline model control variables		
Inflation	Continuous	WDI, World Bank
Real GDP per capita growth	Continuous	WDI, World Bank
Trade openness	Continuous	WDI, World Bank
Financial development (Domestic credit to private sector, in % of GDP)	Continuous	WDI, World Bank
Control of corruption	Score between 0 and 6	ICRG
Fixed exchange rate	Dummy	Author's construction from Ilzetzki et al. (2019)
Broad money growth	Continuous	WDI, World Bank
Additional control variables		
Unemployment rate	Continuous	WDI, World Bank
Primary budget balance	Continuous	Kose et al. (2022)
Public debt	Continuous	Kose et al. (2022)
Public investment	Continuous	IMF Investment and Capital Stock dataset
Foreign direct investment	Continuous	WDI, World Bank
Governor turnover	Dummy	Dreher et al. (2008a); Dreher et al. (2010)
Government stability	Score between -2.5 to 2.5	ICRG
Sound fiscal discipline	Dummy	Author's construction based on Kose et al. (2022)
Rule of law	Score ranging from -2.5 to 2.5	Worldwide Governance Indicators (WGI) database
Human rights	Score ranging from approximately -3 to 3	Fariss (2014)

Table 1.2: Summary statistics for the main model variables

	Variables	Obs.	Mean	Sd	Min	Max
Total sample						
	Private domestic investment	1,842	12.520	5.529	0.085	32.343
	Inflation, one-year lag	1,744	31.911	253.890	-8.484	7481.664
	Real GDP per capita growth	1,842	2.297	3.920	-22.517	15.161
	Financial development (Log.)	1,502	3.289	0.826	0	5.114
	Control of corruption	1,717	2.48	0.894	0	6
	Trade openness	1,764	64.866	31.115	1.219	220.41
	Fixed exchange rate dummy	1,674	0.244	0.430	0	1
	Broad money growth	1,784	34.242	260.751	-50.812	7677.834
Inflation-targeting countries						
	Private domestic investment	334	15.651	4.356	7.652	28.631
	Inflation, one-year lag	334	5.401	3.669	-1.545	19.247
	Real GDP per capita growth	334	2.782	2.660	-6.674	11.315
	Financial development (Log.)	320	3.701	0.5865	2.538	5.013
	Control of corruption	311	2.514	0.785	1	6
	Trade openness	334	67.674	31.804	20.982	168.341
	Fixed exchange rate dummy	265	0.015	0.122	0	1
	Broad money growth	334	12.114	8.312	-4.698	82.588
Non-inflation-targeting countries						
	Private domestic investment	1,508	11.826	5.522643	0.085	32.343
	Inflation, one-year lag	1,410	38.190	282.011	-8.484	7481.664
	Real GDP per capita growth	1,508	2.190	4.1401	-22.517	15.161
	Financial development (Log.)	1,182	3.177	0.845	0	5.114
	Control of corruption	1,406	2.472	0.917	0	5
	Trade openness	1,430	64.210	30.926	1.219	220.407
	Fixed exchange rate dummy	1,409	0.287	0.452	0	1
	Broad money growth	1,450	39.339	288.979	-50.812	7677.834

Table 1.3: Probit estimates of propensity scores

Dependent: Hard inflation targeting	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
Lagged inflation	-0.0786***	-0.0786***	-0.0783***	-0.0785***	-0.0810***	-0.0791***	-0.0786***	-0.0797***	-0.0702***	-0.0779***	-0.0919***	-0.0903***	-0.0819***	-0.0794***
	(0.0122)	(0.0122)	(0.0123)	(0.0123)	(0.0124)	(0.0124)	(0.0122)	(0.0123)	(0.0124)	(0.0134)	(0.0130)	(0.0134)	(0.0125)	(0.0126)
Real GDP per capita growth	0.0189	0.0189	0.0178	0.0173	0.0167	0.0209	0.0189	0.0206	0.0112	0.0057	0.0342**	0.0086	0.0182	0.0184
	(0.0163)	(0.0163)	(0.0164)	(0.0166)	(0.0165)	(0.0168)	(0.0163)	(0.0167)	(0.0165)	(0.0177)	(0.0172)	(0.0170)	(0.0165)	(0.0169)
Financial development (Log.)	0.3409***	0.3409***	0.3418***	0.3511***	0.3126***	0.3409***	0.3409***	0.3227***	0.4012***	0.3933***	0.4378***	0.3418***	0.3195***	0.3383***
	(0.0818)	(0.0818)	(0.0819)	(0.0822)	(0.0830)	(0.0830)	(0.0818)	(0.0838)	(0.0843)	(0.0885)	(0.0874)	(0.0830)	(0.0824)	(0.0834)
Control of corruption	0.1339**	0.1339**	0.1319**	0.1331**	0.1440**	0.1347**	0.1339**	0.1372**	0.2207***	0.3163***	0.0939	0.1140*	0.1536**	0.0014
	(0.0621)	(0.0621)	(0.0622)	(0.0623)	(0.0626)	(0.0633)	(0.0621)	(0.0633)	(0.0665)	(0.0729)	(0.0635)	(0.0651)	(0.0628)	(0.0709)
Trade openness	-0.0046***	-0.0046***	-0.0045***	-0.0048***	-0.0048***	-0.0045***	-0.0046***	-0.0045***	-0.0064***	-0.0078***	-0.0039**	-0.0076***	-0.0044***	-0.0082***
	(0.0016)	(0.0016)	(0.0016)	(0.0017)	(0.0016)	(0.0016)	(0.0016)	(0.0017)	(0.0017)	(0.0018)	(0.0017)	(0.0018)	(0.0016)	(0.0018)
Fixed exchange rate dummy	-2.2884***	-2.2884***	-2.2875***	-2.2828***	-2.0076***	-2.2904***	-2.2884***	-2.2744***	-2.2295***	-2.3184***	-2.3175***	-2.3712***	-2.2787***	-2.4261***
	(0.2134)	(0.2134)	(0.2134)	(0.2137)	(0.2323)	(0.2140)	(0.2134)	(0.2138)	(0.2144)	(0.2198)	(0.2211)	(0.2173)	(0.2160)	(0.2224)
Broad money growth	-0.0190***	-0.0190***	-0.0188***	-0.0184***	-0.0197***	-0.0188***	-0.0190***	-0.0181***	-0.0197***	-0.0195***	-0.0162***	-0.0229***	-0.0180***	-0.0172***
	(0.0055)	(0.0055)	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0055)	(0.0055)	(0.0057)	(0.0060)	(0.0057)	(0.0059)	(0.0056)	(0.0057)
Lagged unemployment rate								0.0087						
								(0.0083)						
Lagged primary budget balance									0.0107					
									(0.0172)					
Lagged public debt										-0.3273***				
										(0.0924)				
Lagged public investment											-0.6372***			
											(0.1051)			
Lagged FDI												0.0975***		
												(0.0172)		
Governor turnover													-0.3606**	
													(0.1762)	
Government stability														0.4173***
														(0.0785)
Constant	-0.8118***	-0.8118***	-0.8163***	-0.8370***	-0.6919**	-0.8193***	-0.8118***	-0.8318***	-1.0980***	0.1100	-0.3250	-0.7228**	-0.7571**	-0.0380
	(0.3136)	(0.3136)	(0.3137)	(0.3155)	(0.3199)	(0.3147)	(0.3136)	(0.3144)	(0.3275)	(0.4802)	(0.3359)	(0.3222)	(0.3145)	(0.3586)
Observations	1181	1181	1134	1163	994	1155	1181	1152	1072	980	1174	1177	1153	1142
Pseudo R^2	0.31	0.31	0.29	0.31	0.25	0.31	0.31	0.31	0.30	0.32	0.34	0.34	0.31	0.33

Notes: This table reports propensity score estimates from a probit model. The dependent variable is a dummy equal to 1 if a country i in the year t has an inflation target, and zero otherwise, referring to conservative dates or hard inflation targeting. Column [1] reports the main model's results. Columns [2]-[14] report estimates from different robustness checks. Specifically, in columns [2]-[7], we exclude the year 1990, hyperinflation episodes, years with financial crises, countries belonging to a monetary union, and dollarized countries, as well as those with a fixed de facto exchange rate or currency boards, new inflation target countries (countries that adopted the monetary regime at the end of the study period), and Central and Eastern European Countries (CEECs), respectively. Columns [8]-[14] augment the main equation, adding the following variables: lagged unemployment rate, lagged primary budget balance, lagged public debt, lagged public investment, lagged foreign direct investment, governor turnover, and government stability, respectively. Standard errors are in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

1.4.2 Results from Matching

By matching inflation-targeting with non-inflation-targeting countries comparable in terms of observable characteristics correlated with the treatment and potentially with the outcome variable, the propensity score matching method allows for mitigating the selection bias in inflation targeting adoption. The observable characteristics between the two groups of countries are summarized in the propensity scores estimated in subsection 1.4.1. Then, these scores are used to match each treated country with at least one of its untreated peers.[7] We refer to the existing literature and draw upon four propensity score matching methods. First, the Nearest-Neighbors method matches each treated observation to the n untreated observations with the most comparable propensity score possible. Following Lin and Ye (2009) and Huang et al. (2019), we retain one-to-one-nearest-neighbor and three-nearest-neighbor matching. Second, the radius method (Dehejia and Wahba, 2002) matches a treated observation to untreated observations located at a certain distance based on propensity scores. We retain the small (R = 0.005), medium (R = 0.01), and wide (R = 0.05) radius. Third, the Kernel method (Heckman et al., 1998) matches each treated observation with a weighted average of all the untreated observations, the weights being inversely proportional to the gap between the propensity scores of treated and untreated observations. Finally, the Local Linear Regression (Heckman et al., 1998) proceeds like Kernel Matching but uses a linear factor in the weighting function.

From the propensity scores of the baseline model reported in column [1] of Table 1.3, we estimate the inflation targeting effect on private domestic investment. Results of the baseline model using the conservative dates (hard inflation targeting) are reported in column [1] of Table 1.4.[8] The estimated coefficients are positive and significant, with a magnitude ranging between 2.80 (Nearest-Neighbors Matching) and 3.26 (Radius Matching) percentage points, suggesting that inflation targeting significantly increases private domestic investment in inflation-targeting compared to non-targeting countries. Furthermore, since the coefficients represent between 22% and 26% of the sample average (see Table 1.2), these effects are economically significant.

[7] It should be noted that the covariates are only used in the propensity scores and not to calculate the difference in the outcome in the equation.

[8] Our results remain robust when referring to soft inflation targeting (Section .a5 of the Appendix reports these results).

Table 1.4: The effect of inflation targeting on private domestic investment in %GDP (using conservative starting dates)

Treatment: Hard inflation targeting	Nearest-Neighbors Matching		Radius Matching			Kernel Matching	Local Linear Regression
	N=1	N=3	r=0.005	r=0.01	r=0.05		
Baseline model [1] ATT	2.8049***	3.1158***	3.2602***	3.1803***	3.0301***	3.0512***	2.8575***
	(0.7321)	(0.6002)	(0.5343)	(0.4966)	(0.4506)	(0.4478)	(0.4586)
Treated observations	251	251	251	251	251	251	251
Control observations	921	921	921	921	921	921	921
Total observations	1,172	1,172	1,172	1,172	1,172	1,172	1,172
Robustness checks							
[2] Excluding year 1990	2.8049***	3.1158***	3.2602***	3.1803***	3.0301***	3.0512***	2.8575***
	(0.6922)	(0.5694)	(0.5387)	(0.5099)	(0.4591)	(0.4571)	(0.4390)
[3] Excluding hyperinflation episodes	2.7395***	2.9115***	3.1695***	3.1468***	3.0051***	3.0404***	2.8535***
	(0.7128)	(0.5755)	(0.5235)	(0.4983)	(0.4737)	(0.4597)	(0.4569)
[4] Excluding financial crises	2.4647***	2.8952***	2.9130***	2.9777***	3.0830***	3.1003***	2.9207***
	(0.6539)	(0.5720)	(0.5450)	(0.5053)	(0.4568)	(0.4350)	(0.4094)
[5] Excluding regimes incompatible with inflation targeting	3.6068***	3.3778***	3.2982***	3.3497***	3.0192***	3.0338***	2.8542***
	(0.6700)	(0.6008)	(0.5670)	(0.4919)	(0.4668)	(0.4684)	(0.4684)
[6] Excluding new inflation-targeting countries	2.5702***	3.0967***	3.2800***	3.2099***	3.0885***	3.0928***	2.9090***
	(0.7332)	(0.6127)	(0.5553)	(0.5274)	(0.4646)	(0.4664)	(0.4735)
[7] Excluding CEECs	3.3084***	3.4715***	3.3301***	3.3891***	3.3539***	3.3559***	3.1876***
	(0.7879)	(0.6812)	(0.5885)	(0.5690)	(0.5463)	(0.5644)	(0.5770)
[8] Including lagged unemployment rate	3.0124***	3.1892***	3.2047***	2.9619***	3.1085***	3.0859***	2.8891***
	(0.7061)	(0.5850)	(0.5362)	(0.5028)	(0.4372)	(0.4249)	(0.4435)
[9] Including lagged primary budget balance	3.0537***	2.7451***	2.9816***	3.0692***	2.8561***	2.8632***	2.7695***
	(0.6765)	(0.5949)	(0.5606)	(0.5236)	(0.4596)	(0.4768)	(0.5205)
[10] Including lagged public debt	2.5762***	2.0814***	2.4569***	1.9990***	1.8707***	1.8641***	1.7760***
	(0.7246)	(0.6489)	(0.5694)	(0.5642)	(0.5190)	(0.5111)	(0.4847)
[11] Including lagged government investment	3.1676***	3.4114***	3.3239***	3.3606***	4.1760***	3.6304***	3.7734***
	(0.6505)	(0.5266)	(0.5152)	(0.4725)	(0.3510)	(0.3640)	(0.3607)
[12] Including lagged FDI	1.8512**	2.3759***	2.2125***	2.3134***	2.4923***	2.5384***	2.4255***
	(0.7266)	(0.6484)	(0.5955)	(0.5903)	(0.5131)	(0.5017)	(0.5020)
[13] Including governor turnover	2.9896***	3.1229***	3.5946***	3.2879***	3.1316***	3.1238***	2.9509***
	(0.7022)	(0.5752)	(0.5344)	(0.4781)	(0.4254)	(0.4718)	(0.4364)
[14] Including government stability	3.0993***	2.8253***	3.2825***	3.0527***	2.5792***	2.5797***	2.4277***
	(0.6871)	(0.5910)	(0.6024)	(0.5324)	(0.4771)	(0.4871)	(0.4486)
Quality of the matching							
Pseudo R^2	0.008	0.005	0.005	0.006	0.006	0.005	0.008
Rosenbaum bounds sensitivity tests	1.9	2.6	3.1	3.3	3.8	3.8	3.3
Standardized bias (p-value)	0.570	0.862	0.886	0.751	0.797	0.813	0.570

Notes: This table reports estimates of the effect of inflation targeting on domestic investment from propensity score matching. The treatment variable is a dummy equal to 1 if a country i in the year t has an inflation target, and zero otherwise, referring to conservative dates. The dependent variable is measured as the share of private-sector gross fixed capital formation to GDP. Line [1] reports the main model results. Lines [2]-[14] report estimates from different robustness checks. Specifically, in lines [2]-[7], we exclude the year 1990, hyperinflation episodes, years with financial crises, countries belonging to a monetary union, and dollarized countries, as well as those with a fixed de facto exchange rate or currency boards, new inflation target countries (countries that adopted the monetary regime at the end of the study period), and Central and Eastern European Countries (CEECs), respectively. Lines [8]-[14] augment the main equation, adding the following variables: lagged unemployment rate, lagged primary budget balance, lagged public debt, lagged public investment, lagged foreign direct investment, governor turnover, and government stability, respectively. Bootstrapped standard errors based on 500 replications are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

1.5 Sensitivity analysis

1.5.1 Robustness

In columns [2]-[14] of Table 1.3, we test the robustness of the propensity scores of the baseline model (column [1]) using alternative specifications. First, we estimate new propensity scores using different subsamples (columns [2]-[7]). In column [2] (Table 1.3), we ignore the year 1990, which initiates inflation targeting adoption. Next, since some countries in the sample experienced at least one episode of hyperinflation from 1990-2019, one may expect that such extreme values could bias the estimations. Consequently, in column [3], we exclude from the sample any episode of hyperinflation, defined as an annual inflation rate equal to or higher than 40% (Lin and Ye, 2009). For the same reasons, in column [4], we ignore years marked by financial crises. Our sample includes a few countries with a fixed exchange rate regime, which therefore implicitly have an inflation target. Since this regime is not compatible with inflation targeting adoption, in column [5] we exclude from the sample countries belonging to a monetary union and dollarized countries, as well as those with a fixed de facto exchange rate or currency boards. In column [6], we exclude new inflation-targeting countries from treated countries, since countries that have recently adopted the monetary framework are unlikely to have a sound fiscal policy that can enhance the credibility and effectiveness of the regime. Excluding these countries from the sample allows us to avoid a possible bias in our results, due to the absence of a potential situation of fiscal dominance among the new treated countries. Finally, since 1990, Central and Eastern European Countries (CEECs) have implemented a wave of reforms, including financial openness, which have significantly reduced the gap between their economic performance and the EU average. In addition, these countries have experienced massive foreign direct investment (FDI) inflows, which could have a significant effect on domestic investment. Therefore, in column [7], we exclude them from the sample. Overall, the new propensity score estimates are comparable to those of the baseline model (column [1], Table 1.3), even if the sign of GDP per capita growth is sometimes ambiguous. From the new scores, we compute new average treatment effects reported in columns [2]-[7] of Table 1.4. New estimates yield similar results to those of the baseline model reported in column [1] of Table 1.4, supporting our previous conclusions.

We further augment our main equation, adding additional variables likely to be correlated both with inflation targeting and the outcome variable (columns [8]-[14], Table 1.3). These variables include lagged unemployment rate, lagged primary

budget balance, lagged public debt, lagged public investment, lagged foreign direct investment, central bank independence (proxied by the variable «Governor turnover», which is a dummy equal to 1 if the central bank governor is changed informally before the end of his or her term, and zero otherwise), and government stability.[9] New estimated scores reported in columns [8]-[14] remain qualitatively comparable to those obtained previously and similar to those obtained for our baseline model. The results from the probit model suggest that FDI and government stability are positively correlated with the probability of a country adopting inflation targeting. However, public debt, public investment, and weak central bank independence reduce the likelihood of adopting the regime. From the new estimated propensity scores in columns [8]-[14] of Table 1.3, we recompute the average treatment effects reported in columns [8]-[14] of Table 1.4. New coefficients remain qualitatively and quantitatively comparable to the baseline model results (column [1], Table 1.4).

Subsections A.3, A.4, A.5, and A.6 of the Appendix report some additional robustness. More specifically, in subsection A.4, we perform random assignment to treatment, considering fake adoption dates, and show that our main estimations from true adoption dates are not biased by omitted variables or a spurious trend. In Subsection A.6, we perform some econometric robustness, using three alternative estimation strategies: the bias-corrected matching estimator, the Inverse Probability Weighting (IPW) estimator, and a nonparametric kernel regression. The results remain stable. Finally, in subsections A.3 and A.5, we change our matching approach and consider an alternative measure of the treatment variable, referring to soft inflation targeting. Again, the new estimates support our main results.

1.5.2 Heterogeneity

Next, we examine some heterogeneity features of the treatment effect, using a control function regression approach, as in Lin and Ye, 2009. First, we assess the effectiveness of the monetary framework by looking at inflation deviations from the target, then we examine the role of economic and institutional factors.

Do deviations from the target matter? By reaching or approaching the inflation target, central banks influence public expectations, thus creating a decision-making framework that increases monetary policy credibility, which may lead to a more conducive environment for investment. In this context, we argue that although our main estimates suggest a positive and significant effect of inflation targeting on

[9]Subsection A.2 of the Appendix discusses the rationale for these variables.

investment, this result may strongly depend on inflation deviations from the target. Referring to Ogrokhina and Rodriguez (2018), we compute inflation deviations from the target as the difference between realized inflation and the inflation target for each treated country over the period 1990-2019.[10] We report an average deviation of 1.18 percentage points among inflation-targeting countries and a median of zero. As can be seen in Figure 1.2, which plots the kernel density of deviations, most inflation-targeting countries do not deviate from their target, resulting in a distribution of deviations concentrated around zero. The long tail is explained by a few countries with large deviations.

In the first column of Table 6.7, we estimate the inflation targeting effect on the outcome variable, using a simple OLS regression. Results suggest that inflation targeting increases domestic investment by an average of 3.82 percentage points. In column [2], we include the estimated propensity score (Pscore) for the baseline model as a control function to correct for potential self-selection. The coefficient of the propensity score is positive and significant, suggesting the presence of a selection bias. The coefficient of the treatment variable remains positive and significant, with a magnitude of approximately 3.01 percentage points. To capture potential heterogeneity in the regime's effectiveness regarding inflation deviations from the target, in column [3] (Table 6.7) we interact the treatment variable with the level of deviation to allow for possible asymmetric deviations between negative and positive deviations. As can be seen, the coefficient on the interactive term does not suggest any presence of heterogeneity. In column [4], following Ogrokhina and Rodriguez (2018), we consider the squared deviation of inflation from the target, rather than the level of deviation, as some deviations are negative. Results suggest that inflation deviations from the target (especially when negative deviations are taken into account) reduce the effectiveness of the monetary framework. Last, in column [5], we consider only extreme deviations from the target. The coefficient on the interactive term remains negative, but increases compared to that in column [4], suggesting that extreme deviations from the target further reduce the beneficial effect of the monetary framework on investment. Hence, although our results suggest a positive and significant effect of inflation targeting on investment, further analysis shows that the beneficial effect of the monetary framework is mitigated when the central bank tends to deviate from its target, or even becomes ineffective in cases of extreme deviations. This result should be put into perspective with some

[10]Data on inflation targets are extracted from Jahan (2012) and publications by the central bank of each country.

important papers in the literature that find ambiguous effects of inflation targeting on domestic investment. For instance, using pooled ordinary least squares, fixed effects IV, and the IV-GMM methodology over the period 1990-2009, Mukherjee and Bhattacharya (2011) find that inflation targeting did not have a significant direct impact on either investment or the responsiveness of investment to interest rate movements in emerging market economies. Likewise, using synthetic control methods for a set of developing and developed economies spanning the period 1984 to 2017, McCloud (2022) finds that inflation targeting adoption did not affect domestic investment in 21 out of 29 treated countries. Most strikingly, in the post-inflation targeting period, the author finds that the domestic investment response to inflation targeting decreased in Paraguay, Mexico, the Philippines, Colombia, Guatemala, and Ghana. The author implicitly claims that this result may be explained by a lack of transparency on the part of the monetary authorities due to a poor communication strategy or by the central bank's deviations from its inflation target.[11] Indeed, in contrast to previous studies, notably Mukherjee and Bhattacharya (2011) and McCloud (2022), the control function regression used in our study allows us to take into account heterogeneity over time to examine to what extent deviations from the target affect the regime's effectiveness. The credibility argument advanced by McCloud (2022), coupled with the results in the previous paragraph, thus seem to provide some rationale for why the monetary framework may be ineffective in some countries. Moreover, our data suggest that Mexico, Colombia, and Ghana, which are half of the countries identified by McCloud (2022) in which domestic investment declined after inflation targeting adoption, also report inflation deviations from the target above the sample average over our study period.[12]

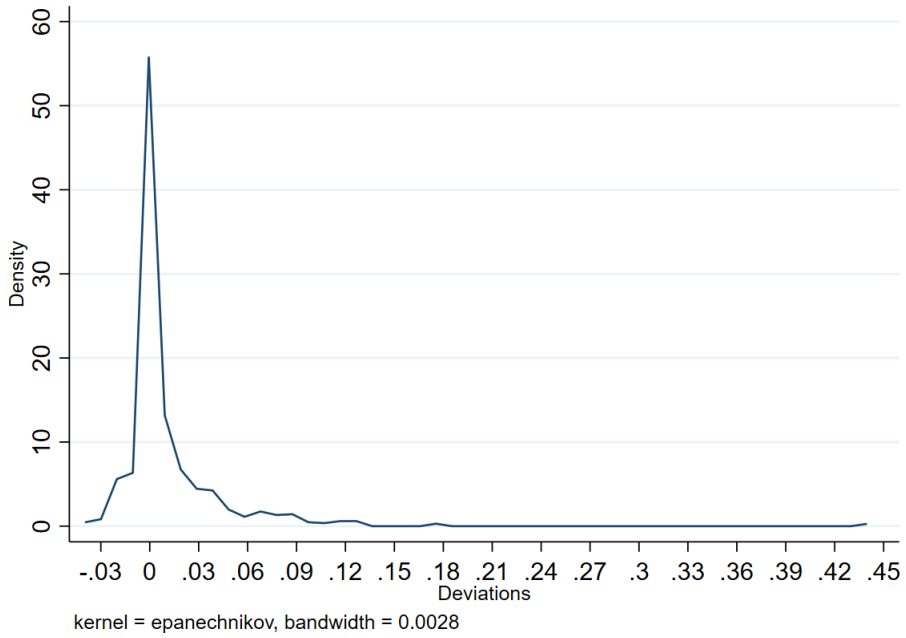
The role of economic and institutional factors. We explore other potential sources of heterogeneity, considering fiscal discipline, the level of economic development, and the quality of institutions. In column [6] of Table 6.7, we interact the treatment variable with the term «Sound fiscal discipline», which is a dummy variable equal to 1 when a country i, at a time t, has a fiscal balance above its long-term average, and zero otherwise. Results suggest that inflation targeting is most effective in countries with good fiscal discipline.[13] Next, we examine the

[11]The author rightly states: "In addition, if an IT [for inflation targeting] central bank misses its target, then this may negatively affect its credibility." (McCloud, 2022, Page 115).

[12]As mentioned earlier, we refer to Ogrokhina and Rodriguez (2018) and compute inflation deviations from the target as the difference between realized inflation and the inflation target for each treated country over 1990-2019. Section B (Appendix) reports these data.

[13]Results remain similar when using other indicators, such as sovereign debt ratings.

Figure 1.2: Distribution of inflation deviations from the target



Notes: This figure plots the kernel density of inflation deviations from the central bank's target of the countries in our sample, over the period 1990-2019. The long tail is explained by a few countries with large deviations. Data on inflation targets are extracted from Jahan (2012) and publications by the central bank of each country.

effectiveness of the monetary regime according to the level of economic development, distinguishing between emerging and low-income countries, based on the IMF's classification. Emerging economies are those considered to be in transition to a developed market economy and are characterized by, among other things, a rapid increase in per capita income. Low-income countries, on the other hand, are characterized by limited structural transformation and their external financial linkages are not strong enough to be considered as emerging market economies.[14] Since less developed countries are generally the least able to contain large shocks to economic activity, given their low resilience and vulnerability, they are likely to benefit more from the stability provided by the monetary framework. However, it can also be argued that emerging countries, generally characterized by better institutions than those of low-income economies, would be more likely to anchor public expectations more strongly, by either improving the central bank's communication strategy or by getting as close as possible to the target set. In Column [7] (Table 6.7), we interact the treatment variable with a dummy variable equal to 1 if the country is

[14]Source: IMF Fiscal Monitor database. Section B of the Appendix reports the list of emerging and low-income countries used in the study.

an emerging economy, and zero otherwise. The positive and significant coefficient on the interactive term suggests that inflation targeting benefits emerging countries the most, corroborating the second hypothesis. The last two columns explore potential heterogeneity features according to institutional quality, in particular the rule of law and respect for human rights. The first variable captures the quality of contract enforcement, property rights, the level of security, and law and order within the society and is extracted from the Worldwide Governance Indicators (WGI) database. The second variable captures the protection of human rights and comes from Fariss (2014). No heterogeneity seems to emerge regarding these variables.

Finally, one may wonder whether the results of this article also apply to developed countries. Subsection A.7 of the Appendix addresses this question. Overall, the literature shows that inflation targeting has no significant effect on the inflation performance of developed countries. Regarding the impact of inflation targeting on domestic investment, among developed countries, McCloud (2022) finds that domestic investment increased in Australia in the post-inflation targeting period.

1.6 Transmission channels

As mentioned earlier, we assume that macroeconomic stability, i.e., the reduction in inflation and its volatility, interest rate, exchange rate, and output volatility, is the main channel through which the monetary framework may affect domestic investment. We adopt a simple two-step approach to test the main transmission channels. In Panel A of Table 1.6, we estimate simple Pearson's correlations in order to capture the relationship between the potential channels and domestic investment. Inflation, interest rate, real effective exchange (REER), and output volatility are negatively correlated with domestic investment. Moreover, the magnitude of the relationship extends from 13% to 20% depending on the nature of the volatility and is significant at the 1% threshold.[15] If monetary policy credibility, leading to greater macroeconomic stability, is an important channel explaining our previous results, we should in turn observe a negative impact of inflation targeting on macroeconomic volatility. Results reported in Panel B suggest that inflation targeting reduces inflation and its volatility, real exchange rate, interest rate, and output volatility, in line with previous studies.

[15]We ensure that each variable is stationary and calculate volatility as the standard deviation of a three-year moving average of that variable in each country.

Table 1.5: Heterogeneity: Exploring conditional effects

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Hard inflation targeting (IT)	3.8252***	3.0093***	3.0147***	3.1784***	3.0725***	2.3909***	1.4023**	2.4600***	2.6868***
	(0.2774)	(0.4156)	(0.4449)	(0.4375)	(0.4176)	(0.5105)	(0.5448)	(0.4645)	(0.4328)
Pscore		4.0563***	4.0504***	3.9292***	4.0200***	4.0331***	2.9869***	2.6163**	4.2650***
		(0.8881)	(0.9065)	(0.9006)	(0.8892)	(0.8889)	(0.8709)	(1.0269)	(0.8947)
Hard IT * Level of deviation			8.2985						
			(12.2618)						
Hard IT * Squared deviation				-2.1378*					
				(1.1048)					
Hard IT * Extreme deviation					-4.4103***				
					(0.3713)				
Hard IT * Sound fiscal discipline						1.2320**			
						(0.6116)			
Hard IT * Emerging countries							1.4441**		
							(0.6591)		
Hard IT * Rule of law								0.5822	
								(0.4576)	
Hard IT * Human rights									-0.3043
									(0.1987)
Observations	1842	1172	1172	1172	1172	1172	1172	892	1161

Notes: Vector X variables in isolation (without interaction with inflation targeting) and controls are included but not reported for the sake of space. Robust standard errors are in brackets. *** p<0.01, ** p<0.05, * p<0.1

1.7 Concluding remarks

A few studies have examined the impact of inflation targeting on private domestic investment, with mixed results. In this paper, we argue that a monetary framework such as inflation targeting, which strongly anchors public expectations, should promote monetary policy credibility and thus greater macroeconomic stability, creating a conducive environment for investment. Using a panel of 62 developing countries over the period 1990-2019, we rely on various propensity score matching methods to mitigate the potential selection bias associated with policy adoption. Our results are twofold. On the one hand, we find that inflation targeting significantly increases domestic investment. The effects are economically significant and robust to various tests. On the other hand, the monetary regime is less effective when the central bank tends to deviate from its target, and exhibits pronounced ineffectiveness in cases of extreme deviations. Moreover, there is evidence that inflation targeting is more effective in countries with sound fiscal discipline and that it benefits emerging

Table 1.6: Validity of transmission channels

Panel A	[1]	[2]	[3]	[4]	[5]			
	DI	DI	DI	DI	DI			
Inflation	-0.0278							
Inflation volatility		-0.1349***						
Interest rate volatility			-0.2063***					
REER volatility				-0.2050***				
Output volatility					-0.1734***			
Panel B	Nearest-Neighbors Matching		Radius Matching			Kernel Matching	Local Linear Regression	
	N=1	N=3	r=0.005	r=0.01	r=0.05			
[1] Inflation	-0.8972**	-0.9317**	-0.8721***	-1.0323**	-1.1364***	-1.3616***	-1.3188***	-1.4245***
	(0.4573)	(0.4087)	(0.3360)	(0.4273)	(0.2835)	(0.3283)	(0.3648)	(0.3896)
[2] Inflation volatility	-0.8948***	-0.9130***	-0.9923***	-0.8413***	-0.9288***	-0.9006***	-0.9176***	-0.8848***
	(0.2617)	(0.2024)	(0.1921)	(0.1676)	(0.1816)	(0.1234)	(0.1374)	(0.1369)
[3] Interest rate volatility	-0.0194***	-0.0210***	-0.0218***	-0.0194***	-0.0211***	-0.0200***	-0.0203***	-0.0196***
	(0.0044)	(0.0037)	(0.0037)	(0.0032)	(0.0030)	(0.0022)	(0.0026)	(0.0021)
[4] REER volatility	-6.1947***	-6.7525***	-7.2684***	-6.3732***	-6.8278***	-6.6643***	-6.7408***	-6.5145***
	(1.5673)	(1.4017)	(1.1303)	(1.2976)	(1.1364)	(0.9716)	(1.0322)	(0.9001)
[5] Output volatility	-0.4155***	-0.4883***	-0.4823***	-0.4757***	-0.5106***	-0.4922***	-0.4971***	-0.4896***
	(0.1280)	(0.1009)	(0.0966)	(0.0967)	(0.0830)	(0.0782)	(0.0662)	(0.0637)

Notes: This table reports the results of the main channels through which inflation targeting may affect domestic investment (DI). Columns [1]-[5] of Panel A present the relationship between different indicators of macroeconomic volatility and domestic investment, based on simple Pearson's correlations. *** indicates significance at the 1% threshold. Panel B reports the effect of inflation targeting on the potential channels, based on propensity score matching methods. The equation specified is the same as in the main model, replacing the dependent variable with the potential channel. Bootstrapped standard errors based on 100 replications are reported in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

economies the most. Regarding the main transmission channels, we find that enhanced credibility resulting from inflation targeting adoption, leading to greater macroeconomic stability, is an important channel through which the monetary framework promotes domestic investment.

Our findings have clear implications. A credible monetary framework such as inflation targeting, which strongly anchors public expectations, can be an important strategy to foster private investment in developing countries. However, since inflation deviations from the target are costly for investment, the central banks of the countries concerned should further improve their communication strategies in order to anchor public expectations more strongly, as these expectations can be a significant source of economic fluctuations (Baranowski et al., 2021). Finally, our results should be interpreted with caution. Although inflation targeting can be an effective framework

for increasing domestic investment in developing countries, there are many other constraints to accelerating investment and growth. For instance, Aman et al. (2022) show that countries with better institutional quality benefit from lower exchange rate misalignment following an inflation targeting policy intervention and that their external competitiveness improves.

A Additional checks

A.1 Assessing the quality of the matching method

Propensity score matching should eliminate significant differences in observables between inflation-targeting and non-targeting countries. First, we test the quality of the matching based on the Pseudo-R^2, as suggested by Sianesi (2004). According to Caliendo and Kopeinig (2008), a good fit is associated with a «fairly low» Pseudo-R^2, defined as the difference between the Pseudo-R^2 for the matched and for the unmatched samples. All the Pseudo-R^2 in our main estimates are less than 0.01 (see Table 4 of the manuscript), suggesting that the matching provided balanced scores. Consequently, our findings are robust regarding the hypothesis of common support. Second, we verify the Conditional Independence Assumption (CIA) for both observables and non-observables. Regarding observables, the standardized bias test which evaluates the mean difference in observables between inflation-targeting and non-inflation-targeting countries supports the absence of significant statistical differences between the two groups after matching (see Rosenbaum, 2002). Regarding unobservables, we test to what extent those that simultaneously affect the assignment to the treatment and the outcome variable could bias our results. The cutting points from Rosenbaum's sensitivity tests at the 1% significance threshold hover between 1.9 and 3.8 (see Table 4 of the manuscript), comparable with existing studies for which the cutting point ranges between 1.1 and 2.2 (see e.g., Aakvik, 2001 or Rosenbaum, 2002 page 188). Thus, we can conclude that our main estimates are also robust regarding the CIA.

A.2 Additional controls

We discuss the rationale for the additional controls used for robustness in the paper. These variables include lagged unemployment rate, lagged primary budget balance, lagged public debt, lagged public investment, lagged foreign direct investment (FDI), central bank independence (proxied by the variable "Governor turnover", which is a

dummy equal to 1 if the central bank governor is changed informally before the end of his or her term, and zero otherwise), and government stability.[16] The unemployment rate may influence the conduct of the inflation targeting policy due to a potential time inconsistency dilemma. On the one hand, in the presence of high unemployment, the central bank may not focus exclusively on price stability. Considering that it cannot ignore the labor market situation, it may adopt an accommodating policy, which may decrease the probability of adopting inflation targeting. On the other hand, countries with high unemployment could adopt the policy in the hope of improving the labor market situation, given the beneficial externalities of inflation targeting. Regarding fiscal discipline, referring to the unpleasant monetarist arithmetic (Sargent and Wallace, 1981), one can consider that sound fiscal discipline may decrease the government's likelihood of pressuring the central bank to finance its deficits, thereby increasing the central bank's likelihood of adopting inflation targeting. Conversely, given the positive effect of this monetary framework on fiscal discipline, poor fiscal discipline may also lead the central bank to adopt inflation targeting to promote fiscal discipline. FDI could boost tax revenue collection by expanding the tax base through the entry of new firms, thereby increasing fiscal space. Therefore, FDI should be positively correlated with inflation targeting adoption. Regular and unofficial changes of the central bank's governor may reflect a monetary institution's lack of independence from the government and, therefore, the central bank's incapacity to implement a credible targeting policy. Thus, the variable "Governor turnover" should reduce the likelihood of the central bank's adoption of inflation targeting. Finally, a stable government, characterized by low political risk, may reflect good governance, strengthen investor confidence, and reduce sovereign bond yield spreads. Government stability also improves sovereign debt ratings and promotes access to financial markets for developing countries (Sawadogo, 2020). Therefore, government stability should promote sound fiscal discipline and increase the likelihood that it will adopt inflation targeting.

A.3 Excluding pre-treated observations

The treatment (inflation targeting) consists of a country-year dimension, as is common in the literature, since our sample includes a time dimension. Therefore, in our sample, observations for a country that is not yet treated (but will be)

[16]Since inflation targeting can have a strong influence on unemployment, FDI, or fiscal variables (see Lucotte, 2012; Minea and Tapsoba, 2014; Huang and Yeh, 2014), we lag these variables by one period to avoid a simultaneity bias.

are included in the control group. This explains why, with 23 inflation-targeting countries and a sample spanning from 1990 to 2019 (30 years), we do not have 690 observations (23×30) in the treated group, but rather 251. That said, this approach may match some observations for certain treated countries to these same countries at a time when the country is not treated. In Panel A of Table A1, we replicate our baseline model by excluding from the sample, observations for a country that is not yet treated but will be (i.e., pre-treated observations). Results remain stable.

A.4 Falsification tests

Since the adoption of inflation targeting may be associated with other alternative measures, one can expect that unobservables correlated with policy adoption and potentially with the outcome variable may drive our results. Therefore, in column [1] of Panel B (Table A1), we perform random assignments to treatment within the inflation-targeting countries, using fake adoption dates. In column [2], assignments are made within the entire sample. If our previous estimations from true adoption dates are biased by omitted variables or a spurious trend, the placebo regressions could also show significant effects. Instead, random assignments to treatment have no significant effect on the outcome variable, which strongly supports our findings.

A.5 Alternative definition of the treatment variable

Next, we analyze the sensitivity of our main results using an alternative definition of the treatment variable, referring to default start dates or informal/soft inflation targeting. Under a soft inflation targeting framework, the central bank's reaction to a deviation from the inflation target is slower than its reaction under a hard inflation targeting regime. Soft inflation targeting, therefore, refers to the date of adoption declared by the central bank itself, while hard inflation targeting refers to the date declared by academics. Examining the difference between soft and hard inflation targeting would make it possible to consider the central bank's credibility, captured here by inflation deviations from the target. In other words, since the central bank's reaction to an inflation deviation from the target is slower in a soft inflation targeting regime than in a hard inflation targeting regime, one would expect relatively smaller effects on investment in the former case. New average treatment effects from the baseline model reported in Table A2 are positive and significant, with a magnitude ranging from 2.47 (Radius Matching) to 3.52 (Nearest-Neighbors Matching) percentage points. Therefore, our results support the hypothesis of a positive and significant effect of inflation targeting on domestic investment, with a

Table A1: Excluding pre-treated observations (Panel A), and falsification tests (Panel B)

Panel A	Nearest-Neighbors Matching		Radius Matching			Kernel Matching	Local Linear Regression
Treatment: Hard inflation targeting	N=1	N=3	r=0.005	r=0.01	r=0.05		
	3.1258***	2.9798***	3.3338***	2.9171***	2.9703***	2.9990***	2.8852***
	(0.7723)	(0.6864)	(0.6388)	(0.5645)	(0.5363)	(0.5226)	(0.5211)
Panel B	Nearest-Neighbors Matching		Radius Matching			Kernel Matching	Local Linear Regression
Treatment: Hard inflation targeting	N=1	N=3	r=0.005	r=0.01	r=0.05		
[1] ATT	0.5469	0.3272	0.4516	0.3783	0.4531	0.4605	0.4626
	(0.5982)	(0.5390)	(0.4328)	(0.4022)	(0.3700)	(0.4183)	(0.4131)
[2] ATT	-0.0725	-0.2824	-0.0709	-0.0491	-0.1985	-0.1889	-0.0039
	(0.5637)	(0.5116)	(0.3301)	(0.2877)	(0.3478)	(0.3203)	(0.3008)

Notes: This table reports estimates of the effect of inflation targeting on domestic investment from propensity score matching. The treatment variable is a dummy equal to 1 if a country i in the year t has an inflation target, and zero otherwise, referring to conservative dates. The dependent variable is measured as the share of private-sector gross fixed capital formation to GDP. In Panel A, we exclude observations for a country that is not yet treated but will be (i.e., pre-treated observations) from the sample. Panel B reports placebo test estimates of the effect of inflation targeting on domestic investment. In column [1], we assign random adoption dates within treated countries. In column [2], we assign random adoption dates within the entire sample. Bootstrapped standard errors based on 500 replications are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

comparable magnitude whether we refer to hard or soft inflation targeting.

A.6 Alternative estimation methods

We perform some econometric robustness checks, using three alternative estimation strategies: the bias-corrected matching estimator, the Inverse Probability Weighting (IPW) estimator, and a nonparametric kernel regression. The bias-corrected matching estimator is similar to the propensity score matching method. However, as argued by Abadie and Imbens (2006, 2011), when matching more than one continuous covariate (as in this study), the previously described matching estimator is not consistent, even in infinitely large samples (Abadie and Imbens, 2006 and Abadie and Imbens, 2011). The bias-corrected matching estimator combines matching and regression, which reduces potential residual biases due to imbalances in the covariates (Balima et al., 2021). New estimates are reported in Panel A of Table A3, considering one and two matched neighbors, respectively. In columns [1] and [2], we include year

Table A2: The effect of inflation targeting on private domestic investment in %GDP (using default starting dates or soft inflation targeting)

Treatment: Soft inflation targeting	Nearest-Neighbors Matching		Radius Matching			Kernel Matching	Local Linear Regression
	N=1	N=3	r=0.005	r=0.01	r=0.05		
ATT:	3.5246***	2.4738***	2.9087***	2.5747***	2.7750***	2.7525***	2.5911***
	(0.6939)	(0.5962)	(0.5492)	(0.5051)	(0.4465)	(0.4586)	(0.4607)
Treated observations	251	251	251	251	251	251	251
Control observations	921	921	921	921	921	921	921
Total observations	1,172	1,172	1,172	1,172	1,172	1,172	1,172
Quality of the matching							
Pseudo R^2	0.013	0.009	0.005	0.006	0.006	0.005	0.008
Rosenbaum bounds sensitivity tests	2.3	1.7	3.1	3.3	3.8	3.8	3.3
Standardized bias (p-value)	0.209	0.482	0.886	0.751	0.797	0.813	0.570

Notes: This table reports estimates of the effect of inflation targeting on domestic investment from propensity score matching, using the main equation. The treatment variable is a dummy equal to 1 if a country i in the year t has an inflation target, and zero otherwise, referring to default dates or soft inflation targeting. The dependent variable is measured as the share of private-sector gross fixed capital formation to GDP. Bootstrapped standard errors based on 500 replications are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

and country-fixed effects, to control for unobserved heterogeneity. Second, since inflation targeting has been adopted by a growing number of developing countries in recent decades, in the last two columns we augment our main equation by adding a trend to capture common long-term movements correlated with inflation targeting adoption and potentially with the outcome variable. New results reinforce our previous conclusions.

Second, although estimating average treatment effects from propensity score matching makes it possible to address the potential selection bias in policy adoption, this estimator may have limits, especially in the presence of a severe lack of data. Data imputation is sometimes considered in dealing with this problem. However, as pointed out by Seaman and White (2013), IPW can be effective as it allows for the correction of missing data by restricting to complete cases, thus avoiding imputation. In addition, IPW may be preferable in our case, where units may have missing observations on several variables, rather than on just one or two (Seaman and White, 2013). New average treatment effects from the IPW estimator are reported in Panel B of Table A3. Results remain stable.

Finally, a substantial part of the literature on inflation targeting draws results from parametric PSM (see, among others, Lin and Ye, 2007; Lin and Ye, 2009; Lin, 2010; Lucotte, 2012; Minea and Tapsoba, 2014; Balima et al., 2017; Minea et al., 2021). Yet, model specification plays an essential role in having consistent PSM estimators. Model misspecification (which often occurs in parametric estimations) leads to inconsistent score estimates. Against this background, Ardakani et al. (2018) estimate the treatment effect of inflation targeting on macroeconomic variables using propensity score matching, adopting a single-index semiparametric method by accounting for the model misspecification of parametric propensity scores. Consequently, we extend our econometric robustness checks by re-estimating our main results from a nonparametric kernel regression, using the same covariates as in the baseline model with PSM. This estimator, which is quite simple technically, performs a local-linear kernel regression but makes no assumptions about the functional form of the relationship between the outcome and the covariates. Results reported in Panel C of Table A3 lead to comparable effects to all our estimates obtained so far.

A.7 Sample dependence

The choice of countries for the control group was rigorously based on previous studies (e.g., see Lin and Ye, 2009; Minea and Tapsoba, 2014). Specifically, we exclude from the control group both countries whose real GDP per capita is lower than that of the poorest treated country in the sample and those whose population is lower than that of the smallest treated country in the sample, to allow for good comparability between the two groups of countries. Sample dependency is a particularly important issue in the literature. Certainly, our sample includes a reasonably large number of 62 developing countries, which can be considered representative of the developing world. Nevertheless, we check whether some specific countries influence our baseline results. As a robustness check, we extend the previous (main) sample by including 24 additional developing countries selected from data availability. Moreover, these cover the whole range of developing countries included in Gong and Qian (2022) who examine the effect of inflation targeting on financial crisis. Estimates reported in Table A4 suggest that expanding the main sample to other developing countries does not affect our results, ruling out a potential bias due to sample dependency.[17]

[17]We expand the main sample by adding the following developing countries: Argentina; the Bahamas; Bahrain; Botswana; Brunei Darussalam; Central African Republic; Congo, Rep; Gabon; Gambia; Guinea-Bissau; Guyana; India; Jamaica; Kuwait; Libya; Mauritius; Niger; Panama; Qatar; Suriname; Syrian Arab Republic; Venezuela; Yemen, Rep.; and Zimbabwe.

The study has examined the inflation targeting effect on domestic investment, focusing on developing countries. Macroeconomic volatility is a fundamental concern for developing countries (Loayza et al., 2007), as they are generally the least able to contain large shocks to economic activity, given their vulnerability and low resilience. Hence, it seems relevant to examine to what extent these economies may benefit from the side effects of a price-stability-oriented monetary policy framework, such as inflation targeting. Nevertheless, one might wonder whether the results of this article also apply to developed countries. Evidence of the impact of inflation targeting on the inflation performance of developed countries is found in the literature. For example, Ball and Sheridan (2004), Lin and Ye (2007), Walsh (2009), De Mendonça and e Souza (2012), and Samarina et al. (2014) find that the policy has no significant effect on the inflation performance of developed countries. Furthermore, as in this study, Lin and Ye (2007) found it interesting to focus mainly on emerging market and transition economies that have adopted inflation targeting, as their economic and social structures are very different from those of industrial countries. Finally, regarding the impact of inflation targeting on domestic investment, very few studies have focused on developed countries. Against this background, applying the synthetic control method to a panel of developing and developed economies over the period 1984-2017, McCloud (2022) finds that inflation targeting adoption did not affect domestic investment in 21 out of 29 treated countries. Among developed countries, the author finds that domestic investment increased in Australia in the post-inflation targeting period.

Table A3: The effect of inflation targeting on private domestic investment (%GDP): Alternative estimation methods

Panel A: Bias-corrected matching	[1]	[2]	[3]	[4]
	n = 1	*n = 2*	*n = 1*	*n = 2*
Hard inflation targeting - ATT :	2.9081***	3.1334***	3.0779***	3.1345***
	(0.2713)	(0.2487)	(0.4006)	(0.3506)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Trend	No	No	Yes	Yes
Panel B: Inverse Probability Weighting				[1]
Hard inflation targeting - ATT:				2.6378 ***
				(0.5564)
Panel C: Nonparametric kernel regression				[1]
Hard inflation targeting - ATT:				2.8248***
				(0.3239)

Notes: This table reports estimates of the effect of inflation targeting on domestic investment from a bias-corrected matching estimator (Panel A), the Inverse Probability Weighting estimator (Panel B), and a nonparametric kernel regression (Panel C). Columns [1] and [2] of Panel A consider 1 and 2 matched neighbors, respectively. Standard errors are in brackets. *** p < 0.01, ** p < 0.05, * p < 0.10

Table A4: The effect of inflation targeting on private domestic investment: Sample dependence

	Nearest-Neighbors Matching		Radius Matching			Kernel Matching	Local Linear Regression
	N=1	N=3	r=0.005	r=0.01	r=0.05		
Hard inflation targeting	1.9047***	3.2382***	3.3084***	3.2473***	3.3526***	3.3737***	3.2565***
	(0.7031)	(0.5755)	(0.4900)	(0.5087)	(0.4654)	(0.4538)	(0.4653)

Notes: This table reports estimates of the effect of inflation targeting on domestic investment from propensity score matching. The dependent variable is measured as the share of private-sector gross fixed capital formation to GDP. The treatment variable is a dummy equal to 1 if a country i in the year t has an inflation target, and zero otherwise, referring to hard inflation targeting. We expand the main sample by adding the following developing countries: Argentina; the Bahamas; Bahrain; Botswana; Brunei Darussalam; Central African Republic; Congo, Rep; Gabon; Gambia; Guinea-Bissau; Guyana; India; Jamaica; Kuwait; Libya; Mauritius; Niger; Panama; Qatar; Suriname; Syrian Arab Republic; Venezuela; Yemen, Rep.; and Zimbabwe. Bootstrapped standard errors based on 500 replications are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

B Sample

Table B1: List of countries

Inflation-targeting (IT) countries			
	Soft IT (default starting dates)	Full-fledged IT (conservative dates)	Average inflation deviations from the target (%)
Brazil	June 1999	June 1999	0.78
Chile	January 1991	August 1999	2.04
Colombia	September 1999	October 1999	1.64
Dominican Republic	2011	2012	-0.44
Ghana	January 2007	January 2007	2.89
Guatemala	January 2005	January 2005	0.09
Hungary	June 2001	August 2001	0.65
Indonesia	July 2005	July 2005	1.00
Kazakhstan	August 2015	August 2015	3.98
Mexico	January 1999	January 2001	1.35
Paraguay	May 2011	May 2011	-0.37
Peru	January 2002	January 2002	0.28
Philippines	January 2002	January 2002	-0.04
Poland	September 1998	September 1998	0.65
Romania	August 2005	August 2005	0.71
Russia	2014	2015	2.91
Serbia	September 2006	September 2006	-0.08
South Africa	February 2000	February 2000	0.25
Thailand	May 2000	May 2000	0.18
Turkey	January 2006	January 2006	2.20
Uganda	June 2011	June 2011	1.42
Ukraine	2015	2017	14.18
Uruguay	2002	2007	1.94
			Average (1990-2019): 1.18
Non-inflation-targeting countries			
Algeria	Bangladesh	Nicaragua	Belarus
Bolivia	Bulgaria	Burkina Faso	Cameroon
China	Costa Rica	Croatia	Ivory Coast
Ecuador	Egypt	El Salvador	Honduras
Iran	Jordan	Kenya	Madagascar
Malaysia	Morocco	Nigeria	Pakistan
Saudi Arabia	Sudan	Sri Lanka	Tanzania
Togo	Tunisia	Vietnam	Zambia
Senegal	Guinea	Haiti	Mali
Lao P.D.R	Myanmar	Ethiopia	

Notes: Data on adoption dates are taken from Rose (2007); Roger (2010); Jahan (2012) and central bank websites. We compute inflation deviations from the target as the difference between realized inflation and the inflation target for each treated country over the period 1990-2019. Data on inflation targets are extracted from Jahan (2012) and publications by the central bank of each country.

Table B2: Country classification

Emerging economies:	Algeria	Belarus	Brazil	Chile	China	Colombia
Croatia	Dominican Republic	Ecuador	Egypt, Arab Rep.	Hungary	Indonesia	Iran, Islamic Rep.
Kazakhstan	Malaysia	Mexico	Morocco	Pakistan	Peru	Philippines
Poland	Romania	Russian Federation	Saudi Arabia	South Africa	Sri Lanka	Thailand
Turkey	Ukraine	Uruguay				
Low-income economies:	Bangladesh	Bolivia	Bulgaria	Burkina Faso	Cameroon	Costa Rica
Cote d'Ivoire	El Salvador	Ethiopia	Ghana	Guatemala	Guinea	Haiti
Honduras	Jordan	Kenya	Lao PDR	Madagascar	Mali	Myanmar
Nicaragua	Nigeria	Paraguay	Senegal	Serbia	Sudan	Tanzania
Togo	Tunisia	Uganda	Vietnam	Zambia		

Source: IMF Fiscal Monitor database.

Chapter 2

Inflation Targeting and Firm Performance in Developing Countries

This chapter is joint work with Jean-Louis COMBES (LEO-UCA), Kabinet KABA (CERI-UCA and World Bank), and Alexandru MINEA (LEO-UCA). A slightly different version of this chapter is published in the Journal of Economic Dynamics and Control (JEDC).

Abstract

We examine the impact of inflation targeting on manufacturing firm performance in developing countries. Using a panel of 31,027 firms in 47 countries from 2006 to 2020 and applying the entropy balancing method to mitigate selection issues, we find that inflation targeting significantly increases firm growth and productivity. The findings are economically significant and robust to various checks. We further show that economic and institutional factors such as the quality of judicial processes, fiscal discipline, central bank deviations from the target, and the time length since the policy adoption also influence the link between the monetary regime and firm performance. Last, we explore the main transmission channels and identify macroeconomic stability as the key driver of the regime's effectiveness.

Keywords: • Inflation targeting • Manufacturing firm performance • Developing countries • Entropy balancing • Monetary policy credibility
JEL Classification: E2, E31, E51, D2

"Anchoring of inflation expectations is not a deus ex machina. It must come from somewhere, and [...] monetary policy must be the source of the change in the evolution of long-run inflation expectations." Mishkin (2007)

2.1 Introduction

The 1970s and 1980s witnessed the emergence of monetary reforms, in a context of surging inflation in many countries. Indeed, in the aftermath of the collapse of the Bretton Woods system, countries whose currencies were pegged to the US dollar had to find an alternative monetary framework to the Bretton Woods system. Exchange rate targeting, adopted by the majority of developing countries during the 1970s, 1980s, and early 1990s, failed due to the massive increase in capital that led to rising inflationary pressures in many countries. In 1990, New Zealand became the first to adopt a new monetary framework based on inflation-targeting objectives. This involves an explicit announcement by the central bank of a quantitative level of inflation and its commitment to achieving this target to ensure price stability. To make the target credible, the central bank explicitly announces that low and stable inflation is its main objective, and reinforces its communication policy, for instance, through quarterly or half-yearly inflation reports (Mishkin and Posen, 1998; Svensson, 2010; Bernanke et al., 2018).

Since the 1990s, inflation targeting has been widely adopted by developing countries as a policy tool to promote macroeconomic stability. There is evidence from a number of empirical studies, mainly using macroeconomic data, that by anchoring inflation expectations more firmly, inflation targeting improves monetary policy credibility in developing countries, thus reducing macroeconomic uncertainty or volatility, typically captured by inflation, interest rate, exchange rate or output volatility (see, among others, Vega and Winkelried, 2005; Lin and Ye, 2009; Lin, 2010; Fratzscher et al., 2020; Arsić et al., 2022). Another strand of the literature has looked at the side effects of the monetary framework through its influence on government behavior. It has been shown that by constraining seigniorage, inflation targeting leads the government to greater fiscal discipline (e.g., see Lucotte, 2012; Minea and Tapsoba, 2014; Combes et al., 2018; Minea et al., 2021).

Other studies have examined the effects of inflation targeting at the country level. For instance, De Mendonça and Lima (2011) and Montes (2013) find that a successful inflation-targeting framework provides a stable macroeconomic environment that

encourages private investment and job creation in Brazil.[1] Unlike the studies mentioned above, a few articles have examined the effects of inflation targeting using industry or firm-level data. Using a panel of 22 manufacturing industries in 39 advanced and emerging market economies over the period 1990–2014, Choi et al. (2022) find that inflation anchoring fosters growth in industries that are more credit-constrained. Kumar et al. (2015) and Coibion et al. (2018) use firm-level data to examine whether inflation expectations are indeed well 'anchored' in New Zealand, the country that pioneered inflation targeting in the early 1990s.

In contrast to the prevailing literature, which mainly focuses on macroeconomic variables, this study combines country and firm-level data to examine the effect of inflation targeting on firm performance. While Choi et al. (2022) examine the inflation targeting effect using industry-level data. , we primarily differ from them in that we employ more disaggregated data, i.e., at the firm level. Kumar et al. (2015) and Coibion et al. (2018) use firm-level data to examine whether inflation expectations are well anchored under New Zealand's inflation targeting regime. We differ from them in two main ways. First, while the authors explore the relationship between the monetary framework and firms' inflation expectations, this paper examines the direct effect of inflation targeting on firm performance indicators such as sales growth and productivity. Second, our study covers 47 developing countries over the period 2006-20.

Our work is closely related to the literature dealing with the effects of macroeconomic uncertainty on firm outcomes. Numerous studies show that by reducing the predictability of the business cycle, macroeconomic uncertainty — generated by rising inflation or inflation volatility — leads firms to postpone investment, thereby strongly undermining their growth and productivity (see, among others, Bloom et al., 2007; Chong and Gradstein, 2009; Kelilume, 2016; Bloom et al., 2018; Vo et al., 2019). Against this background, this paper examines whether a monetary framework geared towards price stability, such as inflation targeting, improves firm performance in developing countries, which are generally subject to high macroeconomic instability.

Using a panel of 31,027 manufacturing firms in 47 developing countries over the period 2006-20, we examine the effect of inflation targeting on firms' sales growth and productivity. Inflation targeting may be correlated with unobservable factors that could also affect the overall performance of the economy, and hence that of firms.

[1] In the same vein, Bambe (2023) provides evidence, for a panel of 62 developing countries, that inflation targeting fosters private-sector investment.

Therefore, we apply the entropy balancing method developed by Hainmueller (2012) to address the potential selection bias associated with policy adoption. The results suggest that inflation targeting significantly increases firm sales and productivity growth in inflation-targeting compared to non-inflation-targeting countries, with economically significant effects. These findings are robust to a series of tests, including a fixed-effects estimation, alternative samples, additional controls, and alternative measures of firm performance. These results could potentially be driven by confounding factors, such as the adoption of other reforms over the study period. Nevertheless, a placebo test reveals that our estimates are not spurious or confounded by shocks, unobserved trends, or the effects induced by other reforms such as IMF programs. We further highlight some heterogeneity features of the monetary regime according to economic and institutional factors. On the one hand, evidence suggests that inflation targeting is more effective in countries with sound institutions and fiscal discipline. On the other hand, the monetary regime is less effective when the central bank tends to deviate from its target. We also find evidence that the positive effect of inflation targeting on firm performance increases over time. Last, we empirically analyze the main transmission channels through which the effect of the monetary regime could transit. After highlighting that macroeconomic uncertainty, i.e., inflation and its volatility, as well as interest rate and exchange rate volatility, are factors that negatively affect firm performance, we show that enhanced macroeconomic stability resulting from inflation targeting adoption is the main channel through which the monetary framework operates.

The article is organized as follows. The next section offers a theoretical framework linking the monetary regime and firm outcomes. Section 2.3 presents our empirical methodology. Section 2.4 describes our data. Section 2.5 reports some stylized facts. Our main findings are presented in Section 2.6. Section 2.7 analyzes the sensitivity of our results. Section 2.8 deals with the key transmission channels. The last section concludes.

2.2 Theoretical background

2.2.1 Credibility as a transmission channel of monetary policy on firm performance

Based on the existing literature, we believe that macroeconomic stability is the main channel through which inflation targeting may affect firm performance. The literature

provides evidence that the explicit announcement of an inflation target plays an important role in coordinating expectations, and significantly increases monetary policy credibility in developing countries, thus reducing macroeconomic instability, captured by inflation and its volatility, as well as interest rate and exchange rate volatility (Minella et al., 2003; Calderón et al., 2004 Vega and Winkelried, 2005; Rose, 2007; Gonçalves and Salles, 2008; Lin and Ye, 2009; Lin, 2010; López-Villavicencio and Pourroy, 2019; Fratzscher et al., 2020; Arsić et al., 2022).[2] In other words, macroeconomic stability involves inflation, exchange rate, and interest rate stability; lower price increases in response to nominal exchange rate shocks; or lower interest rate increases to break inflationary expectations.

Given the favorable effects of inflation targeting in anchoring inflation expectations, a number of studies have looked at the side effects of the monetary framework on private-sector investment, employment, and competitiveness. In a study focusing on the Brazilian economy from January 2000 to September 2009, De Mendonça and Lima (2011) find that a successful inflation targeting framework creates a stable macroeconomic environment that promotes private investment. Elsewhere, Montes (2013) finds evidence that inflation targeting has been an important strategy for achieving a more stable macroeconomic environment, which has been beneficial for investment and job creation in Brazil. Similarly, using a panel of 62 developing countries, Bambe (2023) shows that inflation targeting helps to create an investment-friendly environment in developing countries. Aman et al. (2022) find inflation targeting helps to reduce exchange rate misalignments in developing countries, thereby improving their external competitiveness.

Another source of macroeconomic uncertainty, interest rate volatility, is closely linked to inflation volatility. For instance, in a context of high inflation, a central bank following the Taylor rule will pursue a restrictive monetary policy by increasing the interest rate. Interest rate hikes in turn limit access to credit and depress investment demand, as suggested by the traditional neoclassical framework (Harrison et al., 2004 and Beck et al., 2005). Furthermore, Montes (2013) provides evidence that changes in the short-term interest rate have a significant impact on the real cost of capital and hence on firms' investment decisions. Thus, achieving a relatively low inflation target under inflation targeting may prevent regular interest rate increases

[2]The most immediate effect of inflation targeting is on the level of inflation. However, there is a strong correlation between the level of inflation and its volatility. Ball (1992) states that high inflation leads to uncertainty about future monetary policy, which in turn results in higher volatility. The inverse relationship may also exist (e.g., see Cukierman and Meltzer, 1986b; Devereux, 1989).

to control inflation (De Mendonça and Souza, 2009). This may give way to a more conducive environment for access to credit or firm investment.[3] Along these lines, using industry-level data, Choi et al. (2022) show that anchoring inflation effectively reduces the nominal interest rate and long-term borrowing costs, thereby facilitating lending and the production of output. Last, by reducing exchange rate movements, the exchange rate pass-through effect (Aleem and Lahiani, 2014; López-Villavicencio and Pourroy, 2019), or interest rate volatility (Vega and Winkelried, 2005; De Mendonça and Souza, 2009), inflation targeting should also make firms less vulnerable to exchange rate or global interest rate shocks.

2.2.2 Macroeconomic uncertainty and firm performance

The literature dealing with the effects of macroeconomic volatility is long-standing and well-documented. Among the pioneering theoretical models, Lucas Jr (1967), Nickell (1974) and Dixit et al. (1994) offered an explicit formalization of the impact of uncertainty on investment in the presence of adjustment costs, or when there is irreversibility in the production process. Since then, this literature has expanded widely and is structured around two concepts: irreversibility and expectation under uncertainty. Indeed, macroeconomic volatility reduces the predictability of the business cycle, which can significantly affect investment through *irreversibility effects* (Carruth et al., 2000; Dixit and Pindyck, 2012). In other words, investment involves irreversible costs that affect firms' earnings or expected profitability. Hence, if the economic outlook is not good, it is worth waiting as it gives the entrepreneur the opportunity to process new information before making an effective investment decision. Thus, when faced with uncertainty, investors tend to adopt a *wait-and-see* strategy and postpone investment decisions until the uncertainty is resolved (Bachmann and Bayer, 2013; Stokey, 2016).[4]

[3]Asset prices, such as stocks, bonds, or real estate, could also be another transmission channel for monetary policy. This mechanism is closely linked to changes in the interest rate through a wealth effect. However, in the context of this study, this channel is probably of little relevance for developing countries as the participation of these firms in stock markets is generally low. Similarly, for foreign firms, the relevant wealth effect depends on the market in which they are listed. Last, Bretscher et al. (2022) show that uncertainty also generates risk premium shocks, which can restrict the flow of credit to households and firms.

[4]A related analysis regarding exchange rate uncertainty and investment is provided by Belke and Gros (2001). Furthermore, in an open economy with a fully flexible exchange rate regime, exchange rate movements affect domestic prices through imported goods (*exchange rate pass-through effect*). A rise in domestic prices may result in higher production costs, leading to a deterioration in the investment environment. This effect can be significant and contribute to inflation persistence (e.g., see Agénor, 2000; and Gagnon and Ihrig, 2004).

A large body of literature has empirically examined the impact of macroeconomic volatility on economic performance. For instance, using a panel of 42 developing countries, Aizenman and Marion (1999) show that higher volatility reduces the average rate of investment, with proportional effects to the magnitude of variability in different macroeconomic indicators. Similar evidence is provided by Gavin and Hausmann (1998) for Latin American economies. Studies have also looked at micro-economic variables, by investigating the impact of uncertainty on firms' investment behavior. Using an error correction model (ECM) of investment on a panel of 672 UK-listed manufacturing firms over the period 1972-1991, Bloom et al. (2007) provide empirical evidence that stock price volatility, leading to high uncertainty, makes firms more cautious when investing. These results are further corroborated by Chong and Gradstein (2009) on a detailed cross-country firm-level dataset. Uncertainty can also adversely affect total factor productivity, as it leads to an inefficient allocation of the factors of production across firms, as suggested by Bloom et al. (2018). Last, empirical evidence of the impact of exchange rate volatility on firm performance is also found in the literature (see, among others, Kelilume, 2016; Vo et al., 2019; Khosrowzadeh et al., 2020).

To sum up, based on the mechanisms highlighted above, our theoretical prediction is that firms operating in inflation-targeting countries should benefit more from inflation anchoring, thereby reducing inflation uncertainty and improving their performance.

2.3 Empirical methodology

Our analysis considers firm-level observations as treated when the country is operating under inflation targeting. Identifying and tracing down precisely any genuine effects induced by inflation targeting on the economic variables of interest is challenging (Balima et al., 2020 is a good example on this issue). Since countries that adopted inflation targeting may have emerged from a foreign exchange crisis or episodes of high inflation, selection problems are likely to arise. In other words, inflation targeting adoption may be correlated with unobservable factors which may also affect the overall performance of the economy, hence, potentially domestic firm outcomes. Therefore, the potential endogeneity of inflation targeting must be seriously considered, otherwise, it would lead to bias in the estimates. To allay this concern, we rely on the program evaluation methodology, which consists in estimating the average treatment effect on the treated (ATT). The ATT is the average difference

in outcome (in our case, sales growth and productivity) between firms operating in inflation-targeting countries and those operating in non-inflation-targeting countries, and is defined as follows:

$$ATT = E[(Y_{i1}|T_i = 1)] - E[(Y_{i0}|T_i = 1)] \tag{2.1}$$

Y_0 represents the firm's outcome when the country i does not operate under the inflation targeting framework (T = 0) and Y_1 is the outcome associated with T = 1 (treated observations). Therefore, the inflation targeting effect is the difference between the situation due to the firm's exposure to the treatment and its situation in its absence. A problem arises as this approach faces a counterfactual dilemma, i.e., we cannot simultaneously observe Y_1 and Y_0. In other words, we cannot observe how a firm located in an inflation-targeting country would have evolved if the country had not adopted the monetary framework. To address this issue, we adopt a counterfactual framework composed of untreated firms, but otherwise make up a potential control group. If the treatment assignment was random, a simple approach would be to compare the average performance gaps between firms located in inflation-targeting countries and their peers (untreated units). However, as discussed earlier, this would lead to a spurious identification given the potential endogeneity in the reform. A substantial part of the empirical literature relies on a matching approach to examine the inflation-targeting effect on macroeconomic variables (e.g., see Lin and Ye, 2007; Lin and Ye, 2009; Lucotte, 2012; Minea and Tapsoba, 2014; Ogrokhina and Rodriguez, 2019; Apeti et al., 2023g; Bambe, 2023). The matching approach is to reproduce a situation close to a setting where units would be randomly assigned to treatment. The latter are matched to those not exposed to treatment, based on their pre-treatment observable characteristics, which are as comparable as possible. Then, the outcome variable from matching or the ATT can be formalized as follows:

$$ATT = E\left[Y_{i1}|T_i = 1, X = \chi\right] - E\left[Y_{i0}|T_i = 0, X = \chi\right] \tag{2.2}$$

where χ is a set of pre-treatment country-level covariates described in subsection 2.4.2, correlated with inflation targeting adoption and potentially with the outcome variable. $E\left[Y_{i1}|T_i = 1, X = \chi\right]$ is the expected outcome for the treated units, and $E\left[Y_{i0}|T_i = 0, X = \chi\right]$ is the expected outcome for the best counterfactuals of the treated units.

In this study, we use the entropy balancing method of Hainmueller (2012) to match treated units with their untreated counterfactuals. Entropy balancing was used by

Neuenkirch and Neumeier (2016) to assess the impact of US sanctions on poverty, by Ogrokhina and Rodriguez (2019) to analyze the effect of inflation targeting and financial openness on the currency composition of sovereign international debt, or more recently by Apeti (2023a) to assess the impact of mobile money adoption on household consumption volatility. Entropy balancing is a two-step estimation method. The first step is to compute and apply weights to units not subject to treatment, such that the average of pre-treatment variables in the control group is not statistically different from their average in the treated group. This step allows us to create a synthetic group, not exposed to the treatment, but with observable pre-treatment characteristics close to the treated group. Then, in the second step, the weights resulting from entropy balancing are used in a regression analysis with the treatment indicator as an explanatory variable to neutralize the potential influence of pre-treatment differences on the treatment effect.

Neuenkirch and Neumeier (2016) highlight several advantages of entropy balancing over traditional matching methods. First, unlike propensity score matching methods or the difference-in-differences estimator, entropy balancing is a non-parametric approach, thus requiring no specification of the functional form of the empirical model or the treatment assignment procedure, which may avoid mis-specification issues. Second, the weight system orthogonalizes the covariates with respect to the treatment, which limits multicollinearity issues. Third, entropy balancing ensures a sufficient balance of pretreatment characteristics between treatment and control groups, even in the presence of a small sample or a limited number of untreated units. This makes it possible to construct a suitable control group, representing a near-perfect counterfactual of the treated group. Last, in the second step, the estimator exploits the panel structure of the data, considering both country and time-fixed effects to control for unobserved heterogeneity.

2.4 Data

Firm-level data are extracted from the World Bank Enterprise Surveys (WBES) dataset. The WBES collects nationally representative firm-level surveys in developing countries using a standard sampling methodology — a representative sample (stratified random sampling) — with a standard questionnaire. We use the standardized dataset conducted between 2006 and 2020, which has a repeated cross-sectional structure consisting of aggregations of individual data from comparable surveys conducted in different periods. We retain a sample of 31,027 manufacturing firms

examined in 47 developing countries. The choice of this sample was conditioned by data availability so that the countries selected have sufficient information at the firm level on all the variables used in this study.[5] We report 13,341 treated observations (under inflation targeting) and 17,686 untreated observations.

2.4.1 Treatment variable

Following the existing literature (see, among others, Lin and Ye, 2007; Lin and Ye, 2009; Lucotte, 2012; Minea and Tapsoba, 2014; Combes et al., 2018; Minea et al., 2021; Apeti et al., 2023g; Bambe, 2023), we consider a dummy variable equal to 1 when a country i operates under the inflation targeting regime in a year t, and zero otherwise. We refer to full-fledged or hard inflation targeting, which is considered by academics to be the true date from which the central bank begins to operate under inflation targeting. Our sample includes fifteen inflation-targeting and thirty-two non-inflation-targeting countries, selected from available data. Data on the treatment variable are extracted from previous studies (e.g., see Rose, 2007; Roger, 2009; Jahan, 2012; Ciżkowicz-Pękała et al., 2019; Apeti et al., 2023g; Bambe, 2023).

2.4.2 Matching variables

We consider two categories of country-level variables. The first category defines whether a country meets the pre-conditions to begin an inflation-targeting policy. From the existing literature (see, among others, Lin and Ye, 2009; Minea and Tapsoba, 2014; Ogrokhina and Rodriguez, 2018), we include the following variables: lagged inflation rate, real GDP per capita growth, and fiscal balance. Lagged inflation rate is found to negatively affect inflation-targeting adoption. Indeed, as discussed by Masson et al. (1997), a country is more likely to adopt an inflation-targeting policy when its inflation rate is at a reasonably low level, preferably after successful disinflation. The sign for GDP per capita growth is often ambiguous (e.g., see Lin and Ye, 2009; and Lucotte, 2012). One potential explanation for this mixed effect is that, on the one hand, countries with good macroeconomic performance are more likely to adopt a credible inflation-targeting policy. On the other hand, it can be argued that a better economic situation may also reflect the achievement of successful macroeconomic policies and thus crowd out the adoption of a new

[5]For comparison, using the same database over 2006-2014, Kouamé and Tapsoba (2019) examine the impact of structural reforms on firm productivity in a panel of 37 developing countries.

monetary regime such as inflation targeting. Last, in the spirit of the unpleasant monetarist arithmetic of Sargent and Wallace (1981), fiscal discipline may reduce the likelihood of the government exerting pressure on the central bank to finance its deficits, thus ensuring a credible inflation-targeting regime. Alternatively, since inflation targeting also helps to improve fiscal performance, it can be argued that poor fiscal discipline may, in turn, lead the central bank to adopt the targeting regime to promote further fiscal consolidation. Therefore, the correlation between inflation targeting and fiscal discipline may be ambiguous.

The second group considers variables that may affect the probability of adopting exchange rate targeting as an alternative monetary policy framework. This category includes trade openness and the exchange rate regime. These variables are found to negatively affect inflation-targeting adoption. A common explanation regarding the relationship between inflation targeting and trade openness is that countries that are very open to trade tend to target the exchange rate to hedge against external shocks (e.g., see Fatás et al., 2007; Brenner and Sokoler, 2010). Last, since inflation targeting is implemented under a flexible exchange rate regime, it is negatively correlated with the adoption of the fixed exchange rate regime.

Most of our country-level variables are extracted from the World Bank's World Development Indicator (WDI) database. Fiscal balance is extracted from Kose et al. (2022). Trade openness is measured by the sum of exports and imports as a share of GDP. The exchange rate regime is constructed from Ilzetzki et al. (2019)'s classification and is captured by a dummy equal to 1 if a country is classified as having a fixed exchange rate regime in the year t, and zero otherwise.

2.4.3 Control variables

Information on sales and costs is provided in local currencies and at nominal values in the last fiscal year. We adjust all nominal values for inflation, using the GDP deflator from the IMF's International Financial Statistics (IFS) database, and convert them to US dollars using the exchange rate variable from the WDI database. We include a wide range of firm-level controls, such as firm size, ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively), age, and legal status. Firm size is captured by an ordinal qualitative variable equal to 1 for small (less than 20 employees), 2 for medium (between 20 and 99 employees), or 3 for large firms (100 employees and over). The firm's age measures the duration of its existence, from the year it was formally registered as a start-up. The legal status

of the company is captured by distinct variables.[6] We also include the logarithm of the previous three years' sales to capture initial performance.

As commonly found in the literature, we include some additional country-level variables: institutional quality (proxied by political stability and the level of democracy), financial development, and access to financial markets. The political stability variable is from the Worldwide Governance Indicators (WGI) database and ranges from approximately -2.5 to 2.5 (strong governance). The level of democracy is captured by the Polity V democracy score, ranging from -10 (absolute autocratic regime) to 10 (absolute democratic regime). Financial development is proxied by domestic credit to the private sector as a percentage of GDP and is extracted from the World Bank's WDI database. Last, the access to financial markets variable is from the IMF's Financial Development Index Database and captures the ability of individuals and businesses to access financial services and products.

2.4.4 Dependent variables

We use real sales and labor productivity growth as measures of firm performance. Data on annual sales and workers are provided at the end of the previous fiscal year and three years ago (in $t-3$). Equipped with this dataset, we compute the average annual growth in sales *(Growth)* and labor productivity *(LPG)* over the last three years. To limit the influence of outliers, we refer to Iarossi et al. (2009) and compute sales growth by dividing the change in sales between $t-1$ and $t-3$ by the average value of initial and final sales. Similarly, the growth in labor productivity is calculated by dividing the change in labor productivity *(LP)* between $t-1$ and $t-3$ by the average value of productivity over this period. LP in a given year is calculated as the ratio of total sales to the number of workers. Since there are two points in time between this period, we further follow Kouamé and Tapsoba (2019) and smooth our two variables as follows:

$$Growth_{it} = \frac{1}{2} * \frac{Sales_{t-1} - Sales_{t-3}}{\frac{Sales_{t-1} + Sales_{t-3}}{2}} \tag{2.3}$$

$$LPG_{it} = \frac{1}{2} * \frac{LP_{t-1} - LP_{t-3}}{\frac{LP_{t-1} + LP_{t-3}}{2}} \tag{2.4}$$

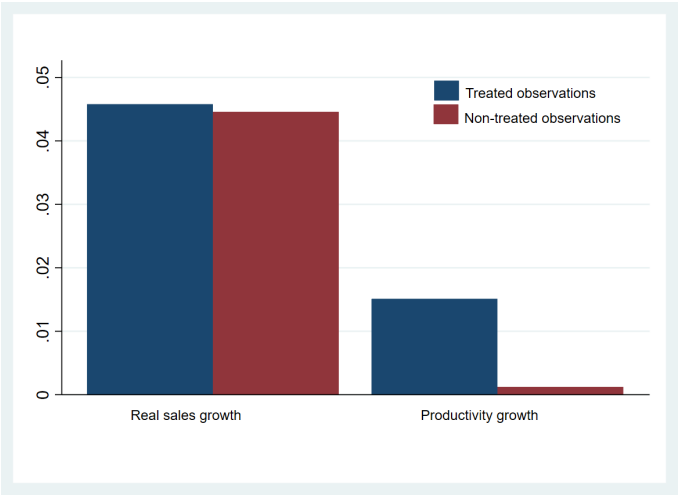
[6]The list includes: Shareholding company with shares trade in the stock market; Shareholding company with non-traded shares or shares traded privately; Sole proprietorship; Partnership; Limited partnership; and Other.

$Growth_{it}$ and LPG_{it} are between -1 and 1, and capture the annual growth of real sales and labor productivity at time t, respectively.

2.5 Stylized facts

We report some correlational evidence linking the monetary regime, average sales growth, and average productivity growth of the firms in our sample, over the period 2006-20. Figure 2.1 presents the average rates of sales and productivity growth between treated and untreated observations. Although the average sales growth appears to be slightly higher for the treated observations, the registered difference is statistically not significant (t = -0.55; p-value: 0.58). However, treated observations record a much higher average productivity growth than untreated observations, with a difference of about 0.02 points, which is statistically significant (t = -3.85; p-value: 0.00). These stylized facts correlate our outcome variables with the treatment, but do not provide any causal relationship. The rest of the study therefore relies on empirical analysis to identify the inflation-targeting effect.

Figure 2.1: Average sales and productivity growth rates between treated and untreated observations (2006-2020)



Notes: The statistics cover 31,027 firms in 47 developing countries, surveyed between 2006 and 2020. We consider 13,341 treated observations (firms located in countries operating under inflation targeting) and 17,686 untreated observations. We compute sales and productivity growth over the last three years. Labor productivity in a given year is calculated as the ratio of total sales to the number of workers.

2.6 Empirical results

2.6.1 Descriptive statistics

First, we look at some descriptive statistics related to the first stage equation. As mentioned previously, our dependent variables are computed over three years (between $t-1$ and $t-3$). Hence, we lag our country-level variables for two periods to circumvent problems of reverse causality. In other words, the inflation rate, real GDP per capita growth, and fiscal balance are averaged from $t-4$ to $t-6$. Panel A of Table 2.1 reports a simple comparison of pre-weighting sample means of all matching covariates between treated (Column [2]) and control (Column [1]) firms, which represent the potential synthetic group. On average, treated observations register a lower inflation rate and a lower level of trade openness compared to non-treated observations. In contrast, untreated observations report a higher GDP per capita growth rate, and a slightly better fiscal balance, and tend to be more oriented towards a fixed exchange rate regime. Column [5] shows significant differences between the two groups for all pre-treatment variables, as all p-values are equal to zero. Such differences could bias the treatment effect due to a potential selection problem. Therefore, in Panel B (Column [1]), we compute a synthetic control group by re-weighting the control units, using the pre-treatment covariates from the benchmark specification. This approach allows making the means of the pre-treatment covariates of the synthetic group as comparable as possible to those of the treated units. As can be seen in Column [5] of Panel B, the weighting eliminated any significant pre-treatment difference between the means of the treated and synthetic covariates, as all p-values are above the 10% threshold. Thus, we can consider the synthetic group as a "near perfect" counterfactual of the treated group.

2.6.2 Treatment effects

Next, we assess the effect of inflation targeting on firm performance using the following econometric model:

$$Y_{i,k,j,(t-1,t-3)} = \alpha + \beta T_{j,t-3} + \eta X_{i,k,j,t} + \gamma Y_{j,(t-4,t-6)} + \mu_k + \phi_j + \psi_t + \epsilon_{i,k,j,t} \quad (2.5)$$

where $Y_{i,k,j,(t-1,t-3)}$ is a measure of the performance of firm i located in industry k, in the country j. $T_{j,t-3}$ is a dummy equal to 1 when country j is operating under inflation targeting, and zero otherwise. We lag the treatment variable by three years due to the lag in our outcome variables. $X_{i,j,k,t}$ is a set of time-varying firm-level

characteristics. $Y_{j,t-4,t-6}$ is a set of country-level variables averaged between $t-4$ and $t-6$. μ_k, ϕ_j, and ψ_j account respectively for industry, country, and time-fixed effects, capturing specific characteristics that may be correlated with the treatment. Finally, $\epsilon_{i,k,j,t}$ is the idiosyncratic error term. Following Chauvet and Jacolin (2017) and Kouamé and Tapsoba (2019), we cluster standard errors at the country-level.[7]

Using the weights computed in Panel B of Table 2.1, we estimate Equation 6.6 from weighted least squares regressions, in which sales and productivity growth are the dependent variables, respectively, and inflation targeting is the explanatory variable referring to conservative dates or full-fledged inflation targeting. The estimated equation includes country, year, and industry fixed effects to capture multi-level heterogeneity, as well as the set of controls described in subsections 2.4.2 and 2.4.3.[8] Results for sales growth and productivity growth are reported in Panel A of Table 2.2, in Columns [1] and [2], respectively. Estimates from the first column (Panel A) show a positive and significant effect at the 1% threshold, suggesting that inflation targeting leads to an increase in sales growth, of about 3 percentage points. Likewise, with regard to productivity growth, results in Column [2] suggest a positive and significant effect of inflation targeting at the 1% threshold, with a magnitude of about 13 percentage points. Since the estimates represent about 11% of the standard deviation of sales growth and 48% of the standard deviation of productivity growth (see Table C.1, Appendix), the inflation-targeting effects are also economically significant.

2.7 Sensitivity

2.7.1 Robustness

Combined entropy balancing and trend. In Panel B of Table 2.2, we introduce a trend in the linear regression to account for common long-term movements correlated with inflation targeting and potentially with firm performance. Despite a slight fall in the new estimates, the results hold.

[7]Clustering the standard errors at the country-industry, country-year, industry-year, country-industry-year levels, or even when including a trend in the equation, yield similar inference.

[8]We include the following controls: lag inflation, lag GDP per capita growth, lag fiscal balance, lag trade openness, lag exchange rate dummy, firm size, the ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively), the firm's age, legal status, the logarithm of the previous three years' sales, political stability, the level of democracy, financial development, and access to financial markets.

Additional controls. Next, we re-estimate our results using an alternative specification in Table 2.3. We augment our baseline specification by including two matching variables in the first stage of entropy balancing to capture the level of economic development and the quality of institutions: the logarithm of per capita income (instead of growth in per capita income as in the baseline model) and central bank independence (proxied by the governor turnover variable). At the firm level, we include the share of domestic and foreign materials used in the inputs, respectively; the export status, and the ease of dealing with construction permits. The export status is captured by a dummy equal to 1 if the firm exports its sales abroad, and zero otherwise. The ease of dealing with construction permits takes into account the business environment. The indicator is extracted from the Doing Business database and ranges from 0 to 100 (the best construction regulation). The literature has shown that IMF reforms also significantly affect firm performance in developing countries (Kouamé and Tapsoba, 2019). Thus, one might assume that the inflation-targeting effect could be confused with those of IMF programs. Therefore, in addition to the variables mentioned above, we also include IMF-supported programs since 2002 from the Monitoring of Fund Arrangements (MONA) database. Consistent with previous work on IMF programs (Dreher et al., 2010; Balima and Sokolova, 2021), we set a dummy variable equal to the value 1 if a country has benefited from any type of IMF-supported program in the previous three years, and zero otherwise. If the effects of the monetary regime are confounded with those of other reforms, such as that of the IMF, including these potential confounding factors should reduce or even make our previous estimates non-significant.

The results reported in Panels A and B of Table 2.3 show that the weighting eliminated any significant pre-treatment difference between the means of the treated and synthetic covariates (all the p-values reported in the last column of Panel B are above the 10% threshold). With regard to the new treatment effects reported in Panel C, despite a slight increase, the coefficients remain qualitatively comparable to those of the baseline model, supporting our conclusions. Moreover, including IMF programs does not significantly affect our coefficients, suggesting the inflation-targeting effects are not confused with the potential effects of IMF reforms.

Further robustness. The data used in the study is drawn from private-sector firm surveys. The surveys cover a representative sample of firms, based on a standard questionnaire, to ensure comparability from one country to another and from one year to another. As is often the case with survey data, precision issues on the data collected should not be overlooked. We therefore check the robustness of our results

by conducting a few additional tests. More specifically, we consider alternative performance measures such as total factor productivity, value-added per worker, firm investment, and export capacity. The results, reported in subsection A.2 (Appendix), suggest that inflation targeting improves total factor productivity at the firm level, value-added per worker, firm investment (including in research and development), and export capacity. Therefore, despite the potential precision concerns in the variables used, based on the series of tests conducted, we can safely claim that our results are unlikely to be driven by measurement error.

Some additional robustness tests are reported in the Appendix. In subsections A.1 and A.3, we re-estimate our baseline model using alternative samples and an alternative definition of the treatment variable, referring to soft inflation targeting. The results remain stable. In subsection A.4, we perform random assignment to treatment or «falsification regressions» and show that our results are not driven by confounding factors or a spurious trend. In subsection A.5, we re-estimate our baseline model from the overall sample, using the OLS estimator: we find a favorable effect of inflation targeting on firm performance, with qualitatively comparable coefficients to those of the baseline model when using entropy balancing. Last, in subsection A.6, we run an additional regression where we consider only the treated countries (to consider the within variation) and show that our results hold.

2.7.2 Heterogeneity

Exploring conditional effects. This section explores some potential heterogeneity features of the treatment effect. We consider the baseline model and augment it with several interactions. The coefficient on the interactive term captures the heterogeneity of the inflation-targeting effect in the presence of a given variable. From a macroeconomic perspective, potential sources of heterogeneity include inflation deviations from the target, fiscal discipline, and institutional quality. On the microeconomic side, we consider firm size, proxied by the level of sales and the number of employees. Estimates are reported in Table 2.4.

In Column [1], we examine a potential heterogeneity of the monetary framework with regard to inflation deviations from the target, i.e., the difference between achieved inflation and the inflation target announced by the central bank, as in Ogrokhina and Rodriguez (2018).[9] We interact the treatment variable with the inflation deviation from the target. The result suggests that the monetary regime is less effective when

[9]Data on inflation targets are extracted from publications by the central bank of each country.

the inflation level is above the target. This effect is further amplified when we take into account the squared deviation in Column [2]. Since inflation deviations from the target, regardless of their sign, reflect the credibility of monetary policy, this result provides evidence that low credibility of monetary policy mitigates the benefit of inflation targeting.

According to the unpleasant monetarist arithmetic (Sargent and Wallace, 1981), or the fiscal price theory (Leeper, 1991; Sims, 1994; Woodford, 1995), persistent fiscal indiscipline is likely to foster a situation of fiscal dominance. This could lead the central bank to focus less on its stabilization objective to finance public deficits, thereby reducing monetary policy credibility. To test this hypothesis, in Column [3], we cross the treatment with the term "Sound fiscal discipline" which is a dummy equal to 1 when a country reports a sovereign debt rating above its average value over the period, and zero otherwise. This variable is extracted from Kose et al. (2022) and captures the market's perception of a government's creditworthiness, as established by credit rating agencies, including Standard Poor's, Moody's, and Fitch Ratings. Results suggest that inflation targeting is more effective in countries with a sound fiscal reputation, i.e., those that are relatively more likely to have a situation of monetary dominance.

Institutions play a crucial role in the success of economic reforms. They can take many forms, such as sociopolitical stability, control of corruption, socio-economic norms promoting private initiative or the protection of property rights, the nature of regulations, administrative constraints, etc. In Column [4], we interact the treatment with a dummy variable equal to 1 if the country has a quality of judicial processes above the sample average, and zero otherwise. This variable is from the Doing Business database and ranges from 0 to 18 (the best judicial processes). Results suggest that inflation targeting is more effective in countries with sound judicial processes that can encourage private-sector development.

In Columns [5]-[8], we check potential heterogeneity features according to firms' level of wealth and their size. The variable named "Rich firm" is a dummy equal to 1 if the firm's annual sales are above the sample average, and zero otherwise. As small businesses are the most likely to be financially constrained, the latter may be the most likely to benefit from the positive externalities of the inflation targeting framework, which may ease financial and investment constraints. However, no heterogeneity seems to emerge regarding firms' level of wealth or size when we test this hypothesis. In other words, inflation targeting seems to benefit all firms,

regardless of their size and wealth.

Dynamic effects of inflation targeting. The effect of monetary policy on the economy can take some time. It would therefore have been interesting to look at how long it takes for the shock of introducing an inflation-targeting regime to affect firm performance, for example, using quarterly data. Unfortunately, as the data provided by the World Bank Enterprise Surveys is annual, we are unable to examine this question. Another useful aspect of examining a dynamic effect is that the credibility of the monetary framework may strengthen over time, with more effective effects on inflation performance. An interesting way of dealing with dynamic effects would be to estimate local linear projections, following Jordà (2005). However, as the data used in our study are repeated cross-sections, such an approach is not possible in our design. Another idea would be to cross the treatment variable with the time length since the monetary regime adoption, as in Lin and Ye (2009). Examining the treatment effect of inflation targeting in developing countries, the authors find that inflation targeting has significant effects on improving inflation performance and that for one additional year of policy adoption, the treatment effect on lowering inflation becomes 0.5 percentage points larger. In this vein, in the last column of Table 2.4, we interact the inflation targeting dummy with the time length since the policy adoption. Results suggest that for an additional year of policy adoption, the effect of the treatment on firm sales growth becomes larger by about 1 percentage point. In other words, this test suggests that the favorable effect of inflation targeting on firm performance increases over time.

2.8 Validity of transmission channels

This section tests the main channel through which the monetary regime may operate. We adopt a simple two-step approach. First, in Columns [1]-[4] of Panels A and B (Table 2.6), we run uni-variate regressions of inflation and its volatility, exchange rate, and interest rate volatility on firm growth and productivity, using the OLS estimator.[10] In line with the literature, results from Panels A and B suggest a negative relationship between macroeconomic volatility and firm growth or productivity. Second, we re-estimate our baseline model using entropy balancing and controlling for the macroeconomic variables used in the first stage equation, replacing our dependent variable with the potential channel. Results reported in Panel C show

[10]We check that each variable is stationary and compute volatility as the standard deviation of a three-year moving average of that variable for each country.

that the monetary regime reduces inflation and macroeconomic volatility, in line with previous studies.[11] In sum, consistent with our hypothesis, these results suggest that macroeconomic stability is an important channel through which inflation targeting affects firm performance.

2.9 Conclusion

While the literature dealing with the effects of inflation targeting focuses mainly on macroeconomic data, the main novelty of this paper is to examine the impact of the monetary framework on firm performance. Using a sample of 31,027 firms in 47 developing countries over the period 2006-20 and applying the entropy balancing method to address selection issues, we show that inflation targeting significantly improves firm growth and productivity. The effects are economically significant and robust. Our main findings are further extended through some heterogeneity analyses. Results suggest that, on the one hand, the monetary regime is more effective in countries with sound judicial procedures and a strong fiscal reputation. On the other hand, central bank deviations from the inflation target tend to reduce the effectiveness of the monetary regime in improving firm performance. We also find evidence that the positive effect of inflation targeting on firm performance increases over time. Last, we examine the main transmission channels and show that macroeconomic stability, i.e., the reduction in inflation and its volatility, interest rates, exchange rates, and output volatility, is the main channel through which the monetary framework improves firm performance.

Our main finding is that a monetary framework that strongly anchors public expectations — such as inflation targeting — can be an important strategy to improve firm performance in developing countries, which are generally subject to high macroeconomic instability.

[11] It would be relevant to investigate business confidence as a potential transmission channel of the monetary regime on firm performance. The OECD provides a measure of business confidence for some countries, but to our knowledge, data covering non-OECD countries are not available.

A Further robustness

A.1 Alternative samples

We test the robustness of our results using alternative samples in Columns [2]-[5] of Table A1.[12] The main sample includes some countries with a fixed exchange rate regime and therefore having an implicit inflation-targeting policy that is inherent to their exchange rate regime. Since the fixed exchange rate regime is not compatible with the adoption of an explicit inflation-targeting framework, in Column [2], we exclude from the sample countries belonging to a monetary union or dollarized countries, as well as those with a fixed de facto exchange rate or currency board.[13] Second, we exclude from our sample countries that adopted inflation targeting at the end of our study period, namely Russia and Kazakhstan (Column [3]), since the effects of monetary policy may have a lag (Fang and Miller, 2011). Third, in our sample, observations relating to a firm that is not yet treated (but will be) are included in the control group used to compile the synthetic group, as our sample includes a time dimension. That said, our approach may match some treated observations to the same firms at a different time when the firm is not treated. For robustness, in Column [4], we exclude from the control group observations for a firm that is not yet treated but will be (pre-treated observations). Fifth, Tunisia, and South Africa, included in our sample, were surveyed in 2020, i.e., during the Covid-19 pandemic. Hence, in the last column, we restrict the study period before 2020. New estimates reported in Table A1 (Columns [2]-[5]) yield qualitatively similar results to those of the main model.

A.2 Alternative measures of firm performance

Next, we re-estimate our baseline model using alternative performance measures such as total factor productivity (TFP), value-added per worker, firm investment, and export capacity. We estimate the TFP from the residual term of Cobb-Douglas and

[12] One might think that hyperinflationary episodes (i.e., observations with an inflation rate of 40% or more) could bias our results. However, no country has such a high inflation rate in our sample over the study period. Therefore, we can rule out this hypothesis.

[13] Excluding countries belonging to a fixed exchange rate allows us to compare two groups of countries operating under a flexible exchange rate, one with and another without an inflation-targeting policy. Since this test leads to a qualitatively similar result to that of the baseline model, we can dismiss the hypothesis of a potential bias in our coefficients, which would be related to the effects induced by the fixed exchange rate regime. Otherwise, this result suggests that among countries with flexible exchange rate regimes, those that explicitly target inflation perform better than those that do not.

trans-log production functions, respectively.[14] Value-added per worker is calculated as the difference between annual sales and raw materials and energy costs, divided by the number of workers. The firm's export status is captured by a binary variable equal to 1 if the firm exports its sales, and zero otherwise (the equation is estimated using a probit model). In addition to investment in land and equipment, we also consider investment in research and development (R&D), captured by a binary equal to 1 if the firm has invested in R&D during the previous fiscal year, and zero otherwise (the equation is estimated using a probit model).[15] The results reported in Table A4 suggest that inflation targeting improves total factor productivity at the firm level, value-added per worker, firm investment (including in R&D), and export capacity.

A.3 Soft inflation targeting

Our baseline model considers full-fledged or hard inflation targeting, which is considered by academics to be the true date from which the central bank begins to operate under the inflation-targeting framework. In contrast to hard inflation targeting, soft inflation targeting is defined as the adoption date declared by the central bank itself. In a soft inflation-targeting regime, the central bank's reaction following a deviation of inflation from the target is slower than in a full inflation-targeting regime. In our sample and over our study period, the adoption dates for soft inflation targeting are similar to those of hard inflation targeting, except for two countries (Dominican Republic and Russia) where there is very little difference between the two dates (one year). Consequently, we believe that using soft inflation targeting should not lead to significantly different results from those of the baseline model. Not surprisingly, the new estimates reported in Panel B of Table A2, when using soft inflation targeting, lead to the same results as those obtained using hard inflation targeting, probably for the reasons mentioned previously.

A.4 Falsification tests

We further perform random assignment to treatment or «falsification regressions». If our results are biased toward unobservables, then the placebo tests could also show

[14]We use sales as the outcome variable, and the net book value of capital and the total permanent full-time employees as inputs.

[15]R&D investment represents one of the basic inputs of innovation and technological progress, and, as with other types of investment, business cycle predictability, and price formation are crucial in R&D investment decision-making (Kung and Schmid, 2015).

significant effects. The results reported in Panel A of Table A2 show that random treatments do not have any statistically significant impact on firm performance. Therefore, we can rule out the possibility of confounding factors driving our results.

A.5 Fixed effects estimates

Next, we re-estimate our main equation from the overall sample, using a fixed effects regression (Panel A, Table A3). OLS estimates suggest that inflation targeting leads to an increase in sales and productivity growth of about 4 and 15 percentage points, respectively. These results are therefore qualitatively comparable to those obtained using entropy balancing (about 3 and 13 percentage points, respectively), supporting our findings.

A.6 Using within variation

Last, we run an OLS regression using only the treated countries, i.e., those in the upper panel countries in Table B.[16] This allows us to consider only the within variation. The results are reported in Panel B of Table A3. The coefficients remain stable.

[16]Convergence is not achieved with entropy balancing when computing the weights. This is probably because, given the restriction of the sample, multicollinearity problems are more likely to occur. We therefore employ a simple OLS regression.

Table 2.1: Descriptive statistics and covariate balancing

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A: Descriptive statistics	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Lag Inflation	6.91	5.71	1.20	17.56	0.00
Lag GDP per capita growth	5.84	3.64	2.20	40.53	0.00
Lag Fiscal balance	-1.15	-1.58	0.43	8.45	0.00
Lag Trade openness	83.02	65.92	17.10	24.89	0.00
Lag Exchange rate dummy	0.16	0.00	0.16	30.03	0.00
Observations	***8,418***	***4,776***			
	[1]	**[2]**	**[3] = [1] - [2]**	**[4]**	**[5]**
Panel B: Covariate balancing	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Lag Inflation	5.70	5.71	-0.01	0.00	1.00
Lag GDP per capita growth	3.64	3.64	0.00	0.01	1.00
Lag Fiscal balance	-1.57	-1.58	0.01	-0.00	1.00
Lag Trade openness	65.92	65.92	0.00	0.00	1.00
Lag Exchange rate dummy	0.00	0.00	0.00	-1.45	0.16
Observations	***8,418***	***4,776***			
Total of weights	***4,776***	***4,776***			

Table 2.2: The effect of inflation targeting (IT) on firm performance

Panel A: Entropy balancing	Growth	Productivity
	[1]	[2]
Full-fledged IT dummy	0.0308***	0.1335***
	(0.0108)	(0.0172)
Observations	12771	12771
R-squared	0.169	0.1244
Country & Industry & Year FE	Yes	Yes
Control variables	Yes	Yes
Level of se clustering	Country	Country
Panel B: Entropy balancing/trend	Growth	Productivity
	[1]	[2]
Full-fledged IT dummy	0.0291***	0.1322***
	(0.0104)	(0.0171)
Observations	12771	12771
R-squared	0.1693	0.1245
Country & Industry & Year FE	Yes	Yes
Trend	Yes	Yes
Control variables	Yes	Yes
Level of se clustering	Country	Country

This table reports estimates of the impact of inflation targeting on firm performance. The treatment variable is an inflation-targeting dummy, referring to conservative dates. The outcome variables are firms' sales growth and productivity growth, respectively. Panel A uses weighted least squares regressions, including controls, country, industry, and year-fixed effects. In Panel B the previous model is augmented by adding a trend. All equations include the following controls: lag inflation, lag GDP per capita growth, lag fiscal balance, lag trade openness, lag exchange rate dummy, firm size, the ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively), the firm's age, legal status, the logarithm of the previous three years' sales, political stability, the level of democracy, financial development, and access to financial markets. Robust standard errors clustered at the country level are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.3: Robustness: Additional controls

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A: Descriptive statistics	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Lag Inflation	6.91	5.71	1.20	17.56	0.00
Lag Log. Per capita income	2.17	2.20	-0.03	-23.56	0.00
Lag Fiscal balance	-1.15	-1.58	0.43	8.45	0.00
Lag Trade openness	83.02	65.92	17.10	24.89	0.00
Lag Exchange rate dummy	0.16	0.00	0.16	30.03	0.00
Lag Governor turnover	0.02	0.01	0.01	6.78	0.00
Observations	***8,418***	***4,776***			
	[1]	**[2]**	**[3] = [1] - [2]**	**[4]**	**[5]**
Panel B: Covariate balancing	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Lag Inflation	5.71	5.71	0.00	0.00	1.00
Lag Log. Per capita income	2.20	2.20	0.00	0.00	0.99
Lag Fiscal balance	-1.58	-1.58	0.00	0.00	0.99
Lag Trade openness	65.93	65.92	0.01	0.00	1.00
Lag Exchange rate dummy	0.00	0.00	0.00	-0.93	0.36
Lag Governor turnover	0.01	0.01	0.00	0.00	0.99
Observations	***8,418***	***4,776***			
Total of weights	***4,776***	***4,776***			
Panel C: Treatment effects	**Sales growth**	**Productivity growth**			
Full-fledged IT dummy	0.0972***	0.2200***			
	(0.0227)	(0.0288)			
Observations	12595	12595			
R-squared	0.1656	0.1304			
Control variables	Yes	Yes			
Country & Industry & Year FE	Yes	Yes			
Level of se clustering	Country	Country			

This table reports estimates of the impact of inflation targeting on firm performance, using additional control variables. We augment our baseline specification by including two matching variables in the first stage of entropy balancing: the logarithm of per capita income (instead of growth in per capita income as in the baseline model) and central bank independence (proxied by the governor turnover variable). At the firm level, we include the share of domestic and foreign materials used in the inputs, respectively; the firm's export status; and the ease of dealing with construction permits. We also control via IMF programs. The baseline model equation includes the following variables: lag inflation, lag fiscal balance, lag trade openness, lag exchange rate dummy, firm size, the ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively), the firm's age, legal status, the logarithm of the previous three years' sales, political stability, the level of democracy, financial development, and access to financial markets. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4: Heterogeneities of the effect of inflation targeting (IT) on firm performance.

Dependent: Growth	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**
Full-fledged IT dummy	0.1113***	0.1001***	0.0911***	0.0308***	0.0235**	0.1372**	0.1574**	0.1346**	0.1181***
	0.0090)	(0.0081)	(0.0150)	(0.0108)	(0.0112)	(0.0575)	(0.0580)	(0.0562)	(0.0372)
IT * Deviations	-0.2165***								
	(0.0351)								
IT * Squared deviations		-0.3469***							
		(0.0562)							
IT * Sound fiscal discipline			0.1372***						
			(0.0078)						
IT * Quality of judicial processes				0.1012***					
				(0.0192)					
IT * Rich firm					-0.0828				
					(0.0908)				
IT * Small firm						-0.0154			
						(0.0174)			
IT * Medium firm							0.0037		
							(0.0149)		
IT * Large firm								-0.0056	
								(0.0306)	
IT * Time									0.0089***
									(0.0014)
Observations	12771	12771	12771	12771	12771	12912	12912	12912	11421
R-squared	0.169 .	0169	0.169	0.169	0.1833	0.1473	0.1139	0.1411	0.1687
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country & Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of the heterogeneity effects of inflation targeting. The equation is estimated by considering the main model augmented by the interactive term. Vector X variables in isolation (without interaction with inflation targeting) and controls are included but not reported for the sake of space. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5: Heterogeneities of the effect of inflation targeting (IT) on firm performance.

Dependent: Productivity	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**
Full-fledged IT dummy	0.1813***	0.1746***	0.1922***	0.1335***	0.1243***	0.2304***	0.2494***	0.2191***	0.1922***
	(0.0102)	(0.0104)	(0.0151)	(0.0172)	(0.0175)	(0.0539)	(0.0548)	(0.0532)	(0.0416)
IT * Deviations	-0.1286***								
	(0.0367)								
IT * Squared deviations		-0.2059***							
		(0.0588)							
IT * Sound fiscal discipline			0.1182***						
			(0.0073)						
IT * Quality of judicial processes				0.0713**					
				(0.0291)					
IT * Rich firm					0.0210				
					(0.0803)				
IT * Small firm						-0.0119			
						(0.0312)			
IT * Medium firm							-0.0096		
							(0.0198)		
IT * Large firm								0.0147	
								(0.0284)	
IT * Time									0.0053***
									(0.0015)
Observations	12771	12771	12771	12771	12771	12912	12912	12912	11421
R-squared	0.1244	0.1244	0.1244	0.1244	0.1343	0.1167	0.1039	0.1134	0.1249
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country & Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of the heterogeneity effects of inflation targeting. The equation is estimated by considering the main model augmented by the interactive term. Vector X variables in isolation (without interaction with inflation targeting) and controls are included but not reported for the sake of space. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.6: Validity of transmission channels

Panel A	[1]	[2]	[3]	[4]
	Growth	Growth	Growth	Growth
Inflation volatility	-0.0011***			
	(0.0004)			
Interest rate volatility		-0.0829***		
		(0.0048)		
Exchange rate volatility			-0.0070***	
			(0.0003)	
Inflation				-0.0011**
				(0.0005)
Observations	21834	17419	17419	21795
Panel B	[1]	[2]	[3]	[4]
	Productivity	Productivity	Productivity	Productivity
Inflation volatility	-0.0003			
	(0.0004)			
Interest rate volatility		-0.0734***		
		(0.0050)		
Exchange rate volatility			-0.0063***	
			(0.0003)	
Inflation				-0.0012**
				(0.0005)
Observations	21261	16950	16950	21224
Panel C	[1]	[2]	[3]	[4]
	Inflation volatility	Interest rate volatility	Exchange rate volatility	Inflation
Full-fledged IT dummy	-0.2179***	-0.0348***	-2.4184***	-0.0004
	(0.0134)	(0.0113)	(0.1471)	(0.0567)
Observations	13194	13194	13194	13194

This table reports the results of the main transmission channel through which inflation targeting affects firm performance. In Columns [1]-[4] of Panels A and B, we estimate a univariate regression of inflation and its volatility, exchange rate, and interest rate volatility on firm growth and productivity, using the OLS estimator. In Panel B, we re-estimate our baseline model using entropy balancing, controlling for the macroeconomic variables used in the first stage equation, and replacing our dependent variable with the potential channel. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A1: Robustness: alternative samples

Panel A: Sales growth	[1]	[2]	[3]	[4]	[5]
Full-fledged IT dummy	0.0308***	0.1207***	0.0312***	0.0292**	0.0284**
	(0.0108)	(0.0093)	(0.0109)	(0.0110)	(0.0112)
Observations	12771	11638	11593	12686	12467
R-squared	0.169	0.169	0.1685	0.1692	0.1725
Control variables	Yes	Yes	Yes	Yes	Yes
Country & Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country	Country
Panel B: Productivity growth	[1]	[2]	[3]	[4]	[5]
Full-fledged IT dummy	0.1335***	0.1940***	0.1341***	0.1298***	0.1311***
	(0.0172)	(0.0110)	(0.0173)	(0.0172)	(0.0174)
Observations	12771	11638	11593	12686	12467
R-squared	0.1244	0.1244	0.1238	0.1254	0.1276
Control variables	Yes	Yes	Yes	Yes	Yes
Country & Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country	Country

This table reports estimates of the impact of inflation targeting on firm performance, using alternative samples. Column [1] reports the results of the baseline model (main sample). In Column [2], we exclude countries belonging to a monetary union or dollarized countries, as well as those with a fixed de facto exchange rate or currency board. In Column [3], we exclude countries that adopted inflation targeting at the end of our study period, namely Russia and Kazakhstan. In Column [4], we exclude pre-treated observations, i.e., observations relating to a firm that is not yet treated (but will be). In Column [5], we restrict our study period to the years before the COVID-19 crisis. All equations include the following controls: lag inflation, lag GDP per capita growth, lag fiscal balance, lag trade openness, lag exchange rate dummy, firm size, the ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively), the firm's age, legal status, the logarithm of the previous three years' sales, political stability, the level of democracy, financial development, and access to financial markets. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Robustness: soft inflation targeting and falsification tests

Panel A: falsification tests	**Sales growth**	**Productivity growth**
	[1]	[2]
Random treatment	0.0018	-0.0012
	(0.0042)	(0.0055)
Observations	12771	12771
R-squared	0.1887	0.1506
Control variables	Yes	Yes
Country & Industry & Year FE	Yes	Yes
Level of se clustering	Country	Country
Panel B: soft inflation targeting	**Sales growth**	**Productivity growth**
	[1]	[2]
Soft IT dummy	0.0308***	0.1335***
	(0.0108)	(0.0172)
Observations	12771	12771
R-squared	0.169	0.1244
Control variables	Yes	Yes
Country & Industry & Year FE	Yes	Yes
Level of se clustering	Country	Country

This table reports the effects of inflation targeting on firm performance. In Panel A, we consider fictitious adoption dates or random assignments to treatment, using the baseline model specification. In Panel B, we refer to soft inflation targeting or default starting dates. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Robustness: OLS estimates and within variation

Panel A: OLS estimates	**Sales growth**	**Productivity growth**
	[1]	[2]
Hard IT dummy	0.0455***	0.1545***
	(0.0085)	(0.0088)
Observations	13294	12949
R-squared	0.189	0.1481
Control variables	Yes	Yes
Country & Industry & Year FE	Yes	Yes
Level of se clustering	Country	Country
Panel B: within variation	**Sales growth**	**Productivity growth**
	[1]	[2]
Hard IT dummy	0.0519***	0.1460***
	(0.0059)	(0.0061)
Observations	7392	7149
R-squared	0.1888	0.1468
Control variables	Yes	Yes
Country & Industry & Year FE	Yes	Yes
Level of se clustering	Country	Country

This table reports the effects of inflation targeting on firm performance. In Panel A, we re-estimate our main equation from the overall sample, using a simple OLS regression. In Panel B, we run an OLS regression using only the treated countries. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Robustness: alternative measures of firm performance

	[1]	[2]	[3]
Panel A	Total factor productivity (1)	Total factor productivity (2)	Log. Value-added per worker
Full-fledged IT dummy	0.3263***	0.2787***	0.3064***
	(0.0692)	(0.0623)	(0.0490)
Observations	9129	9129	10496
Control variables	Yes	Yes	Yes
Country & Industry & Year FE	Yes	Yes	Yes
Level of se clustering	Country	Country	Country
Panel B	[1]	[2]	[3]
	Log. Investment in capital	Exports dummy	R&D investment (probit estimations)
Full-fledged IT dummy	0.3544*	0.1907***	0.2810***
	(0.1985)	(0.0362)	(0.0458)
Observations	5336	14454	10755
Control variables	Yes	Yes	Yes
Country & Industry & Year FE	Yes		
Level of se clustering	Country		

This table presents the effect of inflation targeting on alternative measures of firm performance, using weighted least squares regressions (except in Column [3] of Panel A). The treatment variable is a full-fledged inflation-targeting dummy. In Panel A, the outcome variables are total factor productivity estimated from a Cobb Douglass function (Column 1), total factor productivity estimated from a translog function (Column 2), and the logarithm of value-added per worker (Column 3). In Panel B, the outcome variables are the logarithm of investment in equipment and land, firm export status (a binary variable equal to 1 if the firm exports its sales, and zero otherwise), and a dummy equal to 1 if the firm invested in research and development in the previous fiscal year and zero otherwise, respectively. Columns [2] and [3] of Panel B are estimated from a probit regression, controlling for the previously used variables. All equations include the following controls: lag inflation, lag GDP per capita growth, lag fiscal balance, lag trade openness, lag exchange rate dummy, firm size, the ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively), the firm's age, legal status, the logarithm of the previous three years' sales, political stability, the level of democracy, financial development, and access to financial markets. Robust standard errors clustered at the country level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B Data and sample

Table B1: List of countries

Inflation targeting (IT) countries		
	Soft IT (default starting dates)	Full-fledged IT (conservative dates)
Brazil	June 1999	June 1999
Colombia	September 1999	October 1999
Dominican Republic	2011	2012
Ghana	January 2007	January 2007
Hungary	June 2001	August 2001
Kazakhstan	August 2015	August 2015
Paraguay	May 2011	May 2011
Peru	January 2002	January 2002
Philippines	January 2002	January 2002
Poland	September 1998	September 1998
Romania	August 2005	August 2005
Russia	2014	2015
Serbia	September 2006	September 2006
South Africa	February 2000	February 2000
Thailand	May 2000	May 2000
Non-targeting countries		
Benin	Bhutan	Bolivia
Bulgaria	Cambodia	Cameroon
China	Costa Ricaa	Cote d'Ivoire
El Salvador	Gambia	Georgia
Honduras	Jordan	Kenya
Kyrgyz Republic	Lao PDR Republic	Lesotho
Malaysia	Morocco	Myanmar
Nepal	Nicaragua	North Macedonia
Papua New Guinea	Senegal	Sierra Leone
Solomon Islands	Sudan	Trinidad and Tobago
Tunisia	Vietnam	

Sources: Rose (2007); Roger (2009); Jahan (2012) and Ciżkowicz-Pękała et al. (2019); Apeti et al. (2023g); Bambe (2023)

Table B2: List of variables and their sources

Variables	Nature	Sources
1. Treatment variable		
Full-fledged Inflation Targeting	Dummy	Rose (2007); Roger (2009); Jahan (2012); Ciżkowicz-Pękała et al. (2019); Bambe (2023); Apeti et al. (2023g)
2. Control variables		
2.1 Country-level variables		
Inflation	Continuous	WDI, World Bank
Real GDP per capita growth	Continuous	WDI, World Bank
Domestic credit to private sector	Continuous	WDI, World Bank
Access to financial markets	Continuous	Financial Access Survey (IMF)
Fiscal balance	Continuous	Kose et al. (2022)
Trade openness	Continuous	WDI, World Bank
Fixed exchange rate	Dummy	Authors' calculations based on Ilzetzki et al. (2019)
Political stability	Index ranging from -2.5 to 2.5	Worldwide Governance Indicators database (Kaufmann et al., 2011)
Democracy score	Index ranging from -10 to 10	Polity V
2.2 Firm-level variables - (WBES)		
Log Real sales (3 years ago)	Continuous	
Firm size	Ordinal	
Firm age	Continuous	
Firm's legal status	Ordinal	
Share of private domestic assets in the company	Percentage	
Share of public domestic assets in the company	Percentage	
Share of foreign assets in the company	Percentage	
3. Firm performance indicators		
Sales growth	bounded between - 1 and 1	Authors' calculations
Productivity growth	bounded between - 1 and 1	Authors' calculations
Total factor productivity (Cobb - Douglas function)	Continous	Authors' calculations
Total factor productivity (Trans-log function)	Continous	Authors' calculations
Value-added per worker	Continuous	Authors' calculations
Log. investment in equipment and land	continuous	WBES
Export status	Dummy	WBES
Investment in research and development	Dummy	WBES
4. Additional controls		
Annual GDP growth	Continuous	WDI, World Bank
GDP per capita	Continuous	WDI, World Bank
Governor turnover	Dummy	Dreher et al. (2008a); Dreher et al. (2010)
Log. net book value of capital	continuous	WBES
Log. investment in equipment and land	continuous	WBES
Ease of dealing with construction permits	Score ranges from 0 to 100	Doing Business database
Quality of land administration	Score ranges from 0 to 30	Doing Business database
Quality of judicial processes	Score ranges from 0 to 18	Doing Business database

C Summary statistics

Table C1: Descriptive statistics of the baseline model variables

Variables	Obs.	Mean	Sd	Min	Max
Sales growth	21,795	0.045	0.274	-1	1
Productivity growth	21,224	0.007	0.278	-1	1
Lag Inflation	30,993	5.978	4.225	-0.210	24.798
Lag GDP per capita growth	30,993	3.968	2.960	-1.719	11.606
Lag Fiscal balance	30,993	-1.738	2.729	-7.827	11.084
Lag Trade openness	30,873	76.578	34.732	11.676	166.552
Lag Fixed exchange rate	22,566	0.116	0.321	0	1
Log. Real sales sales (3 years ago)	25,158	8.852	2.174	0	26.252
Firm size	30,993	1.927	0.787	1	3
Firm age	27,725	24.798	15.043	2	203
Firm's legal status	30,407	2.696	1.118	1	6
National share capital	30,301	88.572	29.401	0	100
Foreign share capital	30,294	9.229	26.969	0	100
Government share capital	30,302	0.636	6.282	0	100
Lag Financial development	27,598	48.386	33.236	4.115	127.550
Lag Access to financial markets	24,447	0.283	0.239	0	0.642
Political stability	30,103	-0.385	0.632	-1.727	0.974
Democracy score (Polity V)	24,406	4.138	6.034	-7	10

Chapter 3

Inflation Deviations from the Target: The Disciplinary Effect of Capital Account Openness

Abstract

Numerous studies show that capital account openness contributes to some extent to disinflation. In this paper, we establish a robust finding that capital mobility contributes to the convergence of inflation towards the central bank's target using a set of advanced and emerging economies. We find similar effects controlling for country and year fixed effects and employing an instrumental-variables strategy using regional waves of liberalization. The effects are mainly driven by capital inflows and may vary according to the size of deviations, and some economic and institutional characteristics. We further empirically examine some underlying mechanisms and find that lower inflation and improved macroeconomic policies resulting from capital mobility —notably fiscal discipline— are important channels explaining our main finding.

Keywords: • Inflation targeting • Monetary policy credibility • Capital mobility

JEL Classifications: F36, F41, E31

"Undoubtedly, the state of inflation expectations greatly influences actual inflation and thus the central bank's ability to achieve price stability." Ben S. Bernanke (July 10, 2007)

3.1 Introduction

There is a broad consensus in the literature that expectations are crucial to understanding actual inflation, and that the success of monetary policy will depend on the central bank's ability to break the grip of inflationary expectations. As such, the important role of expectations in shaping actual inflation has led many central banks in industrialized and emerging countries to adopt inflation-targeting regimes, while improving their transparency and communication with the public. By announcing an explicit inflation target, the central bank provides a focal point for the public on the future stance of monetary policy, which in turn helps to anchor inflation expectations, thus enhancing monetary policy credibility (Bernanke and Mishkin, 1997; Walsh, 2009; Bordo and Siklos, 2014). Overall, the macroeconomic stabilization objective within the inflation targeting framework has generally been successful, at least in emerging and developing economies (Neumann and Von Hagen, 2002; Lin and Ye, 2009; Vega and Winkelried, 2005; Lin, 2010; Fratzscher et al., 2020; Arsić et al., 2022). However, inflation target ranges are frequently exceeded —in both advanced and developing countries— with some countries recording extreme deviations, as illustrated in Figure 3.1. In addition, the surge in global inflation amid the COVID-19 pandemic and the war in Ukraine raises fears of inflationary pressures in the future, bringing back to the forefront the role of monetary policy in anchoring expectations to control inflation and stabilize it on a downward trajectory over the next few years (Gelos et al., 2020; Ha et al., 2021; Jordà and Nechio, 2023).

Although the explicit announcement of an inflation target may play an important role in coordinating expectations, theory teaches us that time inconsistency —leading to inflation deviations from the target— reduces the credibility of monetary policy, thus weakening the anchoring objective. As such, one question is what mechanisms can reduce such time inconsistencies. A substantial body of literature discusses how financial openness influences the conduct of monetary policy. One consequence of capital mobility is that people will substitute domestic currency for foreign currency if they do not trust the monetary authorities. Moreover, greater capital account openness implies a higher risk of losing international capital in the presence of inflationary policy, due to strong competition between countries to attract foreign

investors (Cooke, 2010; de Mendonça and da Silva Veiga, 2014). Lastly, another source of central bank time inconsistency problems stems from persistent government fiscal deficits. The latter then sooner or later have to finance their deficits via money creation, thus generating inflation (Sargent and Wallace, 1981). Yet, the literature shows that capital mobility provides incentives for governments to discipline their fiscal policy, for fear of being penalized by the international capital market (Kim, 2003), but also because greater capital mobility makes it more difficult to tax capital due to tax competition, which may trigger important side effects on monetary policy.

Numerous studies provide evidence that financial liberalization contributes in some way to disciplining domestic macroeconomic policies, thus lowering inflation (e.g., see Grilli and Milesi-Ferretti, 1995; Gruben and McLeod, 2002; Tytell and Wei, 2004; Gupta, 2008). A different question is whether capital mobility also contributes to reducing inflation deviations from the target. de Mendonça and da Silva Veiga (2014) develop a theoretical model discussing how an increase in financial openness may contribute to the convergence of inflation towards the target, while providing empirical evidence for an emerging inflation-targeting country, Brazil.[1] This paper expands the existing literature, making the following contributions. First, we provide a detailed analysis of the impact of financial openness on inflation deviations from the target, including a sample of 36 inflation-targeting countries, both advanced and emerging economies, over the period 1990-2021, to enable a broad generalization of the results. In other words, we are not interested in the consequences of inflation targeting on inflation performance, nor in the influence of financial openness on the probability of inflation targeting adoption, nor in the role of inflation targeting in the presence of sudden stops as in Coulibaly (2023), but rather in the effectiveness of the targeting regime under capital mobility. Second, we deepen the analysis, examining the effect according to the type of flows and the size of deviations. In addition, we take good notice of the differences between advanced and developing countries and — as such — conduct heterogeneity analyses according to level of economic development, and examine some economic and institutional factors that may influence the relationship between capital mobility and inflation deviations. Third, we present some tentative results on the potential mechanisms underlying our main finding.

A Tobit analysis based on a panel of 36 inflation-targeting countries over the period

[1] Our study is also closely related to that of Albagli and Schmidt-Hebbel (2003), who identify some determinants of inflation deviations from the target.

1990-2021 suggests that capital mobility reduces inflation deviations from the target. The effect is both statistically and economically significant and robust to a series of tests, including additional controls, alternative subsamples, and measures. The results are consistent even when using the ordinary least squares (OLS) estimator —including country and year fixed effects— to account for unobserved heterogeneity and a bias-corrected fixed effects (LSDVC) estimator to take into account inertia in the dependent variable. These results are confirmed when we instrument domestic financial openness by the degree of openness in neighboring countries. We then conduct a series of heterogeneity analyses, examining the effect of capital mobility according to the type of flows, the size of deviations, and some economic and institutional factors. Regarding the types of flows, the findings suggest that the disciplining effect of capital mobility on monetary policy is mainly driven by capital outflows (rather than inflows) probably because they are a key determinant of the credibility of international investors. About the size of deviations, we find that capital account openness reduces positive, rather than negative deviations (probably due to the disinflationary effect of capital mobility), and all the more as these deviations are large. The data also suggest that the disciplining effect of capital account openness is greater in countries with strong fiscal discipline and in countries where the central bank is more independent from the government. Lastly, we empirically examine some underlying mechanisms and find that the disinflationary effect of capital mobility, together with the disciplining effect on public finances, are important channels explaining our results.

The rest of the document is structured as follows. The next section reviews the literature on inflation targeting and discusses the main mechanisms linking capital mobility and the convergence of inflation toward the target. Section 3.3 describes the variables of the main model, and provides some descriptive statistics and correlational evidence. Section 3.4 describes the econometric strategy and discusses the main results. Section 3.5 examines the sensitivity of the results through a series of robustness checks and heterogeneity analyses, respectively. Section 3.6 provides some empirical evidence on the main transmission channels. The last section concludes.

3.2 Background

We first discuss the rationale for adopting inflation targeting, and then briefly review the empirical evidence on the effect of the monetary framework on macroeconomic

stability. The last subsection reviews the literature linking capital mobility and inflation or inflation deviations from the central bank's target.

3.2.1 Inflation targeting under the discretionary regime

The main implication of inflation bias in a discretionary regime is that rules designed to tie policymakers' hands should reduce central bank inconsistencies in creating inflation surprises. While Rogoff (1985) suggested choosing a more conservative central banker to give more weight to the inflation objective, Walsh (1995) proposed an inflation contract to the central bank, a strategy formally equivalent to inflation targeting recommended by Svensson (1995). Inflation targeting then emerged as one of the most important monetary reforms since the early 1990s, and has become a popular tool for monetary policy in both advanced and emerging economies. By announcing an explicit inflation target and promoting the transparency of its policy within the inflation targeting framework, the central bank contributes to anchoring inflation expectations, thus promoting monetary policy credibility (Bernanke and Mishkin, 1997; Walsh, 2009; Bordo and Siklos, 2014). It is well established in the literature that enhanced credibility facilitates monetary policy management and helps reduce the cost of disinflation (Kydland and Prescott, 1977). A large body of literature examines the macroeconomic effects of inflation targeting. With a few exceptions (e.g., see Levin et al., 2004; Brito and Bystedt, 2010; Ardakani et al., 2018), numerous studies focusing on developing countries provide evidence that enhanced monetary policy credibility resulting from inflation targeting adoption contributes to the desired objective of macroeconomic stability, i.e., a reduction in inflation, interest rate, or exchange rate volatility (see, among others, Neumann and Von Hagen, 2002; Rose, 2007; Lin and Ye, 2009; Vega and Winkelried, 2005; Lin, 2010; Arsić et al., 2022). Turning to developed countries, overall, the literature fails to establish conclusive differences between inflation-targeting and non-inflation-targeting countries about macroeconomic stability (e.g., see Ball and Sheridan, 2004; Lin and Ye, 2007, Walsh, 2009, De Mendonça and e Souza, 2012; Samarina et al., 2014).[2]

3.2.2 Capital mobility and inflation

Among the pioneering works dealing with the effects of liberalization, Romer (1993) showed a negative link between trade openness and inflation. The underlying

[2]See Balima et al. (2020) for a meta-analysis of the macroeconomic effects of inflation targeting.

mechanism is that unanticipated monetary expansion leads to a depreciation of the real exchange rate, with significant consequences in more open economies. The literature has also examined the potential influence of capital account openness on inflation, highlighting some important mechanisms. Low restrictions on capital movements foster greater access to foreign currencies, increasing the elasticity of money demand. A lax policy will therefore result in a deterioration in the credibility of monetary policy, with incentives to substitute domestic currency for foreign currency, which may result in an increase in inflation due to a currency devaluation (in the case of a flexible exchange rate). Consequently, in the context of increased capital mobility, a loose monetary policy is likely to be punished directly by the public. The central bank's temptation to make inflationary surprises is then reduced when capital flows are more mobile. In addition, inflation biases reduce international investors' confidence in the domestic economy. Hence, foreign investors are more likely to move to countries with sound macroeconomic policies and greater credibility. As countries compete with each other to attract foreign investors, the temptation for authorities to implement sound policies is greater with high capital mobility, thus reducing central banks' time inconsistencies (Cooke, 2010; de Mendonça and da Silva Veiga, 2014). Another channel through which capital account openness may affect inflation relates to government behavior. It has been shown that capital mobility leads governments to discipline their fiscal policy for fear of being penalized by the international capital market (Kim, 2003). The disciplining effect of capital mobility on public finances is all the more plausible as capital mobility makes it more difficult to tax capital, through the mechanism of tax competition (Swank, 2016; Jha and Gozgor, 2019). In the same vein, Bartolini and Drazen (1997) and Laban and Larrain (1997) suggest that governments' willingness to attract foreign and domestic investors by liberalizing their capital accounts also signals their commitment to reforming their policies. Sound fiscal discipline promoted by liberalization may contribute to reducing fiscal dominance. This should lead the central bank to focus more on its price stabilization objective, thereby reducing time inconsistency problems.

Using a panel of 61 countries, Grilli and Milesi-Ferretti (1995) find that capital controls are associated with higher inflation and lower real interest rates. Gruben and McLeod (2002), using over 100 countries, also found a strong link between capital account openness and lower inflation. Similar conclusions are provided by Tytell and Wei (2004) for a panel of 62 countries over the period 1975-1999 and Gupta (2008) for 163 countries from 1980 to 2003. Nevertheless, the literature is not unanimous

on the favorable effects of financial liberalization on macroeconomic stability. Other academics, more skeptical, argue that liberalization can also be a source of instability, making economies more vulnerable to destabilizing and inflationary capital flows, thus undermining central banks' efforts to control inflation (Rodrik et al., 1998). de Mendonca and Castro Pires (2007) find roughly similar conclusions in the case of Brazil.

While a major part of the literature highlights the benefits of capital account openness in reducing inflation, another question is whether low restrictions on capital mobility contribute to the convergence of inflation to the central bank's target. de Mendonça and da Silva Veiga (2014) provide a theoretical model linking capital account openness to inflation deviations from the target, with similar arguments to those discussed above. Given the relationship between private capital flows and inflation expectations, capital account liberalization should increase the punishment costs for monetary authorities. The central bank may then have incentives to achieve the inflation target when capital is more mobile. Furthermore, by promoting fiscal discipline, capital mobility should reduce fiscal dominance, and thus central bank time inconsistencies. The authors provide an empirical application for an inflation-targeting country, Brazil, and find that capital account openness contributes to the convergence of inflation towards the target. Our study expands the existing literature by examining the relationship over a set of emerging and developed countries, distinguishing different types of capital flows, taking into account the magnitude of inflation deviations from intended targets, and empirically examining the main underlying mechanisms.

3.3 Data

3.3.1 Main variables

Our sample includes 36 inflation-targeting countries, 14 advanced and 22 developing, over the period 1990-2021. The sample countries and study period were selected based on data availability. The analysis consists of country-year observations, including all the years when the country i targets inflation. For robustness, we include a dummy variable to control for the effects of the 2008-09 global financial crisis and the COVID-19 pandemic. The inflation-targeting adoption date refers to formal or hard inflation targeting, considered by academics as the official date from which the central bank operates under the inflation-targeting framework. Following Ogrokhina and Rodriguez (2018), we compute annual inflation deviations from the

target as the difference between realized inflation and the inflation target for each country over the study period. Data on inflation targets are extracted from Jahan (2012) and publications by the central bank of each country. Central banks can adjust their inflation targets in an attempt to ensure that actual inflation converges towards the target (Kim and Yim, 2020). To avoid such biases in our calculation, we consider only the targets set at the date of introduction of the monetary framework. For robustness, we consider central bank adjustments to the targets. The capital account openness variable comes from Chinn and Ito (2008) and ranges from -1.9 (more restricted capital mobility) to 2.3 (less restricted). The indicator provides a de jure measure of financial openness, based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). While the literature provides other de jure measures of capital account openness (e.g., Quinn and Toyoda, 2008), the Chinn-Ito index offers broader coverage in terms of countries and period, i.e., 184 countries from 1970 to 2021.[3]

We include a series of potential determinants of inflation, which may also be important drivers of inflation deviations from the target. First, we include central bank independence, as the latter would be an important precondition for a successful inflation targeting framework, especially as strong independence also reflects greater credibility from the central bank and more firmly anchored inflation expectations (Bernanke and Mishkin, 1997; Svensson, 1997; Mishkin, 2000; Mishkin, 2004). Another point of view supported in the literature is that inflation targeting could encourage greater central bank independence when the latter is lacking, giving greater scope for improving the performance of monetary policy in countries where central bank independence is weak (see Alpanda and Honig, 2014 for a comprehensive discussion). Next, according to the unpleasant monetarist arithmetic theory (Sargent and Wallace, 1981), persistent fiscal indiscipline is expected to increase the likelihood of the government pressuring the central bank to finance its deficits via money creation, leading to inflationary pressures. Thus, we further consider broad money growth and fiscal balance. We also control for financial development, as it has been shown that good financial development limits the risk of monetization through the sharing of seigniorage power between the central bank and commercial banks (Minea et al., 2021). In addition, sound financial development contributes to better fiscal discipline —an important factor for monetary policy credibility— via tax revenue collection (Nnyanzi et al., 2018; Gnangnon and Brun, 2018; Apeti and Edoh, 2023).

[3]We use the Quinn-Toyoda index and other financial openness measures in robustness.

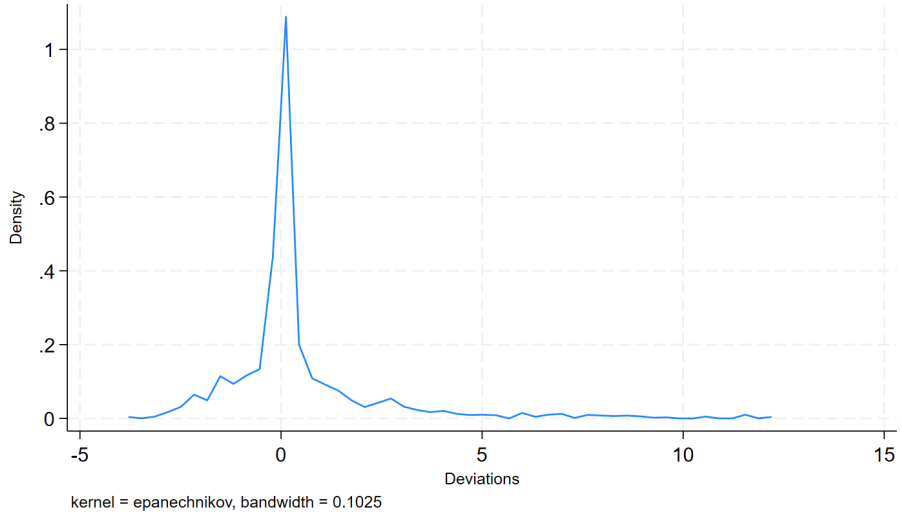
However, these arguments need to be carefully nuanced, as another body of literature examining the effects of financial development on growth volatility finds ambiguous or conditional effects depending on the level of financial development or the quality of institutions (e.g., see Easterly et al., 2001; Acemoglu et al., 2003; Aghion et al., 2004; Beck et al., 2006; Mallick, 2014). Lastly, Combes et al. (2018) argue that constraining reforms such as fiscal rules, by disciplining public finances, contribute to reducing fiscal dominance, leading to lower inflation. Following this idea, we also control via a dummy variable equal to 1 if the country i has implemented a fiscal rule on public debt, deficits, expenditure, or tax revenues in the year t, and zero otherwise. Fiscal balance is measured as a percentage of GDP and is extracted from Kose et al. (2022). Central bank independence is approximated by the governors' turnover variable extracted from Sturm and De Haan (2001) and Dreher et al. (2008a; 2010). Financial development (measured as the share of domestic credit to the private sector, as a percentage of GDP) and broad money growth are extracted from the World Bank's WDI (World Development Indicators) database. The fiscal rules variable is extracted from the IMF Fiscal Rules Dataset, and is measured by a dummy equal to 1 when a country i has adopted a fiscal rule in a year t, and zero otherwise.

3.3.2 Descriptive statistics

This section provides some stylized facts and descriptive statistics on inflation deviations from the target and capital account openness for the countries in our sample (36 inflation-targeting countries, 14 advanced and 22 developing) over the period 1990-2021. We report an average deviation of 0.42 percentage points and a median of zero. Figure 3.1 plots the kernel density of deviations. Around 38% of the country-year observations in the sample do not deviate from their target, resulting in a distribution of deviations concentrated around zero. The long tail is due to a few countries with large deviations. While deviations in advanced countries are on average almost zero, those in developing countries are slightly above the sample average (0.54 percentage points). This suggests that inflation deviations in the sample are notably driven by developing countries, probably because they are more prone to macroeconomic instabilities than their peers. Over the study period and sample, Turkey reported the largest deviation from its target, with a gap of 12 percentage points in 2021, probably due to the COVID-19 pandemic. Ukraine, Russia, Kazakhstan, and Uganda also report high deviations (around 11 percentage points), coinciding with their year of introduction of the inflation targeting framework.

The 2008-09 global financial crisis led to a surge in inflation in many countries, with Ghana experiencing the largest deviation in 2009, i.e., around 9 percentage points. Figure 3.3 plots the average five-year trend in capital account openness in the countries in our sample, based on the Chinn-Ito index. There was a substantial increase in capital account openness in inflation-targeting countries, particularly in advanced countries. The average Chinn-Ito index in advanced countries is 1.85 over the study period. Meanwhile, capital movement restrictions in developing countries began to ease in the mid-1990s, with a growing trend towards openness from the 2000s onwards, before slowing down following the 2008-09 global financial crisis. Overall, although much lower than that of advanced countries, the Chinn-Ito index is positive for developing countries, with an average of 0.35.

Figure 3.1: Distribution of inflation deviations from the target (1990-2021)

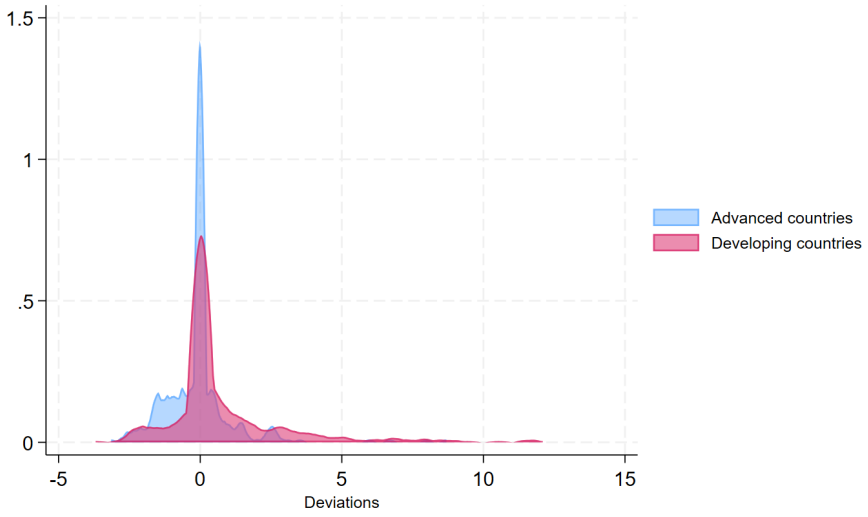


Notes: This figure plots the kernel density of inflation deviations from the central bank's target of the countries in our sample, over the period 1990–2021. The long tail is explained by a few countries with large deviations.

3.3.3 Correlational evidence

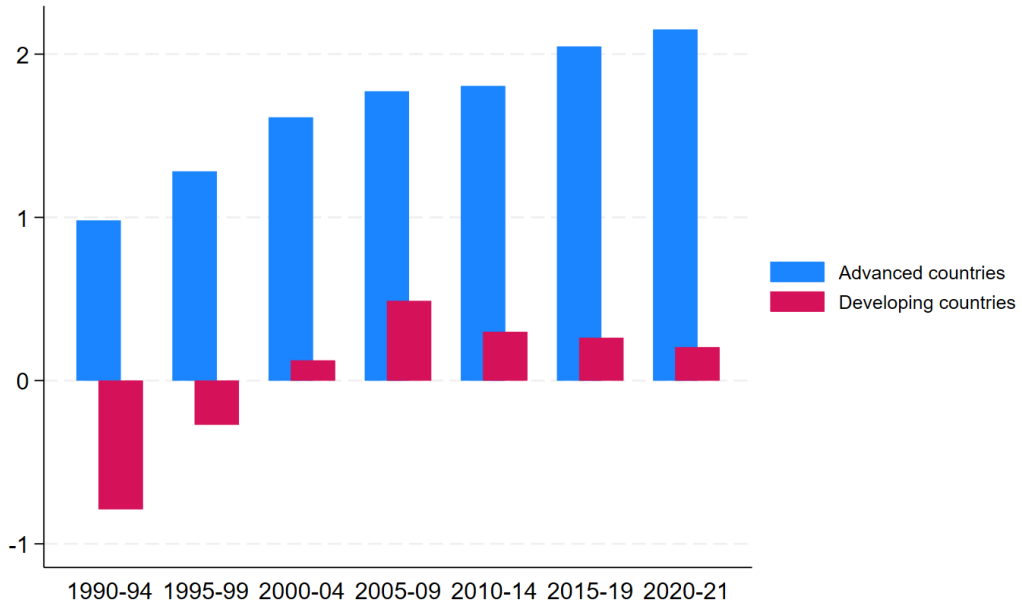
Table A4 (see Appendix) reports Pearson correlations linking capital account openness and inflation deviations from the target, as well as the set of control variables in the benchmark model. There is a negative and significant correlation between capital account openness and inflation deviations from the target, with a magnitude of around 32%. With regard to the control variables, fiscal factors (fiscal balance and fiscal rules) and financial development are negatively correlated with inflation deviations, while broad money growth is positively correlated.

Figure 3.2: Distribution of inflation deviations from the target by income level



Notes: This figure plots the kernel density of inflation deviations from the central bank's target of the countries in our sample, over the period 1990–2021, distinguishing between advanced and developing countries.

Figure 3.3: Trends in opening capital account openness



Notes: This figure plots the average five-year trend in capital account openness in the countries in our sample, based on the Chinn-Ito index.

3.4 Estimation strategy and main results

3.4.1 Methodology

We examine the impact of capital account openness on inflation deviations from the target, using a panel of 36 inflation-targeting countries, including both advanced and developing economies, over the period 1990-2021. As seen in Figure 3.1, there is a high concentration of deviations around zero. One model suitable for examining this type of data is Tobit analysis (Tobin, 1958), in which the dependent variable has a number of its values clustered around a limiting value, usually zero (McDonald and Moffitt, 1980).[4] The model we estimate is the following:

$$\pi_{i,t} \; - \; \pi_{i,t}* \; = f(Z_{i,t}) + \varepsilon_{i,t} \tag{3.1}$$

$\pi_{i,t} \; - \; \pi_{i,t}*$ captures inflation deviations from the target for the country i, in year t. Positive (negative) values indicate deviations above (below) the target. $Z_{i,t}$ is a set of the controls of the main model, i.e., financial development, fiscal balance, fiscal rules, central bank independence, and broad money growth.

The model is estimated using a random-effect Tobit regression, without including fixed effects, as the latter can lead to biased estimates due to incidental parameter problems when estimating Probit, Logit, or Tobit models (Greene, 2004; Wooldridge, 2010; Fernández-Val and Weidner, 2016; Kaya Samut and Cafrı, 2016). A first concern arises from the fact that financial liberalization may be correlated with omitted factors, which are also relevant determinants of the dependent variable. We address this in robustness, by controlling for a series of additional variables. Moreover, we neutralize time-invariant unobserved heterogeneity by including country and year-fixed effects when using the ordinary least squares (OLS) estimator. A second problem is that estimating a static panel does not allow for inertia in inflation deviations. To address this, we check the robustness of our results by estimating a bias-corrected fixed effects (LSDVC) specification, which takes into account inertia in the dependent variable while mitigating the Nickell bias. A third problem arises from reverse causality, which may run from inflation deviations to capital account openness. We sharpen identification in robustness, by instrumenting financial openness with its lagged value and the average rate of openness in neighboring countries.

[4] A growing body of literature employs Tobit analysis to examine the so-called efficiency scores (see, among others, Afonso and Aubyn, 2006; Afonso et al., 2010; Adam et al., 2011; Aldieri et al., 2021; Apeti et al., 2023b).

3.4.2 Main results

Before performing econometric estimates, we conduct unit root tests to examine the stationarity of the variables in the baseline model, to avoid spurious estimates. The results of the Phillips-Perron and Im–Pesaran–Shin unit root tests reported in Table A3 (see Appendix) indicate that the series are stationary in level. Column [1] of Table 3.1 reports the baseline results of the impact of capital account openness on inflation deviations from the target. The coefficient of capital account openness is negative and statistically significant at 1%, suggesting that capital mobility tends to reduce inflation deviations from the target. More precisely, a one-unit increase in the Chinn-Ito index results in a 0.65 percentage point reduction in inflation deviations from the target, which represents 33% of the sample standard deviation, thus suggesting an economically significant impact of capital account openness. Lastly, with regard to the control variables, the results suggest a negative and significant effect of fiscal rules on inflation deviations from the target, while broad money growth is positively associated. The rest of the study examines the robustness of our main results, explores their sensitivity in different economic contexts, and analyzes possible transmission channels.

3.5 Sensitivity

3.5.1 Robustness checks

In Subsection 3.5.1, we conduct a battery of robustness tests to ensure the validity of the main finding, and the next subsection examines a series of heterogeneity in the relationship between capital account openness and inflation deviations, according to the size of deviations, and some economic and institutional factors.

Alternative specifications and additional controls. First, we consider alternative econometric specifications. In Column [2] of Table 3.1, we remove broad money growth from the main model, since the correlation between money supply and inflation would be (purely) mechanical. In Column [3], we include public debt instead of fiscal balance, as in the primary model. Next, we augment the baseline model by including a series of additional controls. This allows us to examine whether the effect obtained in the main model is biased by omitted determinants of capital mobility that are also correlated with inflation deviations. In Column [4] of Table 3.1, we include trade openness and expect a negative correlation between trade openness and inflation deviations, as inflation biases can penalize more open economies, via

Table 3.1: Capital account openness and inflation deviations from the target

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
Ka-Open	-0.654***	-0.688***	-0.760***	-0.610***	-0.654***	-0.283**	-0.533***	-0.558***	-0.654***	-0.707***	-0.225*
	(0.140)	(0.140)	(0.143)	(0.141)	(0.136)	(0.113)	(0.157)	(0.145)	(0.141)	(0.143)	(0.126)
Governor turnover	-0.074	-0.018	-0.036	-0.076	-0.060	0.116	-0.108	-0.038	-0.079	-0.089	0.145
	(0.314)	(0.315)	(0.319)	(0.314)	(0.305)	(0.338)	(0.316)	(0.341)	(0.314)	(0.308)	(0.356)
Fiscal balance	-0.048	-0.040		-0.045	-0.062**	-0.066**	-0.070**	-0.044	-0.048	-0.034	-0.075**
	(0.032)	(0.032)		(0.032)	(0.031)	(0.030)	(0.034)	(0.035)	(0.032)	(0.032)	(0.034)
Broad money growth	0.021***		0.018**	0.020***	0.020**	0.020**	0.023***	0.024***	0.021***	0.021***	0.021**
	(0.008)		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)
Financial development	-0.000	0.000	0.002	0.000	-0.002	-0.003	-0.002	-0.002	-0.000	-0.000	-0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Fiscal rules	-0.664**	-0.587**	-0.770***	-0.660**	-0.805***	-0.584*	-0.637**	-0.698**	-0.665**	-0.725**	-0.928***
	(0.285)	(0.287)	(0.282)	(0.280)	(0.278)	(0.309)	(0.284)	(0.295)	(0.285)	(0.282)	(0.320)
Public debt			-0.008								
			(0.006)								
Log. Trade openness				-0.558							-0.688*
				(0.397)							(0.359)
Output gap					0.726***						0.738***
					(0.160)						(0.195)
Terms of trade shocks						0.082**					0.006
						(0.034)					(0.043)
Commodity price shocks							0.353*				0.433**
							(0.196)				(0.206)
Climate shocks								0.330			0.825
								(0.473)			(0.513)
Election									0.092		0.118
									(0.174)		(0.199)
2008-09 and COVID-19 crises										0.892***	0.862***
										(0.268)	(0.307)
Observations	380	383	378	380	380	327	380	331	380	380	289

Notes: This table reports the results of the effect of capital account openness on inflation deviations from the target, using a Tobit analysis. Data for capital account openness are taken from the Chinn and Ito (2008) database. The main results are reported in Column [1]. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

real exchange rate depreciation, as suggested by Romer (1993). In Column [5], we capture the position of the business cycle via a dummy variable equal to 1 for good times, and zero otherwise.[5] As economic growth is often associated with rising wages, which are indexed to prices, it can in turn lead to high inflation. Consequently, upward phases in the economic cycle are likely to be associated with an increase in inflation deviations. Next, we introduce terms of trade, climate, and commodity price shock variables, respectively, to capture the impact of costly shocks on the

[5]The output gap is computed by extracting potential output from observed real GDP, using the Hodrick-Prescott (HP) filter. Results based on a continuous measure of the output gap remain stable.

economy.[6] Similarly, in Column [9] we control for election years, to capture the effect of political-business cycles. The literature on political economy teaches us that an incumbent politician can manipulate the money supply to stimulate the economy for electoral purposes, which can lead to inflation (Nordhaus, 1975; Rogoff and Sibert, 1988; Lohmann, 1998). Last, we include a dummy variable to capture the 2008-09 global financial crisis and the COVID-19 pandemic, as they led to major imbalances in many economies, including a significant inflationary surge.[7]

The new coefficients are reported in Columns [2]-[11]. The effects of the capital account openness variable remain significant and range approximately from -0.2 to -0.7 percentage points. That said, the new results remain stable. Overall, the coefficients on the baseline model's control variables also remain stable. Likewise, most of the coefficients on the additional controls support our hypotheses: high business cycle phases, commodity price shocks, and the recent crises are positively associated with inflation deviations from the target, while trade openness is negatively associated.

Alternative subsamples. The second robustness check consists of re-estimating the baseline model using alternative subsamples. In 1990, only New Zealand was targeting inflation. The monetary framework began to expand considerably in the early 2000s. Therefore, in Column [1] of Table B1 (see Appendix) we restrict the sample from 2000 onwards. Next, we exclude countries that adopted the monetary framework at the end of our study period (Russia, Kazakhstan, and Ukraine), as the gradual transition to full inflation targeting may take a while. Last, three countries in the sample stopped inflation targeting, once they started, and adopted the euro as their national currency (Finland, Spain, and the Slovak Republic). In the last column, we remove them from the initial sample. The new results reported in Table B1 hold.

Alternative measures. Our main model uses the Chinn-Ito index, which provides a de jure measure of financial openness, covering the largest country and period coverage (184 countries over the period 1970 to 2021). For robustness, we use the Quinn-Toyoda index (Quinn and Toyoda, 2008), which also provides a de jure measure of capital account openness, and ranges from 0 to 100 (total openness). In

[6]We compute terms of trade, climate, and commodity price shocks using the Hodrick-Prescott (HP) filter.

[7]The results are equally stable when we remove from the sample the years marked by the two crises.

contrast to the Quinn-Toyoda index, the Chinn-Ito index is available for all country-year observations in our sample (The Quinn-Toyoda index ends in 2017, while the Chinn-Ito index extends to 2021). Our data suggest a positive and significant correlation between the two indicators, over our sample and study period, with a magnitude of 76%. The results obtained with the Quinn-Toyoda index are reported in Column [2] of Table B2. Although the effect remains negative and significant, it is much lower than that obtained in the baseline model when using the Chinn-Ito index (-0.6 versus -0.02 percentage points), probably because the two indicators are not based on the same scale.

Next, we rely on the Fernández et al. index (Fernández et al., 2016), which provides a de jure measure of capital controls, also derived from the IMF's AREAER, and ranges from 0 to 1 (total restriction). Compared with the Chinn-Ito index, the Fernández et al. index distinguishes between capital inflow and outflow controls, enabling a detailed analysis of capital controls. The data suggest that, over time, inflation-targeting countries have lifted restrictions on both capital inflows and outflows. However, the lifting of restrictions on capital inflows has been stronger than on capital outflows, especially up to the mid-2000s. Following Ogrokhina and Rodriguez (2019), we subtract the Fernández et al. index from 1 to make the results comparable with the Chinn-Ito index. Column [3] of Table B2, which reports the results of the overall Fernández et al. index, indicates a significant and negative effect of capital account openness, with a magnitude comparable to the effect obtained from the Chinn-Ito index. Columns [4] and [5] consider capital inflows and outflows. The results indicate that only the increase in the index associated with capital outflow liberalization reduces inflation deviations from the target. As argued by Ogrokhina and Rodriguez (2019), since credibility is based on how foreign investors perceive countries, foreign investors prefer capital account liberalization, especially if it is associated with capital outflows. Another argument put forward by Aizenman and Pasricha (2013) is that capital outflow liberalization can be used by governments to indirectly mitigate economic imbalances resulting from massive capital inflows. Indeed, the literature shows that net capital inflows (i.e., the difference between capital inflows and outflows) are often procyclical, particularly in emerging markets (Kaminsky et al., 2004). Therefore, during economic expansions, capital inflows can create overheating, thus triggering fears of inflationary pressures. Countries having capital outflow controls can then liberalize capital outflows to reduce net capital inflows in periods of expansion, which should contribute to curbing inflationary pressures.

The capital account openness indicators used so far are de jure measures. As argued by Quinn et al. (2011), de jure indices of financial globalization do not reflect to what extent actual capital flows evolve in response to legal restrictions. This may be because legal restrictions are not necessarily enforced, or because controls in one area may induce a response in other asset flows. Lane and Milesi-Ferretti (2007; 2018) provide a de facto measure of financial integration, calculated as the sum of total assets and total liabilities divided by GDP (higher values indicate greater openness). Column [5] (Table B2) re-estimates the baseline model using the Lane-Milesi-Ferretti's index. The results remain negative and significant.

To conclude, overall, despite some changes, the various tests performed support our main finding. Moreover, the favorable effect of capital mobility on monetary discipline seems to be mainly driven by the lifting of restrictions on capital outflows, rather than on capital inflows.

Alternative methods. The last series of our robustness tests consists of re-estimating the baseline model using alternative econometric methods. Our main model estimates a random-effect Tobit regression, without including fixed effects. As discussed earlier, the econometric literature points out that the inclusion of fixed effects in Probit, Logit, or Tobit models can lead to biased estimates due to incidental parameter problems (Fernández-Val and Weidner, 2016; Kaya Samut and Cafrı, 2016). Furthermore, it has been highlighted that —beyond incidental parameter problems— the inclusion of fixed effects in the Tobit analysis is likely to lead to another problem related to the disturbance variance estimator (Greene, 2004). Excluding fixed effects from our analysis therefore raises another concern relating to unobserved heterogeneity at country and year level. In other words, our results could be biased by unobserved time-invariant country-specific factors, correlated with capital mobility and potentially with inflation deviations, which are not taken into account in the model. Similarly, our analysis does not account for common time-varying shocks correlated with financial liberalization, which could also affect the dependent variable. Given these limitations, in Column [2] of Table B3, we re-estimate our main model using the OLS estimator, including both country and year-fixed effects to account for unobserved heterogeneity. OLS regression yields similar results to Tobit regression, suggesting that unobserved heterogeneity not taken into account in the panel Tobit analysis does not (significantly) alter our results. Next, we estimate a bias-corrected fixed effects (LSDVC) specification, which takes into account inertia in the dependent variable while avoiding the Nickell bias (see Bun and Kiviet, 2003; Debrun et al., 2008; Gootjes et al., 2021 for a similar

approach). The results reported in Column [3] (Table B3) corroborate our hypothesis of strong persistence in inflation deviations. More importantly, although the effect is slightly lower than that obtained with the Tobit analysis, the two coefficients do not differ much and remain qualitatively comparable (about -0.7 versus -0.3 percentage points).

IV estimates. The OLS and LSDVC estimators mitigate bias from unobserved factors and the Nickell bias (Nickell, 1981), respectively, but assume strict exogeneity of the explanatory variables. A relationship reflecting reverse causality may run from inflation deviations to capital account openness. Indeed, economic uncertainty resulting from lax monetary policy can be an important determinant of domestic and international investor confidence, thus affecting investment inflows and/or outflows. Reverse causality will result in a correlation between the estimated effect and the error term; should this correlation be significant, the effect obtained may be strongly biased. Using instrumental variables is well-suited to addressing this issue. A first approach would be to rely on an internal instrument, i.e., to instrument the capital account openness variable with its lagged value (see Arezki and Brückner, 2011; Guerguil et al., 2017). A second approach would be to employ an external instrument. We follow both approaches and develop our intuitions further below.

Many authors argue that reforms in neighboring countries could trigger domestic reforms. The experience of the Arab Spring, of Latin American and Caribbean countries in the 1980s and early 1990s, and of Eastern European, Central Asian, and African countries in the 1990s are striking examples of regional diffusion of democracy (Huntington, 1991). Studies have put forward various channels to explain the regional diffusion of reforms, focusing on political factors such as peer pressure, coercion, imitation, or competition (Dobbin et al., 2007; Shipan and Volden, 2008). As such, a growing literature exploits the regional diffusion of reforms as an instrumental variable. For instance, Persson and Tabellini (2009) use democracy in neighboring countries to estimate the effect of democratic capital on economic growth. Giuliano et al. (2013) argue that democracy and economic reforms are positively correlated, and use democracy in neighboring countries to instrument national reforms. To study the effect of democracy on growth, Acemoglu et al. (2019) instrument democracy with regional waves of democracy, arguing that democratization in one country spreads to other non-democratic countries in the same region, without directly affecting economic growth in those countries. Another strand of the literature also relies on fiscal rules in neighboring countries to instrument national rules (Caselli and Reynaud, 2020; Ardanaz et al., 2021). The underlying argument is that, as fiscal rules promote

fiscal discipline and reduce borrowing costs, countries without fiscal rules can be induced to adopt them to improve their economic performance, for example through the influence of their peers, close economic allies, or international organizations. It is also shown that countries can adopt national fiscal rules strategically by imitating reforms in neighboring countries to send a credibility signal on international markets (Balvir, 2023). Following this literature, in addition to an internal instrument (the lagged value of the financial openness variable), we use the average rate of financial openness in neighboring countries as an instrument for the financial openness variable, assuming that a government's willingness to liberalize its capital accounts can also result from the influence of its neighbors, and that openness in neighboring countries does not directly affect inflation deviations in the domestic country (conditional on the vector of controls). The inclusion of several instruments allows us to perform a Hansen-type over-identification test to check the (internal) validity of our instruments, i.e., whether the lag of the variable of interest is a valid instrument conditional on the fact that openness in the neighboring country is a valid instrument.

Column [4] (Table B3) reports the results of the baseline model, using instrumental variables (2SLS estimator), where capital account openness is instrumented by its lagged value and the average openness rate in neighboring countries. The results of the first-stage equation (not reported but available upon request) suggest a positive and significant influence of openness in neighboring countries on financial openness in the domestic economy. This supports our hypothesis and the relevance of the instrument used. More importantly, the new coefficients on the effect of financial openness remain negative, significant, and very close to that of the Tobit analysis. This suggests that the endogeneity hypothesis does not significantly affect our main finding. Finally, the Cragg-Donald F-statistic is higher than the Stock-Yogo (Stock and Yogo, 2002) critical value for weak instruments at the usual threshold, i.e., 10%., suggesting that the instruments used are strong. Similarly, the p-value of the Hansen test does not compromise the exogeneity hypothesis of the instruments used.

3.5.2 Further robustness

We conduct some additional robustness tests, not reported but available on request.

Soft or informal inflation targeting. The inflation-targeting adoption dates considered so far refer to full-fledged or formal/hard inflation targeting, declared by academics as the true adoption date of the monetary framework. Soft inflation targeting, on the other hand, refers to the date declared by the central bank itself.

It is commonly accepted that under a soft inflation-targeting framework, the central bank's reaction to an inflation deviation from the target is slower, compared with its reaction under a hard inflation-targeting framework (Bambe, 2023). In other words, in a hard-targeting framework, the central bank clearly and formally commits to achieving its inflation target (Carare and Stone, 2006). We may therefore wonder whether our results differ significantly, depending on which adoption date is used. Robustness tests show very close coefficients when considering soft inflation targeting.

Inflation adjustments to the target. As discussed in Kim and Yim (2020), central banks may adjust their inflation targets to ensure that actual inflation reaches the target. In this case, inflation deviations would be purely endogenous to the target. Since our main model considers the targets set at the introduction date of the monetary framework, we believe that inflation target readjustments are of little influence on our results. Nevertheless, for robustness, we re-estimate our baseline model considering the target adjustments. The results do not change much compared to those obtained in the main model.

Core inflation. We conclude our robustness series using core inflation, which excludes certain components of the consumer price index such as food and energy, which can be highly temporarily volatile. Since these variations are often linked to supply disruptions and not to monetary policy, some economists consider that core inflation is the indicator most likely to be affected by the conduct of monetary policy (Cutler, 2001; Hogan et al., 2001; Clark, 2001; Du Plessis, 2015). The new results obtained using the core inflation indicator provided by Ha et al. (2023) do not differ significantly from the results of the main model.

3.5.3 Heterogeneity

Does deviation size matter? First, we conduct a series of tests to examine whether the effect obtained is influenced by the size of deviations. In Columns [2] and [3] of Table C1, we distinguish between positive (deviations above the target) and negative deviations, respectively. The results suggest that capital account openness significantly reduces positive rather than negative deviations. It could be argued that this is because negative deviations are low compared to positive deviations. However, as the data suggest that 26% of deviations are negative, i.e., a non-negligible proportion, the result obtained is probably due to the disinflationary effect of capital account openness. In Columns [4] and [5], we distinguish between large (i.e., above the sample mean) and small deviations. Although the coefficients

of the variable of interest are negative and significant in both columns, it emerges that capital account openness reduces large deviations more than small deviations (-0.5 versus -0.2 percentage points). Finally, in the last column, we consider squared deviations, to give greater weight to large deviations. The results support the previous conclusions: capital account openness reduces inflation deviations from the target, all the more as these deviations are large.

Role of economic and institutional factors. We now re-estimate our baseline specification on more homogeneous subsamples in terms of selected country economic and institutional characteristics. In Columns [1] and [2] of Table C2, a distinction is made between advanced and developing countries, based on the deviation from the median value of real GDP per capita within the sample. Although the effect is slightly greater in advanced countries, the two coefficients do not differ much (around -0.7 percentage points). Next, given the favorable effect of fiscal discipline on monetary policy credibility (Sargent and Wallace, 1981), in Columns [3] and [4] (Table C2) we split the panel based on the sample median of sovereign credit ratings, discriminating between countries with sound fiscal discipline and the others, respectively.[8] As sovereign credit ratings capture the perception of countries' fiscal discipline on the international markets, we expect the favorable effect of capital account openness on monetary discipline to be greater for countries with sound fiscal discipline. The results seem to support our hypothesis, since the effect of financial openness is higher in countries with strong fiscal discipline compared to the others (-1.1 versus -0.4 percentage points). Lastly, another important factor of heterogeneity relates to institutional quality, approximated by the Romelli index (Romelli, 2022), which to some extent captures the strength of central bank independence. Unsurprisingly, the results reported in Columns [5] and [6] (Table C2) suggest that the favorable effect of capital account openness on monetary discipline is amplified in countries with a more independent central bank from the government.[9]

[8]The data are taken from Kose et al. (2022).

[9]The index considers a central bank to be more independent from the government when: i) the executive branch has little or no legal authority in appointing the Governor and other board members; ii) the term of office exceeds the electoral cycle; iii) reappointment is limited; iv) dismissal is based on objective grounds; and v) parallel activities of management bodies are limited.

3.6 Some empirical evidence on the underlying mechanisms

This section empirically examines some mechanisms underlying our main finding. The channels considered include fiscal discipline, approximated by fiscal balance and sovereign debt ratings (the latter variable captures the fiscal discipline perceived by international markets). In addition, we consider an indicator relating to the real sector, the OECD Business Confidence Index (BCI), which provides information on entrepreneurs' future assessment of production, orders, and stocks, as well as the current situation and expectations for the immediate future. The index's long-term average is 100, where values above 100 indicate optimism about future performance. As discussed earlier, capital account liberalization also signals governments' commitment to sound policies, which may be reflected in greater business confidence in the domestic economy.

Following existing research (e.g., see Apeti and Edoh, 2023 and Bambe, 2023), we proceed in two steps. In Panel A of Table 3.2, we provide simple Pearson correlations between the channels considered and inflation deviations. Business confidence and fiscal discipline are negatively correlated with inflation deviations. In Panel B (Table 3.2), we examine the impact of capital account openness on the channels discussed, using the OLS estimator and including the control variables from the baseline model (not reported for space purposes). The results suggest that capital mobility significantly reduces inflation and improves business confidence, fiscal balances, and sovereign credit ratings, corroborating our hypotheses. In other words, these results suggest that the reduction in inflation and improved business confidence and fiscal discipline, due to capital mobility, are plausible channels through which financial openness contributes to the convergence of inflation towards the target.

3.7 Conclusion

Many countries have adopted inflation-targeting regimes as policy tools for maintaining macroeconomic stability. By announcing an explicit inflation target, the central bank may contribute to strongly anchoring inflation expectations, which should improve the credibility of monetary policy. Although the macroeconomic stabilization objective within the inflation-targeting framework has generally been successful, particularly in developing countries, inflation targets are often exceeded in both advanced and developing countries, with sometimes extreme deviations.

Table 3.2: Transmission channels

Panel A	[1]	[2]	[3]
	Inflation dev.	Inflation dev.	Inflation dev.
Business confidence	-0.128***		
Fiscal balance		-0.079**	
Debt ratings			-0.306***

Panel B	[1]	[2]	[3]	[4]
	Inflation	Business confidence	Fiscal balance	Debt ratings
Ka-Open	-0.888***	0.483***	1.266***	0.791***
	(0.237)	(0.185)	(0.366)	(0.159)
Observations	380	292	380	380
R-squared	0.6645	0.5347	0.6744	0.945

Notes: This table presents the results of the main mechanisms through which capital account openness may contribute to the convergence of inflation towards the target. In Panel A, we report Pearson correlations between the potential channels and inflation deviations from the target. In Panel B, we examine the impact of capital account openness on each of the channels discussed, using the OLS estimator and including the baseline model controls (not reported for the sake of space). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Economic theory teaches us that inflation deviations from the target, often resulting from inconsistencies in monetary policy, undermine the central bank's credibility and can lead to major economic imbalances. Among the mechanisms that can reduce the central bank's inflation bias, a large literature discusses the benefits of financial openness. This paper draws on this literature and examines the impact of capital account openness on inflation deviations from the target, using a sample of 36 advanced and developing inflation-targeting countries over the period 1990-2021.

We find robust evidence that capital mobility significantly reduces inflation deviations from the target, and that capital outflows, rather than inflows, mainly drive the disciplining effect of financial openness on monetary policy. Capital mobility reduces positive, rather than negative deviations, and all the more as these deviations are large. In addition, the favorable effect of capital mobility is amplified in countries with strong fiscal discipline and those with a more independent central bank from the government. Lastly, we empirically examine some underlying mechanisms and

find that the disinflationary effect of capital mobility, coupled with improved fiscal discipline, are plausible channels explaining our results.

This paper provides some evidence of the disciplinary effects of financial liberalization on monetary policy. The results support the theoretical model developed by de Mendonça and da Silva Veiga (2014) for a large sample of countries, even after accounting for differences in the size of deviations, the levels of economic and institutional development, and the level of fiscal discipline. Although our findings suggest the lifting of restrictions on capital mobility should be favorable to monetary policy, this does not imply that countries should undertake capital account liberalization without caution, as liberalization can trigger important adverse side effects on other sectors of the economy (see Furceri and Loungani, 2018 for a detailed discussion).

A Data and sample

Table A1: Sample and inflation targets

	Formal adoption date	Target at time of adoption
Australia	1994	2-3
Brazil	1999	4.5 ±2
Canada	1992	2 ±1
Switzerland	2000	0-2
Chile	1999	3 ±1
Colombia	1999	2-4
Czech Republic	1998	3 ±1
Dominican Republic	2012	3-5
Spain	1995	
Spain	out (1998)	
Finland	1994	
Finland	out (1998)	
United Kingdom	1992	2(point target)
Ghana	2007	8.5 ±2
Guatemala	2007	5 ±1
Hungary	2001	3 ±1
Indonesia	2005	5 ±1
Iceland	2001	2.5 ±1.5
Israel	1997	2 ±1
Kazakhstan	2015	4
Korea, Rep	1998	3 ±1
Moldova	2013	3.5-6.5
Mexico	2001	3 ±1
Norway	2001	2.5 ±1
New Zealand	1990	1-3
Peru	2002	2 ±1
Philippines	2002	4 ±1
Poland	1998	2.5 ±1
Paraguay	2011	4.5
Russian Federation	2015	4
Slovak Republic	2006	
Slovak Republic	out (2009)	
Sweden	1995	2(point target)
Thailand	2000	0.5-3
Turkey	2007	5.5 ±2
Uganda	2011	5
Ukraine	2017	5
Uruguay	2007	3-7
South Africa	2000	3-6

The list of inflation-targeting countries is drawn from previous studies (e.g., see Rose, 2007; Roger, 2009; Jahan, 2012; Ciżkowicz-Pękała et al., 2019; ; Apeti et al., 2023g). Data on inflation targets are extracted from Jahan (2012) and publications by the central bank of each country.

Table A2: Summary statistics of the baseline model variables

Variables	**Obs.**	**Mean.**	**Sd**	**Min**	**Max**
Inflation deviations from the target	652	0.4202	1.9387	-3.6920	12.0965
Ka-Open	652	1.0342	1.3977	-1.9311	2.2994
Governor turnover	543	0.0663	0.2490	0	1
Fiscal balance	652	-0.0143	3.3671	-13.462	15.826
Broad money growth	615	10.7533	10.0807	-28.6298	125.031
Financial development	587	73.9011	48.2643	11.6564	304.5751
Fiscal rules	517	0.8356	0.3710	0	1

Table A3: Unit root tests

Variable	**Tests**				
	Phillips-Perron		**Im–Pesaran–Shin**		**Integration Order**
	Statistic	**P-value**	**Statistic**	**P-value**	
Inflation deviations	-17.2555	0.0000	-13.3406	0.0000	I(0)
Capital openness	-5.1937	0.0000	-6.1551	0.0000	I(0)
Fiscal balance	-7.3823	0.0000	-7.2219	0.0000	I(0)
Financial development	-1.6556	0.0489	-3.9447	0.0000	I(0)
Broad money growth	-31.7683	0.0000	-31.2002	0.0000	I(0)

Table A4: Pearson correlations

	[1]	[2]	[3]	[4]	[5]	[6]
	Inflation dev.	Inflation dev.	Inflation dev.	Inflation dev.	Inflation dev.	Inflation dev.
Capital account openness	-0.3176***					
Fiscal balance		-0.0795**				
Fiscal rules			-0.0985**			
Broad money growth				0.2226***		
Financial development					-0.1828***	
Governors' turnover						0.0581

* p < 0.1, ** p < 0.05, *** p < 0.01

B Robustness

Table B1: Capital account openness and inflation deviations from the target: alternative samples

	[1]	[2]	[3]	[4]
	Baseline	Period from 2000	Excluding recent ITers	Excluding Spain, Finland, & Slovak Rep.
Ka-Open	-0.656***	-0.410***	-0.538***	-0.654***
	(0.121)	(0.136)	(0.145)	(0.140)
Governor turnover	-0.074	0.093	0.003	-0.074
	(0.317)	(0.312)	(0.312)	(0.314)
Fiscal balance	-0.048	-0.054*	-0.042	-0.048
	(0.032)	(0.032)	(0.031)	(0.032)
Broad money growth	0.021***	0.019**	0.021***	0.021***
	(0.008)	(0.008)	(0.008)	(0.008)
Financial development	-0.000	-0.001	-0.000	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)
Fiscal rules	-0.666**	-0.707**	-0.708***	-0.664**
	(0.280)	(0.311)	(0.275)	(0.285)
Observations	380	344	376	380

Notes: This table reports the results of the effect of capital account openness on inflation deviations from the target, using alternative subsamples. Data for capital account openness are taken from the Chinn and Ito (2008) database. The baseline results are reported in Column [1]. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

Table B2: Capital account openness and inflation deviations from the target: alternative measures

	[1]	[2]	[3]	[4]	[5]
	Baseline				
Governor turnover	-0.074	-0.059	-0.031	-0.022	-0.034
	(0.314)	(0.328)	(0.327)	(0.326)	(0.326)
Fiscal balance	-0.048	-0.070**	-0.087***	-0.086***	-0.051
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Broad money growth	0.021***	0.022***	0.028***	0.028***	0.025***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Financial development	-0.000	-0.003	-0.002	-0.002	-0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Fiscal rules	-0.664**	-0.698**	-1.002***	-1.062***	-0.762***
	(0.285)	(0.285)	(0.295)	(0.302)	(0.283)
Ka-Open (Chinn-Ito)	-0.654***				
	(0.140)				
Ka-Open (Quinn-Toyoda)		-0.021***			
		(0.007)			
Ka-Open (Fernández et al.)			-0.945*		
			(0.565)		
Ka-Open Outflows				-1.004*	
				(0.607)	
Ka-Open Inflows				0.125	
				(0.668)	
Ka-Open (Lane-Milesi-Ferretti)					-0.458***
					(0.135)
Observations	380	350	373	373	380

Notes: This table reports the results of the effect of capital account openness on inflation deviations from the target, using alternative capital account opening measures. The main results are reported in Column [1]. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B3: Capital account openness and inflation deviations from the target: alternative methods

	[1]	[2]	[3]	[4]
	Baseline	OLS	LSDVC	IV/2SLS
Ka-Open	-0.654***	-0.709***	-0.297**	-0.584**
	(0.140)	(0.137)	(0.149)	(0.267)
Governor turnover	-0.074	-0.105	0.151	-0.129
	(0.314)	(0.288)	(0.445)	(0.228)
Fiscal balance	-0.048	-0.060	-0.072*	-0.001
	(0.032)	(0.049)	(0.042)	(0.035)
Broad money growth	0.021***	0.002	0.007	-0.000
	(0.008)	(0.008)	(0.009)	(0.006)
Financial development	-0.000	0.016***	0.007	0.017***
	(0.003)	(0.004)	(0.005)	(0.006)
Fiscal rules	-0.664**	-0.502	0.465	0.180
	(0.285)	(0.646)	(0.311)	(0.410)
Lag.Deviations			0.321***	
Country & Year fixed effects	No	Yes	Yes	Yes
Observations	380	380	361	301
R-Squared		0.327		0.447
Cragg-Donald Wald stat.				79.758
Stock-Yogo stat.				20.030
Hansen test (P-val.)				0.383

Notes: This table reports the results of the effect of capital account openness on inflation deviations from the target, using alternative estimation methods. The main, estimated from a Tobit analysis, are reported in Column [1]. In Column [4], the capital account openness variable is instrumented by its lagged value and the average openness rate in neighboring countries. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C Heterogeneity

Table C1: Capital account openness and inflation deviations from the target: does deviation size matter?

	[1]	[2]	[3]	[4]	[5]	[6]
	Baseline	Positive deviations	Negative deviations	High deviations	Low deviations	Squared deviations
Ka-Open	-0.654***	-0.382***	-0.121	-0.530***	-0.155**	-2.630***
	(0.140)	(0.130)	(0.102)	(0.148)	(0.062)	(0.943)
Governor turnover	-0.074	-0.502	0.369	-0.820	0.234*	-1.293
	(0.314)	(0.663)	(0.292)	(0.768)	(0.138)	(2.346)
Fiscal balance	-0.048	-0.123**	0.016	-0.162**	0.000	-0.539**
	(0.032)	(0.056)	(0.026)	(0.071)	(0.014)	(0.231)
Broad money growth	0.021***	0.034*	-0.014	0.039*	0.004	0.111*
	(0.008)	(0.019)	(0.012)	(0.021)	(0.003)	(0.058)
Financial development	-0.000	-0.004	0.001	-0.004	0.000	-0.004
	(0.003)	(0.003)	(0.002)	(0.004)	(0.001)	(0.020)
Fiscal rules	-0.664**	-0.816*	0.051	-0.620	0.085	-4.385**
	(0.285)	(0.457)	(0.223)	(0.500)	(0.133)	(2.049)
Observations	380	140	112	105	275	380

Notes: This table reports the results of the effect of capital account openness on inflation deviations from the target, examining the effect according to the size of deviations. The main results are reported in Column [1]. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C2: Capital account openness and inflation deviations from the target: the role of economic and institutional factors

	[1]	[2]	[3]	[4]	[5]	[6]
	Advanced	Developing	High debt ratings	Low debt ratings	Strong central bank indep.	Low central bank indep.
Ka-Open	-0.766***	-0.654***	-1.057***	-0.408*	-0.825***	-0.517*
	(0.134)	(0.140)	(0.144)	(0.226)	(0.178)	(0.284)
Governor turnover	0.339	-0.074	-0.277	-0.038	0.158	-0.415
	(0.359)	(0.314)	(0.294)	(0.600)	(0.318)	(0.776)
Fiscal balance	-0.085***	-0.048	-0.006	-0.167**	-0.002	-0.167*
	(0.027)	(0.032)	(0.027)	(0.079)	(0.034)	(0.090)
Broad money growth	0.013*	0.021***	0.005	0.027	0.014*	0.032
	(0.007)	(0.008)	(0.006)	(0.026)	(0.008)	(0.021)
Financial development	0.005*	-0.000	0.003	-0.021**	-0.000	-0.004
	(0.003)	(0.003)	(0.003)	(0.009)	(0.004)	(0.005)
Fiscal rules	0.115	-0.664**	-0.236	-1.709***	-0.324	-1.230*
	(0.285)	(0.285)	(0.259)	(0.595)	(0.301)	(0.643)
Observations	206	380	239	141	283	97

Notes: This table reports the results of the effect of capital account openness on inflation deviations from the target, examining the effect according to some economic, institutional, and structural factors. In columns [1] and [2], the distinction between advanced and developing countries is based on the IMF classification. In Columns [3] and [8], the sample is split based on the deviation from the mean value of each variable considered. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D Variables and their sources

Table D1: List of variables and their sources

Variables	Nature	Sources
1. Main model		
Inflation deviations from the target	Continuous	Authors, from Jahan (2012) and publications by the central bank of each country
Capital openness	Approximately between -2 and 2	Chinn and Ito (2008)
Fiscal balance	Continuous	Kose et al. (2022)
Governors' turnover	Dummy	Sturm and De Haan (2001) and Dreher et al. (2008a; 2010)
Financial development		
(Domestic credit to the private sector, %GDP)	Continuous	World Development Indicators (WDI)
Broad money growth	Continuous	WDI
Fiscal rules	Dummy	IMF Fiscal Rules Dataset
2. Additional controls		
Public debt	Continuous	Kose et al. (2022)
Trade openness	Continuous	WDI
Output gap	Dummy	Authors, using real GDP from WDI
Terms of trade shocks	Continuous	Authors, using terms of trade variable from WDI
Climate shocks	Continuous	Authors, using annual temperature from the World Bank Group
Commodity price shocks	Continuous	Authors, using data from Gruss and Kebhaj (2019)
Election	Dummy	Scartascini et al. (2018)
2008-09 and COVID-19 crises	Dummy	Authors
3. Alternative measures		
Capital opennes (Quinn-Toyoda index)	Between 0 and 100	Quinn and Toyoda (2008)
Capital opennes (Fernández et al. index)	Between 0 and 1	Fernández et al. (2016)
Capital opennes (Lane-Milesi-Ferretti's index)	Between -6 and 2	Lane and Milesi-Ferretti (2007, 2018)
Core inflation	Continuous	Ha et al. (2023)

Chapter 4

Original Sin: Fiscal Rules and Government Debt in Foreign Currency in Developing Countries

This chapter is joint work with Ablam Estel APETI (LEO and University of Göttingen), Jean-Louis COMBES (LEO-UCA), and Eyah Denise EDOH (LEO-UCA). This chapter is published in the Journal of Macroeconomics.

Abstract

Developing economies often borrow abroad in foreign currency, which exposes them to the problem of "original sin." Although the literature on the issue is relatively extensive, there is limited discussion about the role of fiscal frameworks, such as fiscal rules, in addressing original sin. Using a panel of 59 developing countries from 1990-2020 and applying the entropy balancing method, this study reveals that fiscal rules play a crucial role in reducing government debt in foreign currency, and that the effects are statistically and economically significant and robust. The effectiveness of fiscal rules in curbing original sin is enhanced by factors such as the strengthening of the rule itself, improved fiscal discipline before the reform's adoption, financial development, financial openness, exchange rate flexibility, the level of economic development, and sound institutions. Last, the transmission channel analysis shows that improved fiscal and monetary policy credibility is the main channel through which the effect of fiscal rules on the original sin problem transits.

Keywords: • Fiscal rules • Original sin • Developing countries • Entropy balancing

JEL Classification: F34; F41; G15; H63

4.1 Introduction

Public debt is an important instrument for countries lacking domestic finance to support development projects, smooth short-term shocks, and promote poverty alleviation policies (Fatás et al., 2019; Panizza, 2022; Fujii, 2023). However, debt can be risky, especially if foreign currency dominates its composition. In particular, the international financial integration that paved the way for access to finance is a source of the original sin problem, defined as the inability of (developing) countries to contract debt in local currency (Eichengreen et al., 2002; Hausmann and Panizza, 2003; Ogrokhina and Rodriguez, 2018).

The concept of original sin was first introduced by Eichengreen et al. (2002) and Hausmann and Panizza (2003). Borrowed from the Bible and Christianity (Parramore, 2023), "original sin" refers to the sin committed by Adam and Eve in the Garden of Eden at the beginning of "humanity", and it is not without consequences. According to Eichengreen et al. (2023), countries' inability to borrow in their local currency, i.e., original sin, is correlated with fear of floating, the need to hold additional international reserves, greater volatility in output and capital flows, lower credit ratings, and procyclical rather than counter-cyclical fiscal and monetary policies. These conclusions are also shared by Hausmann et al. (2001) regarding the impact of original sin on the choice of the exchange rate regime. For Engel and Park (2022), local currency debt securities are a better hedge of consumption against income shocks than foreign currency debt securities. In other words, countries that hold a high share of debt in foreign currency would have little policy space to smooth shocks. Finally, countries with a large share of foreign currency debt are exposed to currency mismatches and are more vulnerable to financial crises and economic instability in the presence of a negative shock (Ogrokhina and Rodriguez, 2018).

A large literature documents the causes of the original sin problem. Early studies emphasize that original sin is inevitable, as it comes from external factors that the affected countries cannot control (Eichengreen et al., 2005). However, other authors highlight the importance of domestic policies and institutions as major factors affecting the ability of governments to borrow in their currency. For example, Hausmann and Panizza (2003) note that the issue of original sin is correlated with the quality of institutions, monetary credibility, or fiscal solvency. According to Engel and Park (2022), original sin is related to inflation in developing countries. Indeed, the authors emphasize that while debt securities in local currency constitute a better hedge of consumption against income fluctuations than debt securities in foreign

currency, they may represent a temptation for governments to use inflation as a fiscal solvency instrument. This may reduce their credibility *vis-à-vis* investors, pushing the latter to choose foreign currency debt as an insurance mechanism. Burger and Warnock (2006) argue that the establishment of institutions guaranteeing creditors' rights and an environment with stable inflation promote a debt composition in a less favorable direction to the original sin issue. Hausmann and Panizza (2003), Claessens et al. (2007), Ogrokhina and Rodriguez (2018), Ogrokhina and Rodriguez (2019), Du et al. (2020), and Engel and Park (2022) consider that the implementation of a credible monetary policy allows countries to reduce the share of debt denominated in foreign currency. Other authors emphasize the importance of structural factors such as the size of the country, the level of financial development, or financial openness (for instance, see Caballero and Krishnamurthy, 2003; Hausmann and Panizza, 2003; Claessens et al., 2007). Finally, among the determinants of original sin, other studies highlight the role of fiscal discipline (Claessens et al., 2007; Aizenman and Zheng, 2023) or ideological and political factors (Ballard-Rosa et al., 2022).

Original sin is primarily a problem of developing countries (Ogrokhina and Rodriguez, 2018; Eichengreen et al., 2023; Fujii, 2023). Despite recent progress by some developing countries, such as Brazil, Mexico, and South Africa, in contracting debt in local currencies, the proportion of foreign currency debt still represents a large share of the debt composition of developing countries. Studies examining factors that may mitigate this problem focus mainly on monetary policy credibility (Ogrokhina and Rodriguez, 2018; Ogrokhina and Rodriguez, 2019; Engel and Park, 2022; Onen et al., 2023), the existence of sound creditors' rights (La Porta et al., 1997), and international reserve management (Alfaro and Kanczuk, 2009).

Although the literature on the issue is fairly extensive, little has been said so far about the role of fiscal policy credibility or fiscal rules in controlling the original sin problem. This is a crucial issue for developing countries, given the negative effects of the original debt problem they suffer from, and all the more so as the literature shows that external debt contributes to penalizing their growth (e.g., see Schclarek, 2004; Qureshi and Liaqat, 2020). Indeed, the weak commitment to fiscal sustainability in developing countries compared to developed countries could drive markets to anticipate defaults and inflation surprises and thus ultimately make foreign investors reluctant to buy developing country debt denominated in local currency.[1] Against this background, we may wonder to what extent fiscal

[1]The fiscal credibility issue can be observed by analyzing debt ratings by financial markets, advanced countries having ratings twice as high as those of developing countries (Apeti et al.,

institutions that provide credibility in the management of fiscal policy, such as fiscal rules, matter in controlling original sin.

The gap observed in the literature is all the more surprising given that simple descriptive statistics reveal that countries with fiscal rules experience a relatively higher decline in their share of foreign currency debt. As can be seen in Figure 6.4 that presents the average evolution of sovereign debt in foreign currency, considering an average trend over 10-year sub-periods, during the first decade (1990-1999), the share of public debt in foreign currency in countries with fiscal rules is identical to that of the control countries, i.e., 100%. In the second decade (2000-2009), there was a slight decrease in the treated countries (98%), although the magnitude remained comparable to that of the control countries (99%). The last decade (2010-2020) has seen a significant decline in foreign currency public debt, both in the group of treated and control countries. However, the decline was more pronounced for the treated compared to the control countries (74% versus 86%).[2]

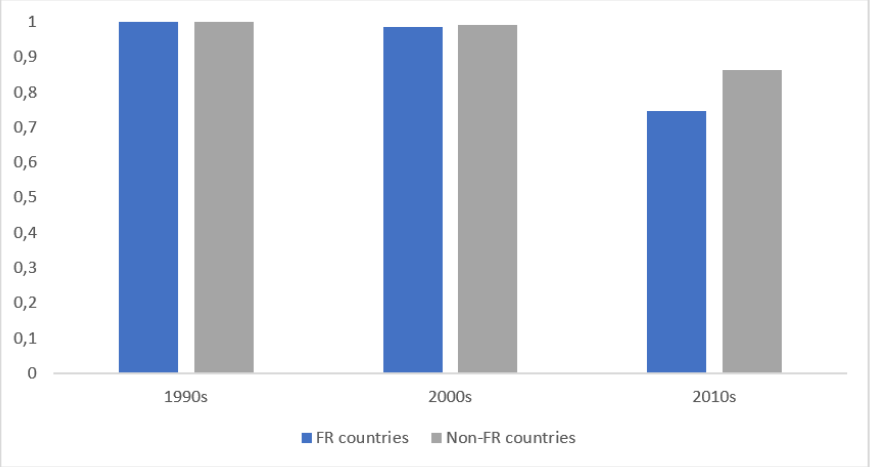


Figure 4.1: Share of foreign currency in sovereign debt (1990-2020) with (FR) and without fiscal rules (Non-FR)

Fiscal rules, which have been popular since the 1990s, are long-term constraints on

2021).

[2]These relationships, although not causal, provide a direction of the treatment effect of fiscal rule adoption and how to identify it. Indeed, the downward trend observed in both groups of countries shows that it would be misleading to estimate the effect of fiscal rules on the share of government debt denominated in foreign currency by comparing this share before and after the adoption of fiscal rules. To avoid overestimating the effect of the policy, we use (details can be found in the methodology section below), the non-fiscal countries as a control group to estimate the counterfactual outcome. By doing so, we can control potential secular trends and isolate the treatment effect (see Lagarde, 2012; Ogrokhina and Rodriguez, 2018; Apeti, 2023a).

fiscal policy through numerical limits on fiscal aggregates or the management of budgetary procedures. Fiscal rules are generally intended to correct biased incentives and contain pressures for excessive spending, particularly in good times, to ensure fiscal responsibility and debt sustainability. Defined to eliminate the persistent accumulation of deficits, fiscal rules may be numerical or procedural, and aim to achieve sound fiscal policy by eliminating three major problems in public finance management: the common pool problem that arises when different decision-makers involved in the budget process (e.g., legislators, minister of finance, line ministers) compete for public resources and fail to internalize the current and future costs of their choices (Weingast et al., 1981; Von Hagen and Harden, 1995; Velasco et al., 1999; Krogstrup and Wyplosz, 2010; Altunbaş and Thornton, 2017); the agency problem that arises from information asymmetry and conflicting incentives between government and voters and within the government hierarchy, which generally leads to manipulation of fiscal policy for electoral purposes (Nordhaus, 1975 ; Buchanan and Wagner, 1977; Cukierman and Meltzer, 1986a; Dixit, 1998); and the problem of dynamic incoherence that leads governments to strategically use budget deficits to tie the hands of their successors in the presence of electoral uncertainty (Alesina and Tabellini, 1988; Alt and Lassen, 2006).

This paper examines the effect of fiscal rules (FR) on public debt denominated in foreign currency in developing countries. The contribution of this paper to the literature is threefold. First, although the existing studies provide a rich picture of the determinants or factors that may contain the original sin issue, the role of fiscal rules, as stated above, remains largely unexplored. Second, we take advantage of recent data using panel data containing up-to-date data. Finally, our analysis is based on a recently developed impact analysis method for identifying the effect of fiscal rules. Based on a panel of 59 countries over the period 1990-2020, we apply the entropy balancing method developed by Hainmueller (2012) to address selection bias issues associated with policy adoption. Our results suggest that fiscal rules significantly decrease the share of foreign currencies in government debt in countries with fiscal rules compared to non-fiscal rules countries, and that the effects are economically significant. In other words, fiscal rules limit the original sin issue in fiscal rules countries relative to non-fiscal rule countries. The results remain robust to various tests, including alternative specifications and estimation methods. Furthermore, placebo tests indicate that our results are not due to a spurious trend or confounding factors. Finally, we explore heterogeneity features in the treatment and highlight some additional results. A distinction between the different types of

rules suggests that the effect of debt rules and expenditure rules is slightly higher compared to that of budget balanced rules. In addition, the strengthening of the rule, better fiscal discipline before the adoption of the reform, financial development, financial openness, the level of economic development, the flexibility of the exchange rate regime, and the quality of institutions amplify the negative effect of fiscal rules on original sin.

The paper is organized as follows. The next section presents the theoretical discussions. Section 4.3 describes the data and the methodology. Section 4.4 reports the main findings. Sections 4.5 and 4.6 examine the robustness of our main results and the main transmission channels, respectively. Section 4.7 examines some heterogeneity analyses, and the last section concludes.

4.2 Fiscal rules and the currency composition of government debt: the arguments

Original sin is a constraint on access to international financial markets in local currency for developing countries. This constraint, which prevents optimal debt management, is mainly due to two factors: a lack of fiscal credibility and a lack of monetary credibility. In this context, based on the existing literature, our reading is that fiscal rules may influence government debt's currency composition via two main channels: fiscal credibility and monetary credibility. Fiscal credibility arises from the commonly shared view in the literature that fiscal rules promote prudent management of fiscal policy. For example, Asatryan et al. (2018) note that the adoption of fiscal rules promotes fiscal discipline by reducing the debt-to-GDP ratio and lowering the probability of a debt crisis. In a recent study, Gomez-Gonzalez et al. (2022) stress that fiscal rules promote macroeconomic stability due to their significant reduction of sovereign risk and the probability of a sudden stop. In a survey, Von Hagen (2002) underlines that fiscal institutions are associated with better fiscal discipline. The favorable effect of fiscal rules on fiscal discipline is supported by various authors in the literature, among them, Grembi et al. (2016); Badinger and Reuter (2017); Fatás et al. (2019); Salvi et al., 2020; Barbier-Gauchard et al. (2021); Caselli and Wingender (2021); Apeti et al. (2023c).[3]

[3]See also Drazen (2004); Primo (2006); Hallerberg et al. (2007); Krogstrup and Wälti (2008); Schaltegger and Feld (2009); Gollwitzer (2011); Argimón and Cos (2012); Tapsoba (2012b); Benito et al. (2013); Dahan and Strawczynski (2013); Luechinger and Schaltegger (2013); Neyapti (2013); Tapp (2013); Foremny (2014); Burret and Feld (2018); Caselli and Reynaud (2020).

Another problem related to fiscal policy in developing countries is procyclicality and deficit bias during electoral periods, which lead to economic instability such as lower economic growth, higher growth volatility, higher inflation and its volatility, thus undermining developing countries' credibility (Fatás and Mihov, 2003; Afonso and Jalles, 2020; Fatás and Mihov, 2013; Sacchi and Salotti, 2015; Rother, 2004; Apeti et al., 2023g; Heimberger, 2023). However, evidence is found in the literature that fiscal rules help to limit the procyclicality of fiscal policy and budgetary drift during electoral periods. For example, using a sample of 56 countries over 1990-2011, Combes et al. (2017) show that fiscal rules limit the procyclicality of fiscal policy. The same result is shared by Debrun et al. (2008), Guerguil et al. (2017), Gootjes and de Haan (2022b) and Apeti et al. (2023c). Regarding the reduction of political budget cycles, Rose (2006), Bonfatti and Forni (2019), and Gootjes et al. (2021) advocate the benefit of fiscal rules. Finally, other studies have looked at the impact of fiscal rules on debt ratings and bond spreads — which reflect the credibility of fiscal policy — showing that fiscal rules increase debt ratings and reduce bond spreads (Badinger and Reuter, 2017; Thornton and Vasilakis, 2017; Afonso and Jalles, 2019; Thornton and Vasilakis, 2020).

As mentioned earlier, the second channel through which fiscal rules may affect government debt in foreign currencies is monetary policy credibility, especially inflation. As pointed out above, monetary policy credibility, especially inflation, is one of the factors that reduce the ability of developing countries to contract debt in local currency (Engel and Park, 2022). Beyond the benefit of fiscal discipline and credibility, the literature provides evidence of the role of fiscal rules in controlling inflation. In other words, FR could improve the credibility of the monetary framework, making it less likely to experience high inflation episodes. For instance, over the period 1990-2009, Combes et al. (2018) find that adopting fiscal rules reduces inflation. Through lower inflation, FR could improve the credibility of the monetary framework, making it less prone to episodes of high inflation, boosting investor confidence, and thus reducing the share of foreign currency debt. Putting these discussions together, we expect fiscal rules to reduce original sin in developing countries, i.e., the share of government debt denominated in foreign currency.

4.3 Data and Methodology

4.3.1 Data

We examine the effect of fiscal rules on the share of government debt in foreign currency, using a panel of 59 developing countries from 1990-2020. Out of this sample, 28 countries have implemented fiscal rules for at least one year between 1990 and 2020. As data are not available for all countries and years, the number of observations depends on the explanatory variables used in the study.

Our treatment variable, fiscal rules (FR), is measured by a dummy variable that takes 1 when a country i has adopted a fiscal rule in year t, and zero otherwise. This variable is from the IMF's Fiscal Rules Dataset. The share of government debt in foreign currency is extracted from the International Debt Securities (IDS) statistics provided by the Bank for International Settlements (BIS), and is measured as follows:[4]

$$Foreign\ currency\ share\ = 1 - \frac{local\ currency\ debt}{total\ international\ debt} \tag{4.1}$$

From the existing literature, we include a set of economic and institutional covariates considered as determinants of fiscal rule adoption (or original sin), such as GDP per capita, annual GDP growth, fiscal balance, financial openness, exchange rate regime, inflation targeting, export shares, and the quality of institutions (captured by the level of democracy). Since better economic performance is likely to promote the adoption of credible fiscal rules, GDP per capita and annual GDP growth may be positively correlated with the probability of adopting FR. Second, the effect of fiscal balance on the likelihood of adopting FR may be ambiguous. On the one hand, a sound fiscal position can reflect the prerequisites for the adoption of a credible fiscal framework such as fiscal rules. On the other hand, it can be argued that countries with loose fiscal policies, i.e, high fiscal deficits may also choose to adopt FR to achieve greater fiscal discipline. Moreover, improved fiscal positions may reflect sounder fiscal policies that can reduce the need for fiscal institutions to promote fiscal discipline (Kopits, 2001; Bohn, 2008; Calderón and Schmidt-Hebbel, 2008). Third, we expect a positive influence of financial openness on fiscal rules, as in some countries fiscal rules have been adopted as part of more comprehensive economic

[4]See, for instance, Hausmann and Panizza (2003), Ogrokhina and Rodriguez (2018), Ogrokhina and Rodriguez (2019), and Eichengreen et al. (2023) for a similar approach.

reforms, including financial liberalization (Tapsoba, 2012b). Fourth, we consider the export shares, as a deterioration in trade is likely to increase the probability of adopting fiscal rules (Kumar et al., 2009). Fifth, we control for the exchange rate regime, as the literature highlighted a strong relationship between the exchange rate regime and the fiscal discipline embodied in fiscal rules (see Masson et al., 1991; Elbadawi et al., 2015). In the same vein, we include a dummy variable capturing whether a country has adopted the inflation targeting regime or not, as several studies have shown that the inflation targeting framework is conducive to the adoption of fiscal rules (Beetsma and Bovenberg, 1997, Castellani and Debrun, 2005, Badinger and Reuter, 2017, Combes et al., 2018). Finally, the correlation between fiscal rules and the level of democracy may be ambiguous. On the one hand, good institutions can foster sound fiscal behavior, which may reduce the incentive for countries to tie their hands through constraining reforms such as fiscal rules. On the other hand, better institutions can create a strong environment for FR adoption through high compliance with the rule's targets. The list of countries, the descriptive statistics of the variables in the baseline model and the definition and source of all variables are provided in the first three tables in the Appendix (Table A1, A2, and A3).

4.3.2 Methodology

We ask whether fiscal rules reduce government debt in foreign currency in developing countries. Fiscal rule adoption is not random and may be affected by economic and institutional performance. Such factors — which may also affect international debt denomination — make fiscal rule adoption endogenous, leading to a potential selection bias. To mitigate the potential endogeneity of fiscal rules, we employ a matching approach, entropy balancing, developed by Hainmueller (2012). The approach has been used by Neuenkirch and Neumeier (2016) to assess the impact of U.S. sanctions on poverty or Caselli and Wingender (2021) to assess the effect of fiscal rules on public deficits using the Maastricht treaty's fiscal criterion as an example.[5] Fiscal rules adoption is the treatment, and government debt in foreign currency is the outcome variable. As is common in the literature, we consider country-year observations, those with fiscal rules being the treated units, and those without fiscal rules being the control units. The treatment effect on the treated (ATT) is defined as follows:

[5]See other studies using the same approach: Bambe et al. (2022); Apeti (2023b); Apeti (2023a); Apeti and Edoh (2023); Apeti et al. (2023a).

$$ATT = E[Y_{(1)}|T = 1] - E[Y_{(0)}|T = 1] \tag{4.2}$$

where $Y_{(.)}$ is the outcome variable, i.e., the share of government debt in foreign currency. T is a dummy variable indicating whether the unit is subject to fiscal rules adoption ($T = 1$) or not ($T = 0$). $E[Y_{(1)}|T = 1]$ is the outcome variable during the fiscal rules period and $E[Y_{(0)}|T = 1]$ is the counterfactual outcome for countries with fiscal rules, i.e., the share of government debt in foreign currencies that would have been observed if they had not introduced fiscal rules. Indeed, $E[Y_{(0)}|T = 1]$ is not observable due to a counterfactual issue. Identifying the treatment effect requires a good proxy for $E[Y_{(0)}|T = 1]$. To do so, we match fiscal rules units with non-fiscal rules units that are as close as possible, based on observable characteristics, correlated with fiscal rules adoption, and potentially with the outcome variable. Based on this, we can rewrite Equation 4.2 as follows:

$$ATT(\chi) = E[Y_{(1)}|T = 1, X = \chi] - E[Y_{(0)}|T = 0, X = \chi] \tag{4.3}$$

where χ is a vector of covariates that may affect both a country's decision to adopt fiscal rules and its international debt denomination. $E[Y_{(1)}|T = 1, X = \chi]$ represents the share of government debt in foreign currency for fiscal rules countries, and $E[Y_{(0)}|T = 0, X = \chi]$ is the expected share of government debt in foreign currency for non-fiscal rules countries (the synthetic control group). Entropy balancing requires two steps. The first step is to compute the weights of the control group (untreated group) so that they satisfy pre-specified balanced constraints involving the sample moments of observable characteristics (X). Following Neuenkirch and Neumeier (2016), we choose equilibrium constraints that impose equal covariate means between the treatment and control groups. In doing so, we ensure that the control group is composed, on average, of untreated units that are as similar as possible to the treated units. The second stage uses the weights from the first stage in a regression analysis where the share of government debt in foreign currency is the dependent variable, and the fiscal rule dummy is the main explanatory variable. We control for entropy balancing covariates as well as time and country-specific effects, as in a randomization experiment, to increase the efficiency of the estimations.

Entropy balancing allows identifying the effect of fiscal rules by comparing fiscal rule and non-fiscal rule countries that are as similar as possible in their observable characteristics, while accounting for country and time-specific effects. By combining a matching approach with a regression approach, entropy balancing offers some

advantages over several alternative methods, as argued by Neuenkirch and Neumeier (2016). A particularly important advantage is that entropy balancing is a non-parametric approach, thus circumventing model misspecification issues. In addition, in contrast to regression-based analyses, the treatment effects estimated from entropy balancing do not suffer from multicollinearity, as the reweighting scheme orthogonalizes the covariates with respect to the treatment indicator. Moreover, in contrast to other matching methods, entropy balancing ensures a high covariate balance between the treatment and control groups, even in small samples, and a more flexible reweighting scheme. In other words, entropy balancing reweights observations to achieve a balance between treated and untreated units, while keeping the weights as close as possible to the base weights to avoid a loss of information. Finally, by combining a matching approach with a regression analysis, entropy balancing allows addressing properly the panel structure of our data, by including country and time effects in the regression analysis, thus accounting for unobserved heterogeneity.

Although entropy balancing is our baseline method, we test the robustness of our findings with alternative methods using Ordinary Least Squares (OLS), two-stage least-squares (OLS-IV/2SLS) and to some extent, event study, and local projection analysis following Jordà (2005).

4.3.3 Descriptive statistics: visualizing the effect of FR using event-study

Before turning to the results of the entropy balancing, an event-study approach *à la* De Chaisemartin and d'Haultfoeuille (2020) is used in this section to analyze the evolution of the share of foreign-currency debt following the introduction of fiscal rules. Figure 4.2 shows the results. Two main findings emerge from this figure. First, we observe that, prior to the adoption date, there is no evidence for a pre-trend. This evidence indicates a parallel trend between the two groups (FR countries and non-FR countries) since the effect is statistically non-significant in the pre-adoption episodes. In addition, it is important to note that the estimated coefficients over this period are positive but not statistically significant. After the introduction of the fiscal rules, we observe that the coefficient of the share of debt in foreign currency becomes negative from year 1 to year 9. Even if the effect is only significant at year 7, we can conclude that the introduction of fiscal rules leads to a change in the composition of foreign currency debt in our sample countries. Moreover, the time needed to achieve a statistically significant effect reflects the delay that governments may experience in adapting to new changes, but above all, in the case of public

policies such as fiscal rules (see for instance Apeti et al., 2023f for the case of inflation targeting), the time needed to gain credibility with financial markets. Finally, it should be noted that the average of these coefficients over the 9 years following the adoption of fiscal rules is -4.5 percentage points and statistically significant at 1%.

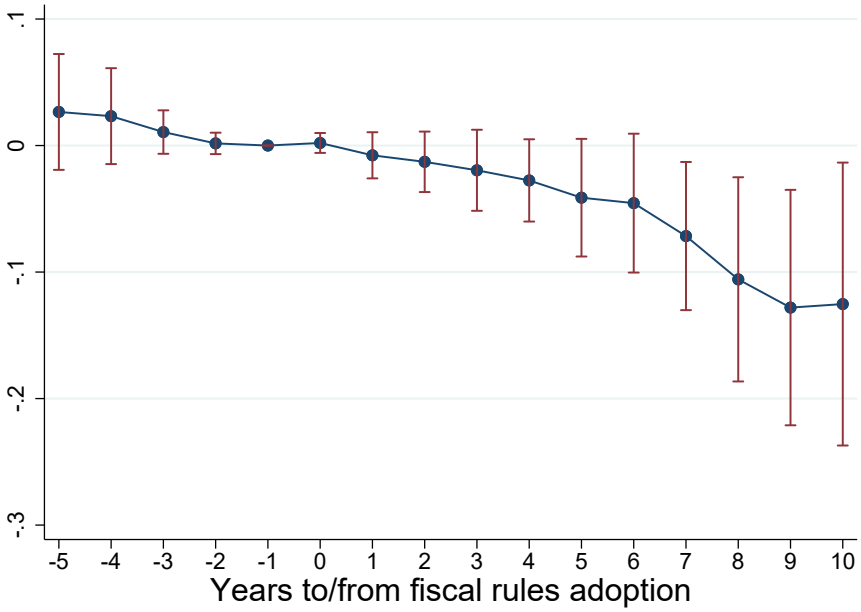


Figure 4.2: Share of foreign currency debt around fiscal rules

4.4 Results

4.4.1 Covariates balance

Table 4.1 reports descriptive statistics related to the first stage equation. Panel A shows a comparison of pre-weighting sample means for the matching covariates, between units with fiscal rules (Column [2]) and control units or the potential synthetic group (Column [1]). Column [5] suggests statistically significant differences between units with fiscal rules and controls, as some p-values are below the 10% threshold. More specifically, countries with fiscal rules seem to be more likely to adopt a monetary framework geared towards price stability, such as inflation targeting, compared to control units. In addition, countries with fiscal rules are characterized by stronger institutions, in particular a better democratic framework, and have better fiscal discipline compared to control units. Such differences could lead to selection bias in policy adoption, hence, to spurious estimates, if endogeneity is not properly addressed. Therefore, from the pre-treatment covariates of the main

model, we re-weight the control units to make the pre-treatment covariates of the control group, on average, as comparable as possible to those of the treated units. The means of the covariates of the synthetic group are reported in Column [1] of Panel B. Column [5] suggests that the weighing eliminated any statistically significant pre-treatment differences between the means of the treated and synthetic covariates. The synthetic group can therefore be seen as a "near perfect" counterfactual of the treated group, which allows for addressing potential selection problems due to policy adoption.

4.4.2 Main results

The second step of the entropy balancing is to estimate the effect of the treatment (fiscal rules), based on the weights calculated in Panel B of Table 4.1. We estimate the following model:

$$Y_{i,t} = \alpha + \beta FR_{i,t} + \eta X_{i,t} + \mu_i + \psi_t + \varepsilon_{i,t} \tag{4.4}$$

where $Y_{i,t}$ is the share of foreign currency in government debt of country i in year t. $FR_{i,t}$ is a dummy variable equal to 1 for a country i that has adopted a fiscal rule in year t, and zero otherwise. X_{it} is the set of the covariates described in subsection 4.3.1. μ_i and ψ_t represent country and time-fixed effects, respectively, capturing unobserved heterogeneity. Finally, $\varepsilon_{i,t}$ is the idiosyncratic error term.

Main results. Panel A of Table 6.2 displays the main results. In Column [1], we run a simple univariate (naive) regression from entropy balancing to capture the only responsiveness of government debt in foreign currencies following the introduction of fiscal rules. Column [2] includes all the controls of the baseline model. In Columns [3]-[4], we include country and year fixed effects, respectively. Column [5] reports the main results, i.e., considering both covariates as well as country and year fixed effects. The estimates suggest that the introduction of fiscal rules reduces the share of foreign currency in government debt in developing countries by 2.9 percentage points compared to other developing countries that did not introduce fiscal rules. This result is statistically significant at the 1% threshold. In Column [6], we analyze the influence of some particular confounding factors that may pollute our effects, by including a time trend in the previous model. We refer in particular to Saka et al. (2022) and Apeti and Edoh (2023) who state that controlling for time trends removes distinctive trends in our outcome variable in individual countries that might otherwise bias our estimates if they accidentally coincide with other changes

in fiscal rules. The results remain consistent with those of the baseline model. Finally, regarding the control variables in the baseline model (Column [5]),[6] we find that per capita income, GDP growth, institutional quality (captured by the level of democracy), fiscal balance, fixed exchange rate regime, and export shares significantly reduce the share of government debt in foreign currency.[7] The negative influence of the fixed exchange rate regime on original sin may be explained by the beneficial effect of this regime on fiscal discipline, as suggested in the literature (e.g., see Masson et al., 1991; Giavazzi and Pagano, 1988; Elbadawi et al., 2015).

Magnitude of the effect. Our main results suggest a negative and significant effect of fiscal rules on the share of foreign currency in government debt in developing countries, with a magnitude of 2.9 percentage points. We find that this effect represents about 15% of the standard deviation of the outcome variable, which suggests an economically significant impact of fiscal rules.

4.5 Robustness

4.5.1 Alternative samples

We conduct some additional tests by re-estimating our main model from alternative samples. The results are reported in Panel B of Table 6.2. First, we exclude hyperinflation episodes from the sample, as they can be very costly for the economy. Second, since the 2008-2009 financial crisis and the COVID-19 pandemic led to significant macroeconomic imbalances in many countries, we exclude these years from the study period. Similarly, in Column [3] we exclude the post-Cold War years (1990-1995), during which many countries experienced particular economic dynamics. Fourth, our main sample includes seven fragile states. Since the latter exhibit very different characteristics from other countries, we exclude them from the main sample.[8] Fifth, since our data suggest a decline in the share of foreign currency debt from the 2000s onwards (Figure 6.4), in the last column we restrict

[6]The coefficients are not reported in Table 6.2 for space purposes but are reported in the appendix (Tables B1, B2, and B3).

[7]For instance, see Hausmann and Panizza (2003); Claessens et al. (2007); or Ogrokhina and Rodriguez (2018) for similar results.

[8]Fragile states are classified by the IMF as those having characteristics that significantly undermine their economic and social performance, with weak governance, limited administrative capacity, chronic humanitarian crises, persistent social tensions, and, often, violence or the legacy of armed conflict and civil war.

our study window to this period, i.e., 2000-2020. Finally, although this rarely occurs, in the last column we exclude from the sample the years when fiscal rules were lifted. The results reported in Columns [1]-[6] of Panel B (Table 6.2), respectively, remain stable.

4.5.2 Additional controls

Our main estimates may suffer from a bias due to some omitted potential determinants of fiscal rules that may be correlated with the outcome variable. To control for these factors, we extend Table 4.1 by including the following covariates: inflation,[9] financial development, sovereign debt ratings, public debt,[10] government consumption, political checks and balances, a dummy equal to 1 if a country, at a given time, has experienced a currency, debt, inflation, or banking crisis, and zero otherwise, government stability.[11] As in Table 4.1, Table B5 shows that entropy balancing provides a balanced sample after matching. In addition, the new treatment effects,

[9]Following Talvi and Vegh (2005), Dreher et al. (2008a), Dreher et al. (2009), Dreher et al. (2010), we normalize the inflation as (inflation/1+inflation), to mitigate the influence of hyperinflation episodes.

[10]Our debt excludes the cycle-related portions. In other words, we use a cycle-adjusted public debt. The intuition is that "bad debt", i.e. debt unrelated to the economic cycle or governed by political ambitions, for example, would be the most inclined to reinforce the share of foreign currency debt, thus increasing the original sin.

[11]We briefly discuss the relevance of the selected additional controls. We include financial development, since the literature stresses its positive effect on the adoption of credible fiscal rules (Hansen, 2020; Gootjes and de Haan, 2022a). Since sovereign debt ratings and public reflect sound fiscal discipline, it can be argued that countries with higher ratings, thus meeting the necessary preconditions, are more likely to implement credible fiscal rules. On the other hand, the literature shows that financial markets act as a watchdog or enforcement mechanism for fiscal rules (Halac and Yared, 2022) as the financial markets directly punish (fiscal rules) governments when loose fiscal behavior is detected (Kelemen and Teo, 2014; Kalan et al., 2018; Gootjes and de Haan, 2022a), thus reinforcing compliance with requirements set by the rule. The effect of government size, captured by government consumption, on the adoption of fiscal rules, is ambiguous. On the one hand, an increase in government size may favor output stability (Fatás and Mihov, 2001; Andrés et al., 2008; Asimakopoulos and Karavias, 2016), creating a favorable framework for the adoption of fiscal rules. On the other hand, Afonso and Furceri (2010), Bergh and Karlsson (2010), Bergh and Henrekson (2011), Asimakopoulos and Karavias (2016) pointed out that a large government size penalizes economic activity, which may reduce the likelihood of the adoption of credible rules. Next, since sharing policies among a larger number of decision-makers can lead to problems of negotiation, agency, coordination, and collective action (Franzese Jr, 2002), it can be assumed that political checks and balances may hinder the adoption of reforms such as fiscal rules. As better economic performance would influence the likelihood of FR adoption (Kumar et al., 2009; Budina et al., 2012), factors such as high inflation and crises would be negatively correlated with FR. Last, good government stability may facilitate budget planning and reforms aimed at promoting the public administration's ability to mobilize domestic revenue, and ultimately better budget discipline, which can be conducive to the adoption of FR.

reported in Columns [2]-[9] of Table B4 in the Appendix (where the new controls are introduced cumulatively) remain negative and statistically significant, with a magnitude ranging from -2.1 to -3 percentage points, i.e., comparable to that of the baseline model (-2.9 percentage points). Regarding the new controls, we find a negative and statistically significant influence of financial development and political checks and balances on original sin, while government consumption is positively associated. The result of financial development can be put into perspective with the argument put forward by Claessens et al. (2003), that a more developed banking system is associated with a larger investor base, thereby fostering wider domestic currency bond markets. The favorable effect of political checks and balances on the control of original sin is probably because stronger checks and balances in the budgetary process can limit budgetary pressures, and thus the scope for governments to incur more debt (Alesina and Perotti, 1996; Fabrizio and Mody, 2006). Finally, the adverse effect of government size is probably because a large government can penalize economic activity, as pointed out by Afonso and Furceri (2010), Bergh and Karlsson (2010), Bergh and Henrekson (2011), and Asimakopoulos and Karavias (2016).

4.5.3 Alternative estimation methods

In this section, we check whether our baseline results are sensitive to other econometric methods, such as OLS (ordinary least squares) and IV (instrumental variables) estimators.

OLS estimates. We re-estimate our main model using a simple fixed-effects panel regression, from the OLS estimator. The results reported in Column [1] of Table B6 suggest a negative and statistically significant effect of fiscal rules on the share of foreign currency in government debt. Moreover, the effect obtained from OLS (3.8 percentage points) remains qualitatively comparable to that of the baseline model obtained from entropy balancing (2.9 percentage points).

IV/2SLS estimates. Next, we test the robustness of our results by using instrumental variables proposed in the literature. For instance, Debrun et al. (2008) and Gootjes et al. (2021) use the lag in fiscal rules as instruments, while Caselli and Reynaud (2020) and Ardanaz et al. (2021) exploit the geographical diffusion of fiscal rules across countries, arguing that reforms in neighboring countries can influence the adoption of domestic reforms, for example through peer pressure (Caselli and Reynaud, 2020; Ardanaz et al., 2021) or an imitation effect to send a credibility signal

to international markets (Balvir, 2023). Instrumental variables allow for mitigating potential endogeneity issues resulting from unobserved time-varying factors that may affect both fiscal rules and the share of government debt in foreign currencies. Following the studies mentioned above, we strengthen our robustness, relying on two instruments: the fiscal rule variable lagged by one year and the number of fiscal rules in place in countries with common borders with respect to the national economy.[12] Column [2] (Table B6) suggests that fiscal rules significantly reduce the share of government debt in foreign currencies, even when we re-estimate our main model from instrumental variables. Although the new coefficients obtained from IV (about -5 percentage points) are slightly higher than those obtained from entropy balancing (about -3 percentage points), the magnitude of the coefficients does not differ substantially. Moreover, the first-stage equation (not reported but available on request) suggests a significant influence of the instruments used on the variable of interest. Likewise, the Kleinbergen-Paap and Stock-Yogo statistics suggest that the instruments used are strong. Similarly, the Hansen test, with a p-value above the 10% threshold, supports the hypothesis of exogeneity of the instruments used.

4.5.4 Placebo and falsification tests

This section performs placebo tests, based on random assignments to the treatment. The underlying intuition is that if our results so far are driven by unobservables or a spurious pattern, randomly assigned adoption dates could also lead to statistically significant effects (Apeti et al., 2023g; Bambe, 2023). Results are reported in Panel C of Table 6.2. In Column [1], we randomly assign the treatment to the sample. Regression results suggest that fictitious adoption dates have no statistically significant effect on the outcome variable. We can therefore reasonably rule out the hypothesis of unobservables or a spurious trend that could drive our results. In the same vein, the introduction of fiscal rules may lead to a change in the economic, political, institutional, and social environment of the treated country, which could

[12]The number of fiscal rules in place in countries with common borders with respect to the national economy is defined as follows:

$$contiguity_{i;t} = \sum_{j \neq = i}^{n-i} FR_{j,t} * X_{j,i,t} \tag{4.5}$$

where j is the neighboring country of the domestic country i. $FR_{j,t}$ is a dummy equal to 1 when the country j has a fiscal rule at the time t, and zero otherwise. $X_{j,i,t}$ is equal to zero when countries have no common borders and sums the number of countries with common borders. Finally, $contiguity_{i;t}$ is our instrument and captures the number of fiscal rules in place in countries with common borders with respect to the national economy.

lead to effects that may overlap with those induced by fiscal rules (Neuenkirch and Neumeier, 2015; Apeti, 2023a; Apeti and Edoh, 2023). Therefore, in Column [2] of Table 6.2, we re-estimate our main results by considering a five-year window before and after the adoption of the reform.[13] The estimates from a smaller window remain negative, statistically significant, and close to that obtained from the full sample (-2.9 percentage points), suggesting that our coefficients are unlikely to be driven by the change in the economic, political, institutional, and social environment following the introduction of the rule. In other words, the effect identified in this paper is due to fiscal rules and not to economic, political, institutional, and social changes following those rules.

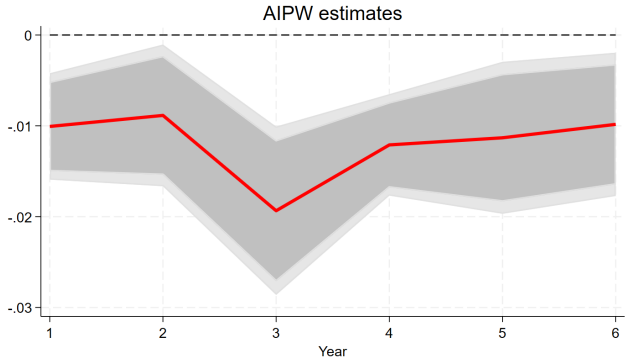
4.5.5 Dynamic effects of fiscal rules

The credibility of fiscal rules may strengthen over time, with more effective effects on reducing foreign currency debt. Hence, this section extends the study by examining the dynamic effect of fiscal rules. We consider the fiscal rules variable as treatment and are interested in characterizing a dynamic average treatment effect. We rely on Jordà (2005)'s local projections (LP), as this method does not impose the dynamic restrictions embedded in vector autoregressions (or autoregressive distributed lags), and is particularly suited to estimating nonlinearities in the dynamic response (see, among others, Jordà, 2005, Auerbach et al., 2013; Ramey and Zubairy, 2018, and Alesina et al., 2020 for a more detailed discussion of the advantages of this approach). In their recent paper, Jordà and Taylor (2016) introduce augmented regression-adjusted estimation (denoted AIPW) —a family of 'doubly robust' augmented inverse-propensity-score weighted regression adjustment methods— which combines inverse probability weighting (IPW) with regression control to estimate the LP responses. This method allows for reducing selection issues related to reform adoption. We proceed in two steps. First, we predict a country's likelihood of adopting fiscal rules from the baseline model's control variables described in subsection 4.3.1. Then, the propensity scores are used to perform matching.

Figure B1 (Appendix) presents smooth kernel density estimates of the propensity score distribution for treated and control units to check for overlap. The figure shows considerable overlap between the distributions, indicating that we have a satisfactory

[13]This narrow time window characterizing our fiscal rules variable would provide a more robust estimate of its effect on the share of foreign currency debt since the slow-changing institutional, political, social, and economic environment is more likely to be stable over narrow periods (Neuenkirch and Neumeier, 2015; Apeti, 2023a; Apeti and Edoh, 2023).

Figure 4.3: Dynamic effects of FR: Year-by-Year treatment effects



first-stage model for correctly identifying the treatment effect. We observe some differences in scores between treated and control units, making some observations likely to receive very high weights. However, AIPW has the property that high weights in IPW are compensated at the same rate by the augmentation term (Jordà and Taylor, 2016). Table B7 (Appendix, Columns [1]–[5]) and Figure 4.3 report the dynamic average treatment effect of fiscal rules. The coefficients for years 1 to 5, although slightly lower than the average effect obtained from the whole sample with entropy balancing (-2.9 percentage points), are negative, statistically significant, and range from -1 to -1.9 percentage points.

4.6 Transmission channels

As discussed in Section 4.2, our reading is that fiscal and monetary policy credibility are the key factors through which fiscal rules may reduce foreign currency borrowing. We may therefore ask whether the countries that introduced fiscal rules experienced an improvement in the credibility of their monetary framework and better fiscal outcomes. In Columns [1] and [2] of Table 6.8, we examine the impact of fiscal rules on fiscal balance and sovereign credit ratings (as the latter is an important determinant of investor confidence in the domestic economy), respectively.[14] In Columns [3] and [4] we consider inflation and its volatility as dependent variables, used as proxies for the credibility of monetary policy. Inflation volatility is approximated by the standard deviation of inflation over a three-year window. In the first two columns,

[14]These variables capture fiscal policy credibility.

we consider as control variables some key determinants of fiscal discipline, such as inflation, annual GDP growth, dependency ratio, trade openness, and parliamentary system. Similarly, in the last two columns we consider some main determinants of inflation and its volatility, such as public debt, trade and financial openness, annual GDP growth, and central bank independence (approximated by Central Bank governor turnover). The results show that fiscal rule adoption leads to better fiscal outcomes (fiscal balance and sovereign credit ratings) and a reduction in inflation and inflation volatility. In other words, improved credibility of fiscal and monetary policies resulting from the adoption of fiscal rules seems to be important mechanisms through which the reform contributes to reducing foreign currency borrowing, corroborating our hypotheses.[15]

4.7 Heterogeneity

4.7.1 The types of fiscal rules

This section explores some heterogeneity features, distinguishing between the different types of rules. In our sample and over our study period, budget balanced rules (BBR) are the most common — adopted by 25 countries — followed by debt rules (DR) — adopted by 17 countries — and expenditure rules (ER), adopted by 15 countries.[16] BBR set a numerical ceiling or target for the government's budget balance, while DR set an explicit limit on the stock of government debt to ensure convergence to a debt target. Finally, ER, by limiting total, primary, or current expenditure, directly targets the size of the government. Previous studies have shown that BBR (e.g., see Tapsoba, 2012b; Barbier-Gauchard et al., 2021) and ER (Tapsoba, 2012b) significantly improve the Cyclically-Adjusted Primary Fiscal Balance (CAPB), with a stronger effect for ER (Tapsoba, 2012b). Regression results reported in Table 6.6 suggest a negative and significant effect of all the different types of rules on the share of foreign currency in public debt, the effect of DR and ER being slightly higher (about -5 and -7 percentage points, respectively) compared to that of BBR

[15]Moreover, following previous studies (e.g., see Gutmann et al., 2021; Bambe et al., 2022; Apeti, 2023a; Apeti, 2023b; Apeti and Edoh, 2023; Bambe, 2023; Bambe et al., 2024), we examine the correlations between the main channels discussed and foreign currency borrowing. The results suggest a negative correlation between fiscal policy credibility (fiscal balance and sovereign credit ratings) and foreign currency borrowing. Similarly, low monetary policy credibility, captured by higher inflation and its volatility, is positively correlated with foreign currency borrowing.

[16]We do not assess the effect of revenue rules (RR) as only two countries (Côte d'Ivoire and Senegal) have implemented RR in our sample.

(about -2 percentage points).

Before moving ahead, we should indicate that subsections 4.7.2 and 4.7.3 document the heterogeneity of the effect of fiscal rules through various factors, such as the strength of fiscal rules and some structural factors. The results are reported in Table C2 (Appendix, Columns [1]-[9]). Our parameters of interest are the coefficients of interaction. As Brambor et al. (2006) show, the coefficients of the fiscal rules and each of the variables introduced in the model to test heterogeneity in interaction models should not be interpreted as the average (unconditional) effect on the share of foreign currency debt as in linear-additive models. The marginal effect of fiscal rules on the share of foreign-currency debt should therefore not be assessed according to the statistical (non)significance of the coefficient of the interaction term but should be assessed for all possible values of each of the variables used to test the heterogeneity. Consequently, to better judge our heterogeneity effects as a function of the different variables discussed in subsections 4.7.2 and 4.7.3, we use Figure 4.4 to plot the marginal effect of the rules on the share of foreign currency debt, conditional on each of the variables used to test heterogeneity (see Neuenkirch and Neumeier, 2015; Gootjes et al., 2021; Gootjes and de Haan, 2022a; Apeti et al., 2023d for similar exercises). Note that the black line/slope represents the marginal effect of fiscal rules, and the dotted lines indicate the 90% confidence interval for which the marginal effect is computed.

4.7.2 Credibility of the rules

The success of fiscal rules may depend to a large extent on the credibility of the fiscal framework. In what follows, we examine whether the strengthening of the rules, measured by the fiscal rule index and used as a proxy for credibility, influences the reform's effectiveness. Following Gootjes et al. (2021), we construct a fiscal rule index, by considering the four aspects of the rule: balanced budget rules, debt rules, expenditure rules, and revenue rules. The index ranges from 0 to 5, with higher values indicating a strengthening of the rule.[17] Figure 4.4 suggests that the

[17] The indicator is constructed as follows:

$$FRI = Coverage + Legal\ \ basis + Supporting\ \ procedures + Enforcement + Flexibility \quad (4.6)$$

where FRI (Fiscal Rules Index) represents the strength of the rule and ranges from 0 to 5. Coverage captures the type of government (central or general) covered by the rule. The legal basis considers the legal aspects of the reform, such as political agreements, legislative statutes, or constitutional rules. Supporting procedures take into account the presence of multiannual expenditure ceilings, a

beneficial effect of fiscal rules on the control of original sin is amplified when the rule is tightened.

4.7.3 Macroeconomic and institutional factors

Next, we explore other sources of heterogeneity, considering economic, and institutional factors such as lagged fiscal balance, the quality of institutions (proxied by the level of democracy, central bank independence, and government fragmentation), the level of (economic) development (proxied by real GDP per capita), exchange rate flexibility, financial openness, and financial development. We lag fiscal balance (by one year) to capture the preconditions for the implementation of credible fiscal rules. A sound fiscal discipline prior to the adoption of the reform should enhance the credibility of the fiscal framework, thus amplifying the effectiveness of the rules. A good institutional framework, such as democracy, encourages governments to be more transparent in budget management and helps to promote greater capacity to implement healthy and sustainable reforms that can foster the sustainability of public finances. This may reinforce the beneficial effect of fiscal rules on original sin. Similarly, in the spirit of the unpleasant monetarist arithmetic (Sargent and Wallace, 1981) or the fiscal theory of the price level (Leeper, 1991; Sims, 1994; Woodford, 1995), weak central bank independence is likely to lead to fiscal dominance, resulting in higher deficits. Therefore, in line with this literature, we expect central bank independence to enhance the beneficial effect of fiscal rules on original sin. Next, a large literature has examined the effect of government fragmentation on fiscal outcomes, suggesting that fragmentation tends to be associated with a lax fiscal policy (e.g., see Kontopoulos and Perotti, 1999; Edin and Ohlsson, 1991; Borrelli and Royed, 1995; Franzese, 2000; Volkerink and De Haan, 2001; Balassone and Giordano, 2001; Artés and Jurado, 2018). The effect of fiscal rules on original sin could therefore be mitigated in the presence of high government fragmentation. On the other hand, fiscal rules may be implemented to correct fiscal distortions due to fragmentation. As economic development is positively correlated with the quality of institutions, we expect fiscal rules to be more effective in reducing original sin in countries with a high real GDP per capita. Regarding the exchange rate

law on fiscal responsibility, and an independent fiscal body that sets budgetary assumptions and monitors their implementation. Enforcement captures the number of formal enforcement procedures in place. Flexibility captures the presence of a well-defined exemption clause, determines whether the balanced budget target is adjusted for the cycle, and whether public infrastructure spending is excluded from the spending cap. The computed index is normalized to the unit, allowing its values to vary between 0 and 1.

regime, a large literature highlights a strong correlation between the fixed exchange rate regime and fiscal discipline, embodied in fiscal rules (e.g., see Masson et al., 1991; Giavazzi and Pagano, 1988; Elbadawi et al., 2015). However, Tornell and Velasco (1995) suggest that the difference between fixed and flexible regimes lies in the intertemporal distribution of the costs of fiscal laxity, considering that these costs under a fixed exchange rate appear in the future, while they occur immediately in flexible rates through exchange rate movements. Financial openness and development are expected to amplify the effect of fiscal rules on original sin due to the principle of sanctions, which acts as a monitoring body for rules compliance (Garrett, 1995; Kim, 2003; Altunbaş and Thornton, 2017; Halac and Yared, 2022). The results presented in Figure 4.4 suggest that better fiscal discipline prior to the adoption of the reform, institutions, the level of economic development (proxied by real GDP per capita),[18] exchange rate flexibility, financial openness, and financial development foster the beneficial effect of fiscal rules on original sin.

4.8 Conclusion

Most developing countries usually borrow from the international capital markets in foreign currency, a phenomenon known in the literature as "original sin." Indeed, when a currency crisis occurs, the depreciation of the domestic currency leads to government insolvency and the inability to honor its foreign currency debt, with significant consequences for the economy. Against this background, this paper examines to what extent binding fiscal frameworks aimed at promoting fiscal discipline, such as fiscal rules, affect the control of original sin. To do so, we rely on a panel of 59 developing countries over the period 1990-2020 and apply the entropy balancing method to mitigate potential selection bias associated with policy adoption. We find that the fiscal rules significantly reduce the share of public debt in foreign currency, and that the effect is economically significant. These results are robust to the inclusion of additional controls, sample size changes, and the use

[18]The effect of the level of development measured by real GDP per capita on the findings discussed in this paper is achieved by the interaction approach. We use a second approach which takes the median value of real GDP per capita as the cut-off point. Countries above the median are classified as high-income countries, and those below as low-income countries. The results presented in Table C3 (Appendix, Column [1]-[2]) show a negative effect of fiscal rules on the share of foreign currency debt, irrespective of the level of development. However, the results are statistically significant only in high-income countries, probably due to their ability to implement fiscal reforms more effectively (see for example Apeti et al., 2023g for the case of monetary policy reforms). In addition, these results support those observed in the interaction context, where we only achieve statistically significant effects above a certain level of real GDP per capita.

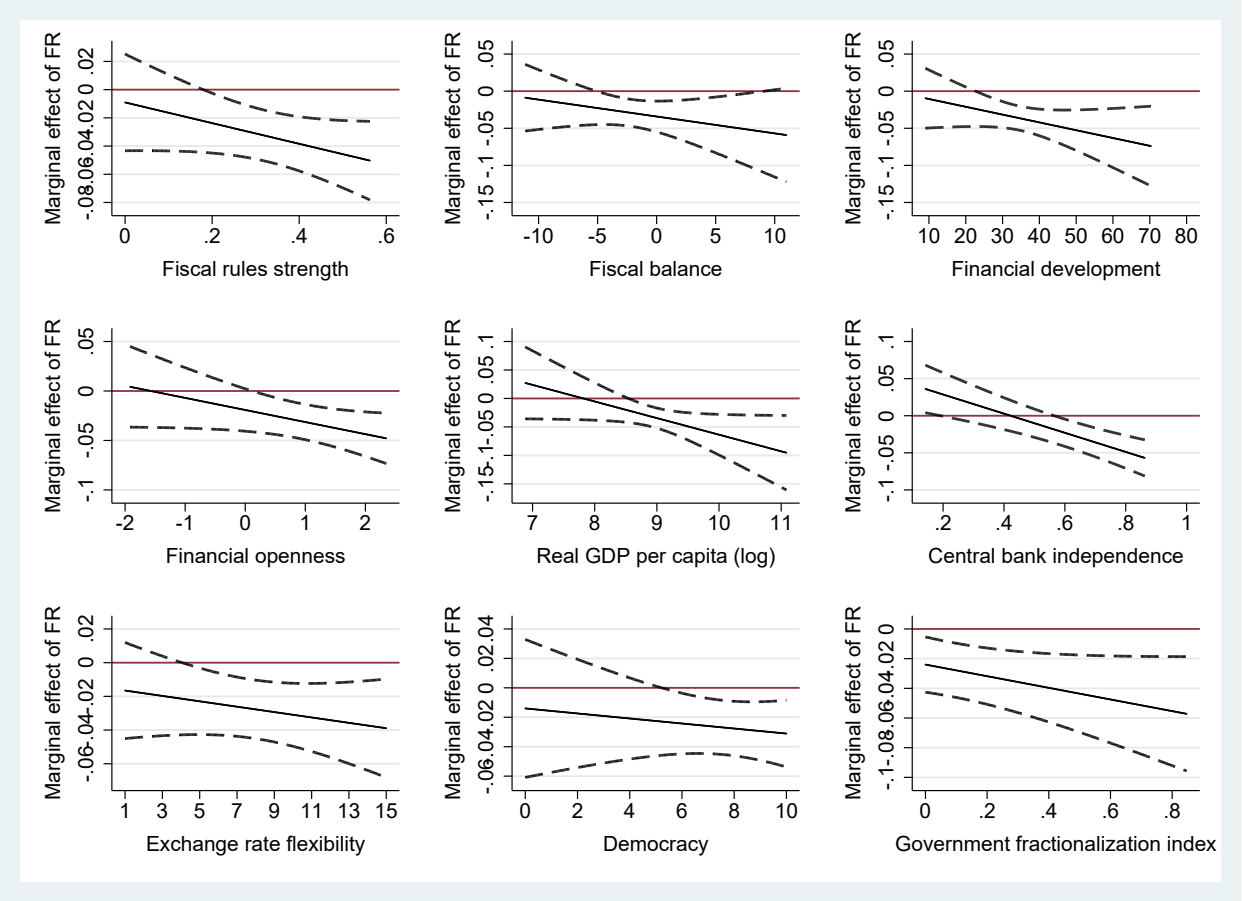
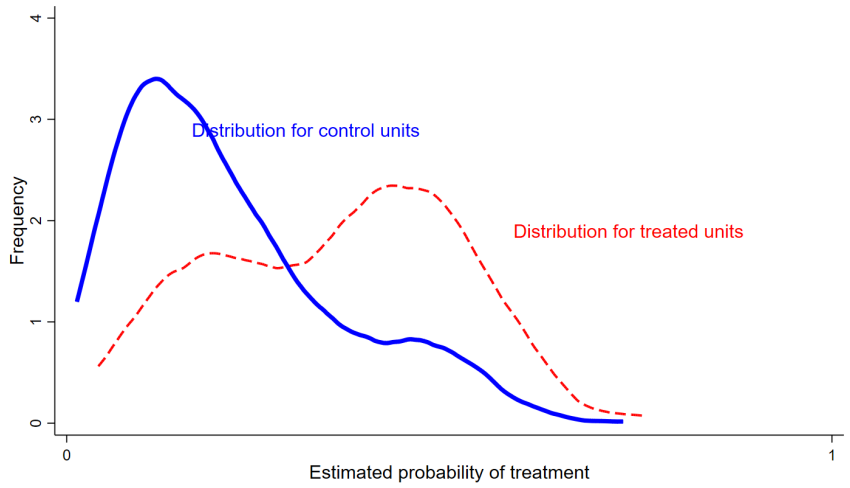


Figure 4.4: Heterogeneity: Exploring conditional effects

of alternative estimation methods. Our estimates could be driven by unobservable factors or a spurious trend, but placebo tests suggest that the observed effect is due to fiscal rules and that our estimates are not altered by confounding factors. We also find that the effect of debt rules and expenditure rules is slightly higher compared to that of budget balanced rules. In addition, the strengthening of the rule, better fiscal discipline prior to the adoption of the reform, financial development, financial openness, flexibility of the exchange rate regime, the level of economic development, as well as the quality of institutions, amplify the beneficial effect of fiscal rules on the control of original sin.

Overall, this study contributes to the literature on original sin and fiscal institutions, highlighting a key finding: fiscal frameworks aimed at promoting fiscal discipline, such as fiscal rules, matter in controlling original sin. As a result, developing countries could exploit the opportunity of fiscal rules to increase investor or financial

Figure B 1: Overlap Check: Empirical Distributions of the Treatment Propensity Score



Notes: This figure the predicted probabilities of treatment (dashed line) and control units (solid line).

market confidence to improve the currency composition of their debt.

Table 4.1: Descriptive statistics and covariate balancing

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A : Descriptive statistics	**Non-FR**	**FR**	**Difference**	**t-Test**	**p-Val.**
Log.GDP per capita	8.4666	8.4423	0.0243	0.3555	0.7224
Inflation targeting	0.1579	0.4115	-0.2536	-6.5602	0.0000
Democracy	3.5357	4.1693	-0.6336	-5.9783	0.0000
Exports share	0.0046	0.0039	0.0007	1.2999	0.1941
Lag.Fiscal balance	-1.9906	-0.6764	-2.9986	-2.9986	0.0029
Fixed exchange rate regime	0.2071	0.2188	-0.0117	-0.3391	0.7348
Government durability	22.9219	24.026	-1.1041	-0.6008	0.5485
Annual GDP growth	4.6556	4.1382	0.5174	1.6504	0.0998
Capital openness	0.263	0.2256	0.0374	0.3314	0.7405
Observations	***589***	***192***			
	[1]	**[2]**	**[3] = [1] - [2]**	**[4]**	**[5]**
Panel B : Covariate balancing	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Log.GDP per capita	8.4418	8.4423	-0.0005	0.01	0.995
Inflation targeting	0.4094	0.4115	-0.0021	0.04	0.966
Democracy	4.1599	4.1693	-0.0094	0.08	0.939
Exports share	0.0039	0.0039	0.0000	-0.08	0.936
Lag.Fiscal balance	-0.6824	-0.6764	-0.006	0.01	0.993
Fixed exchange rate regime	0.2184	0.2188	-0.0004	0.01	0.992
Government durability	24.023	24.026	-0.003	0.00	0.999
Annual GDP growth	4.1434	4.1382	0.0052	-0.01	0.988
Capital openness	0.224	0.2256	-0.0016	0.01	0.989
Observations	***589***	***192***			
Total of weights	***192***	***192***			

Table 4.2: FR and the share of foreign currency in government debt

Panel A: Entropy balancing	[1] Naive	[2] Adding Controls	[3] Controls & Country FE	[4] Controls & Time FE	[5] Controls Time/Country FE	[6] Controls Time/Country FE/Trend
FR dummy	-0.029***	-0.025***	-0.018**	-0.022***	-0.029***	-0.029***
	(0.0075)	(0.0077)	(0.0088)	(0.0079)	(0.0111)	(0.0111)
Observations	570	570	570	570	570	570
R-squared	0.0365	0.217	0.5831	0.2911	0.6118	0.6118
Panel B: Alternative samples	[1]	[2]	[3]	[4]	[5]	[6]
FR dummy	-0.027**	-0.028**	-0.026**	-0.025**	-0.024*	-0.028**
	(0.0108)	(0.0118)	(0.0117)	(0.0110)	(0.0139)	(0.0112)
Observations	524	505	522	525	446	533
R-squared	0.6597	0.6376	0.621	0.6624	0.6414	0.6293
Country, Time FE & Controls	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: Placebo & falsification tests					[1]	[2]
FR dummy					-0.004	-0.028***
					(0.0046)	(0.0106)
Observations					569	402
R-squared					0.5293	0.6031
Country, Time FE & Controls					Yes	Yes

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt. Panel A uses weighted least squares regressions. Panel B estimates the main equation using alternative samples. That is, the first column of Panel B excludes from the sample any episode of hyperinflation. Columns [2] and [3] ignore the 2008-2009 financial crisis and the post-Cold War years (1990-1995), respectively. In Column [4], we exclude fragile states. In the last column, we exclude the year of the beginning of the global pandemic, i.e., 2020, from our study period. Finally, Panel C runs placebo tests from the main model. In Column [1], we randomly assign the treatment to the sample. In Column [2], we re-estimate our main results over a shorter period, considering a five-year window. All specifications include the variables of the baseline model: GDP per capita (log), annual GDP growth, fiscal balance (lag), financial openness, the exchange rate regime, inflation targeting, export shares, and the level of democracy. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.3: Transmission channels

	[1]	[2]	[3]	[4]
	Fiscal balance	Credit ratings	Inflation	Log. Inflation volatility
FR dummy	0.671**	0.895***	-3.102***	-0.158**
	(0.3391)	(0.2114)	(0.8564)	(0.0707)
Inflation	-0.012*	-0.001***		
	(0.0069)	(0.0003)		
Annual GDP growth	0.047	0.021	-0.312***	-0.012
	(0.0761)	(0.0181)	(0.1200)	(0.0079)
Age dependency ratio	0.431	-4.247***		
	(2.1914)	(0.8260)		
Trade openness	0.034***	-0.005	0.073***	0.005***
	(0.0096)	(0.0046)	(0.0234)	(0.0014)
Parliamentary system	12.882	-5.169***		
	(10.1093)	(0.2743)		
Public debt			0.138***	0.006***
			(0.0368)	(0.0012)
Financial openness			-0.011	0.003
			(0.0508)	(0.0038)
Central Bank governor turnover			1.592	-0.014
			(1.0500)	(0.0582)
Observations	1228	1020	843	834
R-squared	0.4137	0.7827	0.5092	0.4744
Country & Time FE	Yes	Yes	Yes	Yes

Notes: This table reports the results of the main channels through which fiscal rules might reduce foreign currency debt. In Columns [1] and [2], we examine the impact of fiscal rules on fiscal credibility, captured by fiscal balance and sovereign credit ratings, respectively. In Columns [3] and [4], we examine the impact of fiscal rules on the credibility of the monetary framework, captured by inflation and its volatility. The regressions are estimated using the OLS estimator, including both country and year-fixed effects, and some main determinants of the channels discussed. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A Data and sample

Table A1: List of Fiscal Rules (FR) and Non-FR countries

Treatment group(FR)	Date	**Control group(Non-FR)**	
Argentina	2000	Aruba	Ukraine
Bahamas, The	2018	Albania	Venezuela, RB
Brazil	1998	United Arab Emirates	South Africa
Chile	2001	Bahrain	
Cote d'Ivoire	2000	Belarus	
Congo, Rep.	2002	Belize	
Colombia	2000	Bolivia	
Costa Rica	2001	Barbados	
Gabon	2002	China	
Georgia	2013	Dominican Republic	
Grenada	1998	Egypt, Arab Rep.	
Indonesia	1990	Fiji	
India	2004	Ghana	
Jamaica	2010	Guatemala	
Kazakhstan	2013	Iraq	
Sri Lanka	2003	Jordan	
Mexico	2006	Lebanon	
Mongolia	2013	Morocco	
Mauritius	2008	North Macedonia	
Namibia	2001	Oman	
Nigeria	2007	Philippines	
Peru	2000	Papua New Guinea	
Paraguay	2015	Qatar	
Russian Federation	2007	Saudi Arabia	
Senegal	2000	Seychelles	
Serbia	2011	Trinidad and Tobago	
Thailand	2019	Tunisia	
Uruguay	2006	Turkey	

Table A2: Descriptive statistics of the main variables

Varibable	**Obs.**	**Mean**	**Sd**	**Min**	**Max**
Share of government debt in foreign currency	881	0.9367	0.2026	0	1
Log.GDP per capita	1,718	8.5337	0.9193	6.2681	11.0985
Inflation targeting	1,769	0.1633	0.3698	0	1
Democracy	1,508	3.5991	1.3802	0	6
Exports share	1,138	0.0035	0.0082	1.85E-6	0.0943
Lag.Fiscal balance	1,524	-2.3350	5.4048	-35.398	29.802
Fixed exchange rate regime	1,109	0.2587	0.4381	0	1
Government durability	1,514	21.169	20.2342	0	99
Annual GDP growth	1,739	3.4384	5.8842	-64.0471	57.8178
Capital openness	1,517	0.0503	1.4392	-1.9165	2.3467

Table A3: Sources of variables

Variables	Nature	Sources
1. Main model variables		
Fiscal rules	Dummy	IMF Fiscal Rules Dataset
Share of government debt in foreign currency	Ranging from 0 to 1	The International Debt Securities (IDS)
Fiscal balance (%GDP)	Continuous	Kose et al. (2022)
Annual GDP growth	Continuous	WDI
GDP per capita	Continuous	WDI
Financial openness	Index ranging approximately from -2 to 2	Chinn and Ito (2006)
Fixed exchange rate regime	Dummy	Authors, from Ilzetzki et al. (2019)
Inflation targeting	Dummy	Rose (2007); Roger (2009); Ciżkowicz-Pękała et al. (2019)
Share of World Exports	Continuous	Direction of Trade, IMF
Democracy	Index ranging from 0 to 6	The International Country Risk Guide (ICRG)
Government durability	Continuous	Polity IV
2. Additional controls		
Financial development	Index ranging from 0 to 1	IMF Financial Development Index Database
Sovereign debt rating	Index ranging from 1 to 21	Kose et al. (2022)
Government consumption	Continuous	WDI
Inflation	Continuous	WDI
Polical checks and balances	Continuous	The Database of Political Institutions
Exchange rate volatility	Continuous	Authors, from Penn World Table
Crisis	Dummy	Nguyen et al. (2022)
Government stability	Index ranging from 0 to 12	The International Country Risk Guide (ICRG)

B Robustness

Table B1: FR and the share of foreign currency in government debt: Results showing the full set of controls for Table 6.2 (Panel A)

Panel A: Entropy balancing	[1] Naive	[2] Adding Controls	[3] Controls & Country FE	[4] Controls & Time FE	[5] Controls Time/Country FE	[6] Controls Time/Country FE/Trend
FR dummy	-0.029***	-0.025***	-0.018**	-0.022***	-0.029***	-0.029***
	(0.0075)	(0.0077)	(0.0088)	(0.0079)	(0.0111)	(0.0111)
Log.GDP per capita		-0.009**	-0.147***	-0.005	-0.101***	-0.101***
		(0.0045)	(0.0238)	(0.0045)	(0.0358)	(0.0358)
Inflation targeting		-0.050***	0.019**	-0.046***	0.005	0.005
		(0.0078)	(0.0094)	(0.0078)	(0.0100)	(0.0100)
Democracy		0.005*	-0.007*	0.003	-0.011***	-0.011***
		(0.0029)	(0.0038)	(0.0030)	(0.0040)	(0.0040)
Exports share		-0.566	-3.287	-0.665	-4.612**	-4.612**
		(0.9715)	(2.0943)	(0.9678)	(2.0633)	(2.0633)
Lag. Fiscal balance		-0.002	-0.001	-0.003*	-0.003*	-0.003*
		(0.0015)	(0.0014)	(0.0016)	(0.0015)	(0.0015)
Fixed exchange rate regime		-0.017*	-0.052***	-0.014	-0.033*	-0.033*
		(0.0095)	(0.0159)	(0.0097)	(0.0175)	(0.0175)
Government durability		-0.001**	-0.000**	-0.001**	-0.000	-0.000
		(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Annual GDP growth		-0.002**	-0.001	-0.002**	-0.002*	-0.002*
		(0.0007)	(0.0008)	(0.0008)	(0.0009)	(0.0009)
Capital openness		-0.009***	0.001	-0.011***	-0.003	-0.003
		(0.0027)	(0.0036)	(0.0028)	(0.0037)	(0.0037)
Observations	570	570	570	570	570	570
R-squared	0.0365	0.217	0.5831	0.2911	0.6118	0.6118

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt, showing the full set of controls for Panel A of Table 6.2. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B2: FR and the share of foreign currency in government debt: Results showing the full set of controls for Table 6.2 (Panel B)

Panel B: Alternative samples	[1]	[2]	[3]	[4]	[5]	[6]
FR dummy	-0.027**	-0.028**	-0.026**	-0.025**	-0.024*	-0.028**
	(0.0108)	(0.0118)	(0.0117)	(0.0110)	(0.0139)	(0.0112)
Log.GDP per capita	-0.140***	-0.098***	-0.119***	-0.092***	-0.185***	-0.123***
	(0.0329)	(0.0285)	(0.0393)	(0.0307)	(0.0527)	(0.0378)
Inflation targeting	0.006	0.008	0.013	0.005	0.030**	-0.004
	(0.0100)	(0.0102)	(0.0106)	(0.0103)	(0.0141)	(0.0096)
Democracy	-0.015***	-0.011**	-0.012***	-0.012***	-0.019***	-0.016***
	(0.0036)	(0.0042)	(0.0045)	(0.0044)	(0.0052)	(0.0040)
Exports share	-3.782*	-5.769***	-5.599**	-4.560**	-6.987**	-4.594**
	(2.0723)	(1.8963)	(2.3093)	(2.0173)	(2.9159)	(2.0513)
Lag. Fiscal balance	-0.005***	-0.002	-0.003*	-0.003**	-0.002	-0.003*
	(0.0018)	(0.0013)	(0.0015)	(0.0013)	(0.0017)	(0.0015)
Fixed exchange rate regime	-0.139***	-0.036*	-0.036**	-0.030	-0.042*	-0.043**
	(0.0378)	(0.0194)	(0.0181)	(0.0188)	(0.0227)	(0.0178)
Government durability	-0.000	-0.000**	-0.000	-0.000**	-0.000	-0.000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)
Annual GDP growth	-0.003***	-0.002	-0.002*	-0.002**	-0.002*	-0.002*
	(0.0009)	(0.0011)	(0.0010)	(0.0011)	(0.0011)	(0.0010)
Capital openness	-0.004	-0.002	-0.003	-0.004	-0.002	0.002
	(0.0041)	(0.0038)	(0.0043)	(0.0037)	(0.0049)	(0.0036)
Observations	524	505	522	525	446	533
R-squared	0.6597	0.6376	0.621	0.6624	0.6414	0.6293
Country & Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt, showing the full set of controls for Panel B of Table 6.2. The first column excludes from the sample any episode of hyperinflation. Columns [2] and [3] ignore the 2008-2009 financial crisis and the post-Cold War years (1990-1995), respectively. In Column [4], we exclude fragile states. In the last column, we exclude the year of the beginning of the global pandemic, i.e., 2020, from our study period. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B3: FR and the share of foreign currency in government debt: Results showing the full set of controls for Table 6.2 (Panel C)

Panel C: Placebo & falsification tests	[1]	[2]
FR dummy	-0.004	
	(0.0046)	
Log.GDP per capita	-0.035*	-0.073
	(0.0208)	(0.0685)
Inflation targeting	-0.009	-0.008
	(0.0080)	(0.0068)
Democracy	-0.005**	-0.009***
	(0.0024)	(0.0029)
Exports share	-4.966**	-5.234**
	(2.0832)	(2.5153)
Lag. Fiscal balance	-0.002	-0.002
	(0.0010)	(0.0016)
Fixed exchange rate regime	-0.001	-0.035*
	(0.0161)	(0.0191)
Government durability	0.000	0.001**
	(0.0003)	(0.0004)
Annual GDP growth	-0.002***	-0.002**
	(0.0006)	(0.0011)
Capital openness	-0.008**	0.011***
	(0.0033)	(0.0034)
FR dummy		-0.028***
		(0.0106)
Observations	569	402
R-squared	0.5293	0.6031
Country & Time FE	Yes	Yes

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt, showing the full set of controls for Panel C of Table 6.2. In Column [1], we randomly assign the treatment to the sample. In Column [2], we re-estimate our main results over a shorter period, considering a five-year window. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B4: FR and the share of foreign currency in government debt: Additional controls

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	Baseline								
FR dummy	-0.029***	-0.025**	-0.030**	-0.027**	-0.024**	-0.022**	-0.022*	-0.021*	-0.023**
	(0.0111)	(0.0119)	(0.0120)	(0.0114)	(0.0111)	(0.0109)	(0.0111)	(0.0109)	(0.0114)
Inflation		-0.007	-0.012	-0.015	-0.016	-0.004	-0.006	-0.005	-0.004
		(0.0056)	(0.0083)	(0.0121)	(0.0115)	(0.0047)	(0.0054)	(0.0057)	(0.0055)
Financial development			-0.322***	-0.358***	-0.388***	-0.421***	-0.492***	-0.471***	-0.461***
			(0.0744)	(0.0921)	(0.0858)	(0.0893)	(0.0914)	(0.0921)	(0.0937)
Sovereign debt ratings				0.001	0.002	0.002	0.004	0.003	0.003
				(0.0028)	(0.0028)	(0.0030)	(0.0031)	(0.0029)	(0.0026)
Government consumption					0.008***	0.009***	0.009***	0.009***	0.009***
					(0.0020)	(0.0020)	(0.0021)	(0.0023)	(0.0024)
Political checks and balances						-0.014***	-0.013***	-0.013***	-0.010**
						(0.0046)	(0.0046)	(0.0044)	(0.0047)
Crisis							0.016	0.021*	0.018
							(0.0117)	(0.0124)	(0.0125)
Government stability								-0.003	-0.002
								(0.0023)	(0.0024)
Public debt									-0.000
									(0.0005)
Observations	570	535	535	472	451	429	429	429	406
R-squared	0.6118	0.6641	0.6744	0.6999	0.6972	0.7328	0.7321	0.7465	0.7589
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt, including additional controls. Column [1] reports the results of the main model. All specifications include the variables of the baseline model: GDP per capita (log), annual GDP growth, fiscal balance (lag), financial openness, the exchange rate regime, inflation targeting, export shares, and the level of democracy. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B5: Additional covariates

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A : Descriptive statistics	**Non-FR**	**FR**	**Difference**	**t-Test**	**p-Val.**
Log.GDP per capita	8.5595	8.4777	0.0818	1.0400	0.2991
Inflation targeting	0.2426	0.5241	-0.2815	-5.9640	0.0000
Democracy	3.5943	4.4241	-0.8298	-6.6867	0.0000
Exports share	0.0036	0.0047	-0.0011	-2.1843	0.0299
Lag. Fiscal balance	-1.504	-1.5769	0.0729	0.1668	0.8676
Fixed exchange rate regime	0.186	0.0897	0.0963	3.0835	0.0022
Government durability	22.2884	27.1517	-4.8633	-2.1576	0.0320
Annual GDP growth	4.5464	4.4206	0.1258	0.3952	0.6929
Capital openness	0.3091	0.5467	-0.2376	-1.8138	0.0707
Inflation	0.8161	0.8239	-0.0078	-0.1653	0.8688
Financial development	0.3234	0.3193	0.0041	0.3318	0.7403
Sovereign debt ratings	10.9072	10.4453	0.4619	1.6667	0.0966
Government consumption	14.617	12.7727	1.8443	4.9117	0.0000
Political checks and balances	2.6523	3.8483	-1.196	-5.0760	0.0000
Crisis	0.2318	0.1517	0.0801	2.1596	0.0316
Government stability	8.7601	7.6931	1.067	7.0574	0.0000
Public debt (cycle-adjusted)	-0.0758	0.2249	-0.3007	-0.5646	0.5727
Observations	***371***	***145***			
	[1]	**[2]**	**[3] = [1] - [2]**	**[4]**	**[5]**
Panel B : Covariate balancing	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Log.GDP per capita	8.4775	8.4777	-0.0002	0.00	0.998
Inflation targeting	0.522	0.5241	-0.0021	0.03	0.973
Democracy	4.4177	4.4241	-0.0064	0.04	0.966
Exports share	0.0047	0.0047	0	-0.00	0.998
Lag. Fiscal balance	-1.5812	-1.5769	-0.0043	0.01	0.994
Fixed exchange rate regime	0.0899	0.0897	0.0002	-0.01	0.994
Government durability	27.088	27.1517	-0.0637	0.02	0.981
Annual GDP growth	4.4215	4.4206	0.0009	-0.00	0.998
Capital openness	0.5426	0.5467	-0.0041	0.03	0.978
Inflation	0.8247	0.8239	0.0008	-0.04	0.970
Financial development	0.3192	0.3193	-0.0001	0.00	0.997
Sovereign debt ratings	10.4453	10.4453	0	0.00	1.000
Government consumption	12.7812	12.7727	0.0085	-0.02	0.983
Political checks and balances	3.8439	3.8483	-0.0044	0.01	0.993
Crisis	0.1526	0.1517	0.0009	-0.02	0.984
Government stability	7.6986	7.6931	0.0055	-0.03	0.978
Public debt (cycle-adjusted)	0.2249	0.2249	0	0.00	1.000
Observations	***371***	***145***			
Total of weights	***145***	***145***			

Table B6: FR and the share of foreign currency in government debt: OLS, and IV estimates

	Panel A: OLS	**Panel B: IV**
	[1]	[2]
FR dummy	-0.038***	-0.054***
	(0.0105)	(0.0129)
Log.GDP per capita	-0.053**	-0.052***
	(0.0264)	(0.0195)
Inflation targeting	-0.012	-0.011
	(0.0081)	(0.0076)
Democracy	-0.007**	-0.007***
	(0.0029)	(0.0029)
Exports share	-6.207***	-6.323***
	(2.2614)	(2.1613)
Lag.Fiscal balance	-0.002*	-0.002**
	(0.0011)	(0.0008)
Fixed exchange rate regime	-0.010	-0.019
	(0.0169)	(0.0166)
Government durability	3.761E-4	3.586E-4
	(0.0004)	(0.0003)
Annual GDP growth	-0.001**	-0.002***
	(0.0006)	(0.0006)
Capital openness	-0.008**	-0.007**
	(0.0035)	(0.0035)
Observations	570	555
R-squared	0.5417	0.4046
Country & Time FE	Yes	Yes
Instruments		Lag. Fiscal rules/Contiguity
Kleinberg-Paap rk test		83.30
Stock-Yogo Stats test		19.93
Hansen p-value		0.2115

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt. Panel A re-estimates the baseline model using OLS. Panel B relies on instrumental variables, considering the fiscal rule variable lagged by one year and the number of fiscal rules in place in countries with common borders with respect to the national economy as instruments. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B7: Dynamic effects FR on foreign currency in government debt, AIPW estimates

	[1]	[2]	[3]	[4]	[5]
	Year 1	Year 2	Year 3	Year 4	Year 5
FR dummy	-0.010***	-0.009**	-0.019***	-0.012***	-0.011**
	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)
Observations	525	505	482	456	433
Country, Time FE & Controls	Yes	Yes	Yes	Yes	Yes

Notes: . * p < 0.1, ** p < 0.05, *** p < 0.01

C Heterogeneity

Table C1: FR and the share of foreign currency in government debt: types of rules

	[1]	[2]	[3]
	BBR	DR	ER
ATT	-0.024**	-0.045**	-0.071***
	(0.0109)	(0.0176)	(0.0175)
Observations	570	570	570
R-squared	0.6144	0.6658	0.7738
Baseline Controls	Yes	Yes	Yes
Country & Time FE	Yes	Yes	Yes

Notes: This table reports estimates of the impact of fiscal rules on the share of foreign currency in government debt, distinguishing between budget balanced rules (BBR), debt rules (DR), and expenditure rules (ER). All specifications include the variables of the baseline model: GDP per capita (log), annual GDP growth, fiscal balance (lag), financial openness, the exchange rate regime, inflation targeting, export shares, and the level of democracy. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

Table C2: Heterogeneity: Conditional effects

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
FR dummy	-0.009	-0.034***	0.012E-03	-0.019	0.228	0.054**	-0.015	-0.014	-0.024**
	(0.0208)	(0.0126)	(0.0319)	(0.0130)	(0.1600)	(0.0237)	(0.0189)	(0.0284)	(0.0113)
FR dummy * Fiscal rules strength	-0.073								
	(0.0544)								
FR dummy * Fiscal balance		-0.002							
		(0.0028)							
FR dummy * Financial development									
			-0.001						
			(0.0009)						
FR dummy * Financial openness				-0.012					
				(0.0078)					
FR dummy * Real GDP per capita (log)					-0.029				
					(0.0179)				
FR dummy * Central bank independence						-0.129***			
						(0.0356)			
FR dummy * Exchange rate flexibility									
							-0.002		
							(0.0020)		
FR dummy * Democracy								-0.002	
								(0.0034)	
FR dummy * Government fractionalization									-0.039
									(0.0270)
Observations	570	570	570	570	570	563	570	549	520
R-squared	0.614	0.613	0.623	0.615	0.615	0.623	0.627	0.615	0.620
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the results of the heterogeneity effects of fiscal rules. The equation is estimated by considering the main model augmented by the interactive term. Vector X variables in isolation (without interaction with FR) and controls are included but not reported for space purposes. All specifications include the variables of the baseline model: GDP per capita (log), annual GDP growth, fiscal balance (lag), financial openness, the exchange rate regime, inflation targeting, export shares, and the level of democracy. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C3: Heterogeneity: level of economic development

	[1]	[2]
	High income countries	Low income countries
FR dummy	-0.041***	-0.021
	(0.0144)	(0.0197)
Observations	296	274
R-squared	0.7533	0.3545
Baseline Controls	Yes	Yes
Country & Time FE	Yes	Yes

Notes: This table reports the results of the heterogeneity effects of fiscal rules, distinguishing between advanced and developing countries. The sample is split around the average real GDP per capita. All specifications include the variables of the baseline model: GDP per capita (log), annual GDP growth, fiscal balance (lag), financial openness, the exchange rate regime, inflation targeting, export shares, and the level of democracy. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

Chapter 5

Determinants of Public Sector Efficiency: A Panel Database from a Stochastic Frontier Analysis

This chapter is joint work with Ablam Estel APETI (LEO and University of Göttingen) and Aguima Aime Bernard LOMPO (CERDI-UCA). This chapter is published in Oxford Economic Papers.

Abstract

This paper provides a large dataset on public sector efficiency using a parametric approach, covering 158 countries of all income levels, over the period 1990-2017. The analysis includes four sectors: education, health, infrastructure, and public administration. We further consider three efficiency indicators regarding the 'Musgravian' tasks for government: allocation, distribution, and stabilization. After computing the efficiency scores for our sample countries, we examine the determinants of government efficiency using a wide range of economic and institutional factors. Our key findings are that trade globalization, factor productivity, and institutional quality seem to be important determinants of total public sector efficiency. The results remain robust to alternative specifications and methods. Finally, we provide additional evidence, by exploring the sensitivity of the main determinants to different country groups, considering the level of economic development, geographical regions, and fragile states.

Keywords: • Public sector efficiency • Panel data • Stochastic Frontier Analysis (SFA)
JEL Classification: C19, E02, E62

5.1 Introduction

Typically associated by economists and political scientists with the size of the state in the economy, government spending helps influence economic conditions to achieve economic and social policy objectives such as stabilization, allocation, and resource redistribution (Musgrave, 1959; Desmarais-Tremblay, 2021). From the middle of the 20th century onwards, public spending in the first industrialized countries — especially social spending — rose sharply, while public revenues increased historically over the same period. Similarly, the structure of public spending in developing countries has changed significantly since the mid-1990s, with a growing focus on social sectors. Prevailing tax rates in industrialized countries today leave little scope for increased taxation, especially in countries with the greatest pressures from aging. Developing countries, on the other hand — generally characterized by strong unequal income distribution, macroeconomic instabilities, poor infrastructure, and high levels of poverty — are facing a huge development challenge, moving fiscal choices to the top of the political agenda for achieving the Sustainable Development Goals.

Governments in both industrialized and developing countries should adopt a much more ambitious fiscal policy, given their scope for maneuver, to better align public policies with their set objectives. In other words, governments need to do 'more' with 'less', especially in the post-Covid era of prolonged recession and monetary policy normalization, where economies around the world are facing budgetary and financing capacity constraints (Hallaert and Primus, 2022). Against this background, there is a growing literature focusing on the utility of public sector activities, with empirical assessments of government efficiency. Essential contributions include, among others, Tanzi and Schuknecht (1997, 2000); Gupta and Verhoeven (2001) or Afonso et al. (2005, 2010). Furthermore, Hauner and Kyobe (2010) compiled a cross-country panel data set on health and education expenditure efficiency, covering 114 countries over the 1980-2006 period, and examined some determinants of the computed scores.

Data are needed to determine the factors that influence and shape public sector efficiency, to help governments to improve their spending efficiency in order to ensure their economic and social role and thus limit the need for painful reforms with high political costs, as currently illustrated by the French context with the pension reform, causing social unrest and protests (The Economist, 2023). In addition, data on public sector efficiency are useful for informing citizens about public sector management, comparing differences in performance between countries, and identifying areas where

improvements can be made. In the literature, Afonso et al. (2005) are one of the first contributions that examine the question of PSE, providing crosssectional data on PSE for 23 industrialized countries over the period 1990–2000. Accordingly, the purpose of this paper is to take advantage of new methods to provide a panel database on public sector efficiency, including a country-year dimension. A secondary motivation is to analyze some robust determinants of efficiency, also exploring those that can explain the efficiency gap between developed and developing countries.

This paper contributes to the literature on public expenditure efficiency on two main grounds. First, while Afonso et al. (2005) compile efficiency scores for 23 industrialized countries over 1990-2000 using non-parametric methods, we provide the same indices using panel data over a longer period, 1990-2017, and include a large sample of 158 countries of all income levels. Furthermore, here efficiency scores are measured through a parametric approach — a Stochastic Frontier Analysis (SFA) following Kumbhakar et al. (2015) — in contrast to the existing literature which generally uses non-parametric approaches, namely the Data Envelopment Analysis (DEA) or the Free Disposal Hull (FDH) method.[1] Indeed, although non-parametric methods have the main advantage of not imposing any specific functional form on data distribution, they have two major limitations. On the one hand, they are very sensitive to random variations in the data and to measurement errors, sample variations, heterogeneity between units, the presence of outliers, and the degrees of freedom. On the other hand, as deterministic methods, they ignore measurement errors as well as any stochastic influence, considering any variation between units as inefficiency (Kumbhakar and Lovell, 2003). Thus, the SFA approach allows considering measurement errors as well as country-independent randomness to disentangle inefficiency resulting from exogenous factors and that resulting from public sector mismanagement. This method is all the more relevant as public expenditure is affected by exogenous shocks such as commodity price shocks or environmental shocks, etc. A few studies using parametric methods are found in the literature. For example, Evans et al. (2000) use the SFA approach to assess health expenditure efficiency for a sample of 191 countries over the period 1993-1997. Likewise, estimating a stochastic frontier model, Grigoli and Kapsoli (2018)

[1]For example, Herrera and Pang (2005) use both the FDH and DEA approach to estimate health and education expenditure efficiency for a sample of 140 developing countries between 1996 and 2002. Afonso et al. (2005) analyze expenditure efficiency in 23 industrialized countries, using the DEA and FDH methods. Hauner and Kyobe (2010) compile a cross-country panel data set on education and health expenditure efficiency for 114 countries between 1980 and 2004, using the DEA approach. Finally, Wang and Alvi (2011) also use the DEA method, with an application to Asian countries.

analyze health expenditure efficiency for 80 emerging and developing countries over 2001-2010.

Second, we provide some descriptive analyses and econometrically correlate the calculated scores with a series of economic and institutional determinants. On the descriptive side, advanced economies report a higher and statistically significant score (0.71) compared to developing countries (0.65). Furthermore, the 10 best-performing are advanced countries, while the 10 worst-performing are developing countries, and are mostly located in Africa. On the econometric side, a Tobit analysis suggests that trade globalization, factor productivity, and institutional quality tend to be associated with greater efficiency. Robustness was checked by controlling for some additional determinants and using alternative measures of expenditure efficiency. In addition, we address endogeneity issues, by re-estimating our baseline model using the system Generalized Method of Moments (GMM) estimator. Finally, we deepen the analysis, by examining our main determinants according to the level of economic development — distinguishing between advanced and developing countries — and geographical regions. First, our data suggest that trade globalization, factor productivity, and institutional quality seem to increase efficiency in both advanced and developing countries, while taxation seems to decrease efficiency in advanced countries. Second, trade globalization, factor productivity, and the level of democracy seem to reduce the efficiency gap between advanced and developing economies. Third, factor productivity and the level of democracy appear to be positively correlated with public expenditure efficiency in all the groups considered (Africa, Asia, Latin America, and Europe), while the positive impact of trade globalization on efficiency seems to be driven by Asian and European countries. Likewise, the negative effect of taxation on efficiency seems to be mainly driven by Latin American and European countries. Finally, government durability seems to promote efficiency in European countries, while it seems to reduce efficiency in fragile states.

We organize the document as follows. The following section defines the conceptual framework for measuring efficiency. Section 5.3 describes the methodology for calculating the scores. Some stylized facts are then reported in Section 5.4. Section 5.5 examines some potential determinants of the calculated scores. Sections 5.6 and 5.7 analyze the robustness and heterogeneity of our main results. The last section concludes.

5.2 Conceptual Framework

Government deficits, particularly in developing and emerging market economies, have grown significantly in recent years (Gnimassoun and Do Santos, 2021). Public finances deteriorated further in the context of the Covid-19 crisis, including in advanced economies, where a number of measures have been introduced to support social policies, leading to a substantial increase in public debt. That said, governments should promote sound fiscal management, given their room for maneuver, to better achieve the targets set. Furthermore, as long argued by the public choice school, given the lack of competition in public services, waste is likely to occur in the public sector, leading to inefficiency (Jackson and McLeod, 1982). Against this background, firstly used to assess firm performance, the concept of efficiency has been progressively extended to the public sector, in order to judge to what extent government spending contributes to the objectives set, in the quest for better public sector management. Indeed, researchers argue that attempts to measure public sector efficiency are not entirely new (Pollitt and Bouckaert, 2011). This literature has expanded considerably in recent years, with major contributions from, among others, Tanzi and Schuknecht, 1997, 2000; Gupta and Verhoeven, 2001; Afonso et al., 2005, 2010 or Hauner and Kyobe, 2010).[2] Conceptually, efficiency implies achieving an objective in an economy of means, i.e., the relationship between the results obtained, and the resources used to achieve them. In other words, greater efficiency is essential to ensure that governments deliver high-quality services to their citizens while using public resources responsibly. Empirically, efficiency scores are derived based on the relative distances of inefficient observations from an ideal frontier, made up of the best-performing units in the sample (see Farrell, 1957). The literature distinguishes between technical and allocative efficiency. The first is defined as the ability of a unit to produce a given set of outputs with minimal inputs, regardless of input prices. The latter measures the ability of a unit to use inputs in optimal proportions given their prices. In this study, we choose the first approach, as estimating allocative efficiency requires information on the price structure of inputs (which, in our context, would be difficult to obtain), while the former requires only quantity data (Lovell, 2000; Afonso and Fernandes, 2008).

Measuring efficiency in organizational units such as the public sector is challenging, as public objectives are usually poorly defined, complex, and multidimensional

[2]Other contributions assess efficiency at the local level (e.g., see Eeckaut et al., 1993; Worthington, 2000; Afonso and Fernandes, 2008).

(M. Lewis, 2015). In other words, public sector performance is a multidimensional concept, sometimes involving hybrid public sector organizations that combine elements of the public and private sectors, thus generating complexity in public management (Jackson, 2011; De Waele et al., 2021). Therefore, the dimensions of the economy that are likely to be really affected by public sector activities need to be rigorously grounded in the literature, to avoid ad hoc indicators that could bias the analysis. Such an exercise is not straightforward, as internationally comparable, relevant, valid, and reliable data are not always available, coupled with measurement difficulties and the potential effects of many external factors. The existing literature has often examined government efficiency in sectors such as education, health, and infrastructure, as public spending in these sectors has been shown to have a significant impact on economic growth, human capital, poverty or inequality, and business conditions (see, among others, Aschauer, 1989; Barro, 1990; Baffes and Shah, 1998; Jung and Thorbecke, 2003; Wilhelm and Fiestas, 2005; Chauvet and Ferry, 2021). In the same vein, the study by Afonso et al. (2005), which we follow in this paper, has attempted to approach the public sector through several dimensions, considering two categories of performance indicators. The opportunity performance includes the following sectors: education, health, infrastructure, and public administration. The Musgravian indicators allow for taking into account the traditional tasks of government, including three dimensions: distribution, stability, and economic performance. We further discuss the relevance of the selected indicators in subsection 5.3.1.

5.3 Methodology

As mentioned above, Public Sector Efficiency (PSE) refers to the relationship between the socio-economic indicators targeted by the government and the public resources used to achieve them. Subsection 5.3.1 describes the socio-economic indicators used in the study (Public Sector Performance —PSP— indices). Next, subsection 5.3.2 discusses the methodology for calculating the efficiency scores.

5.3.1 Public Sector Performance (PSP) Indices

We compute sectoral performance indices from a series of social indicators. For a given country i and j areas of government activity, the PSP is defined as follows:[3]

[3]See Afonso et al. (2005).

$$PSP_i = \sum_{j=1}^{n} PSP_{i,j} \tag{5.1}$$

with $PSP_{i,j} = f(I_k)$. Therefore, an improvement in PSP depends on improving the values of the relevant socio-economic indicators:

$$\Delta PSP_{ij} = \sum_{i=k}^{n} \frac{\delta f}{\delta I_k} * \Delta I_k. \tag{5.2}$$

As mentioned earlier, this study follows Afonso et al. (2005), who attempted to approach the public sector through several dimensions, considering two categories of performance indicators.[4] The first, described as opportunity performance, includes the following sectors: education, health, infrastructure, and public administration. Education and health spending have direct and indirect impacts on both economic growth and poverty or inequality. Health is fundamental to improving population productivity and well-being. Education, in turn, provides skills that increase employment opportunities and incomes, while helping to protect populations from socioeconomic risks (Wilhelm and Fiestas, 2005). Public investment in infrastructure improves business conditions and can affect positively both domestic and foreign investment, which raises employment and growth (Arrow and Kurz, 1969; Aschauer, 1989; Barro, 1990; Baffes and Shah, 1998; Carboni and Medda, 2011). Last but not least, good quality of public administration, characterized by a good judicial system, efficient property rights, and well-functioning markets, can be seen as preconditions for a level playing field in the organization of a society (Afonso et al., 2005), and helps to build conditions for strong and sustained economic growth. The second category, described as 'Musgravian' performance, includes the traditional tasks for government: allocation, distribution, and stabilization. Indeed, the countercyclical role of fiscal policy is to promote macroeconomic stabilization and reduce economic fluctuations. Moreover, redistributive policies in favor of the poorest households also contribute to reducing poverty and inequality (Lindbeck, 1985; Ravallion, 1997; Cornia and Reddy, 1999). Finally, government spending, especially in social sectors, helps make households resilient to external shocks and can prevent them from falling into a poverty trap.

Outcome indicators were selected based on data availability and previous work

[4]Appendix C discusses the limitations of our measure of public sector efficiency and some possible extensions.

(e.g., see Afonso et al., 2005; Herrera and Pang, 2005; Hauner and Kyobe, 2010). The education sector outcome index includes three sub-indicators: public primary enrollment, public secondary enrollment, and expected years of schooling.[5] The output indicators in health are life expectancy at birth and infant mortality rate (per 1000 live births). Following Donaubauer et al. (2016), we calculate an infrastructure sector outcome index using six infrastructure sub-indices, classified into three main groups: transport, communication, and energy. The output indicators in transport are the total length of roads in kilometers, normalized by the country's area, and the number of paved roads as a percentage of total roads. The outcome index for communication includes fixed telephone subscriptions (per 100 people), fixed broadband subscriptions (per 100 people), and faults for 100 fixed telephone lines per year. Three sub-indicators are also considered for the energy sector: the proportion of households with electricity, electric power consumption (in kWh per capita), and electric power transmission and distribution losses (as a percentage of production). Following Afonso et al. (2005), we retain four sub-indicators for public administration: the independence of the judiciary, the quality of property rights, the quality of government, and the level of the shadow economy. On the input side, we consider public expenditure on education (as a percentage of GDP) for the educational sector, public expenditure on health (as a percentage of GDP) for the health sector, public capital stock (as a percentage of GDP) and public-private partnership stock (as a percentage of GDP) for infrastructure, and government final consumption expenditure (as a percentage of GDP) for administration.

As mentioned earlier, we also consider Musgravian indicators, including three sub-indicators: distribution, stability, and economic performance. The outcome indicator for distribution performance is proxied by the Gini index. For the stability sub-indicators, we use the standard deviation of the three-year moving average of GDP growth and inflation. To measure economic performance, we include GDP per capita, GDP growth (10-year average), and unemployment rate (10-year average). We use total public expenditure (as a percentage of GDP) as input for economic stability and performance, and social protection expenditure (as a percentage of GDP) as input for distribution.

Finally, to capture the common features of the performance sub-indicators used, we compute a composite outcome index for each sector, following Anderson (2008).

[5]Qualitative indicators such as PISA (Programme for International Student Assessment) measures could have been considered, but these data are partly available only for OECD countries. Here we do not include them due to our sample size.

This method applies generalized least squares estimators that account for variables with missing data, giving them less weight compared to the principal component analysis (PCA) method, which, moreover, is particularly sensitive to the presence of outliers.[6]

Appendix G describes the set of variables used to compute the efficiency scores and their sources.

5.3.2 Measuring Public Sector Efficiency

Both parametric and non-parametric approaches are used in the literature to estimate efficiency scores. Non-parametric techniques include Free Disposal Hull (FDH) analysis and Data Envelopment Analysis (DEA). These methods impose no restrictions on the distribution of inefficiency and no behavioral hypothesis (profit maximization objective), in contrast to parametric methods which are based on econometric estimation techniques. However, non-parametric approaches, as deterministic methods, ignore measurement errors as well as any stochastic influence, considering any variation between units as inefficiency (Kumbhakar and Lovell, 2000; Kumbhakar and Lovell, 2003). Such an assumption can lead to major estimation biases, as public expenditure is impacted by exogenous shocks (e.g., commodity price shocks, environmental shocks, etc.), which in turn affect public sector performance, irrespective of the resulting efficiency (or inefficiency). Moreover, these methods are very sensitive to random variations in data, measurement errors, sample variations, heterogeneity between units, and the presence of outliers (Fiorentino et al., 2006). Among the non-parametric methods, the DEA approach is commonly used in the literature. A few other studies use the FDH approach (e.g., see some pioneering work: Tulkens and Eeckaut, 1995; Tulkens, 2006). In contrast to the DEA analysis, the latter imposes only slight restrictions on the production technology, while allowing for a comparison of efficiency between units (see Bauer, 1990 and Seiford and Thrall, 1990 for further discussion on the merits of these methods). However, as it remains a non-parametric approach, it does not allow for random factors unrelated to efficiency to be considered.[7]

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[6]We use the Stata procedure proposed by Schwab et al. (2020). Nevertheless, for robustness purposes, we compare the composite indicators obtained following Anderson (2008) with those obtained using the PCA method. Overall, in our case, the two approaches lead to very similar results. For example, for the four sectors — education, health, infrastructure, and administration — the Pearson correlations are 95%, 100%, 18%, and 96%, respectively.

[7]Establishing the relative efficiency of municipal spending in Belgium, Eeckaut et al. (1993) compare results of the FDH analysis with those of the DEA, and conclude that the assumption

Given the limitations of non-parametric methods, parametric techniques are often used in the literature. The latter use a stochastic production function — a Stochastic Frontier Analysis (SFA) — and allow the error term to have two components: a negative term which measures inefficiency and an idiosyncratic error which captures idiosyncratic shocks (Aigner et al., 1977; Meeusen and van Den Broeck, 1977). However, these methods require strong hypotheses on data distribution. The most commonly used distributions are semi-normal, exponential, and truncated normal.

5.3.3 Computation of the efficiency scores

Among the parametric methods, those of Kumbhakar (1991), Lee and Schmidt (1993), and Battese and Coelli (1992) have been widely used in the literature, especially on panel data. Here we adopt a more recent method, that of Kumbhakar et al. (2015), for two main reasons. First, the latter approach allows distinguishing unobserved heterogeneity across units from inefficiency, unlike older methods, notably those mentioned above. This, therefore, improves the analysis, by capturing countries' heterogeneous characteristics such as their level of development, structural or institutional features, etc. Second, unlike Greene (2005b) and Kumbhakar and Wang (2005) who merely separate individual heterogeneity from stochastic noise, Kumbhakar et al. (2015) propose a further decomposition of inefficiency by distinguishing between persistent (long-run) and transitory or variant (short-run) inefficiency. This makes it possible to take into account inefficiency resulting from structural characteristics that persist over time and those resulting from short-term features.

We now describe the conceptual framework described in Kumbhakar et al. (2015) to compute the efficiency scores. The econometric model is specified as follows:

$$Y_{it} = \alpha_0^* + f(x_{it};\beta) + v_{it} - u_{it}^* - \eta_i^* \tag{5.3}$$

with:

$$\alpha_0^* = \alpha_0 - E(\eta_i) - E(u_{it}) \tag{5.a}$$

$$u_{it}^* = u_{it} - E(u_{it}) \tag{5.b}$$

$$\eta_i^* = \eta_i - E(\eta_i) \tag{5.c}$$

---

of convexity imposed by the DEA distorts the results of the efficiency analysis. Furthermore, in a study on public expenditure efficiency in developing countries, Gupta and Verhoeven (2001) found that the FDH analysis is strongly influenced by changes in the number of output indicators, highlighting the sensitivity of the results of this method to variations in the dataset.

where Y_{it} is a measure of government performance, proxied by the public sector performance index, in country i in year t. X_{it} is the vector of inputs. The model consists of three steps. First, we estimate Equation 5.3 using a standard random effect regression. We thus obtain consistent measure of β and predicted values of η_i^* and u_{it}^*. Second, persistent technical inefficiency is computed using the predicted values of η_i^*. Then, persistent technical inefficiency can be obtained from:

$$\eta_i = Max(\eta_i^*) - \eta_i^* \tag{5.4}$$

Finally, persistent technical efficiency (PTE) is calculated from exp(-η_i), then residual technical efficiency (RTE) is computed in the last step. To do so, we go back to the first step and obtain the residues (i. e, $Y_{it} - f(x_{it};\beta)+\eta_i=\alpha_0+v_{it} - u_{it}$). Assuming that v_{it} is iid, i.e., $v_{it} \sim$ N(0, σ_v^2), and u_{it} is iid, i.e., $u_{it} \sim N^+(0, \sigma^2)$, we can maximize the log-likelihood function for the next standard normal stochastic frontier model for the grouped data:

$$r_{it}=\alpha_0+v_{it} - u_{it} \tag{5.5}$$

where $r_{it} = y_{it} - f(x_{it};\beta)+\eta_i$. In practice, we use the estimated values of β and η_i to define r_{it}. In other words, the sampling variability associated with β and η_i is ignored. Using the standard boundary model on Equation 5.4, we obtain estimates of α_0, σ_v^2 and σ^2. Following Jondrow et al. (1982), we estimate residual technical inefficiency, $_{it}$, based on the estimated residues, $(v_{it} - u_{it})$. Thus, we can use $_{it}$ to calculate residual time-varying technical inefficiency defined as RTE = exp(-$_{it}$), and then estimate the overall technical efficiency (OTE) defined as the product of PTE and RTE (OTE = PTE * RTE).

5.4 Stylized facts

This section reports some stylized facts and descriptive statistics of the calculated scores, for 158 countries, over the period 1990-2017. By construction, the calculated scores can range from 0 to 1 (best performance). We report an average score of 0.66 over the sample and the period considered. Figure 6.1 displays the average scores, distinguishing between advanced, emerging, and low-income countries. On average, advanced countries are the closest to their efficiency frontier, with a score of 0.71, while the average efficiency scores reported for emerging and low-income

countries are 0.67 and 0.64, respectively.[8] Furthermore, statistical tests suggest that the differences in efficiency between country groups are statistically significant. Last, Appendix F presents country rankings based on average efficiency scores. On the one hand, the 10 best-performing countries report scores ranging from 0.80 to 0.72 and are all advanced economies. On the other hand, the bottom 10 ranked countries report scores between 0.48 and 0.60, and most of them are African economies. Finally, Figure 5.2 provides some highlights. Indeed, we observe a high concentration of the worst-performing countries in Africa, i.e., those with an average score below the sample average, while the best-performing countries are almost exclusively located in North America, Europe, and the South Pacific.

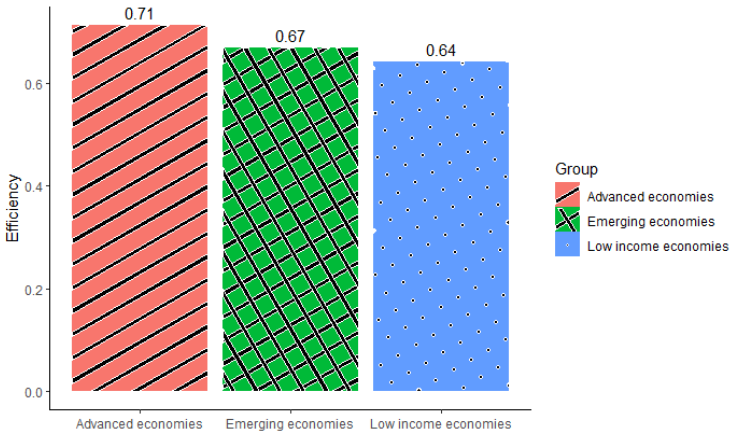

Figure 5.1: Average government efficiency scores (1990-2017)

Source: Authors' calculations. **Notes:** The statistics cover 158 countries over 1990-2017, including 35 advanced, 37 emerging, and 86 low-income economies.

[8]For instance, a score of 0.66 for a given country means that the latter could, on average, increase its efficiency by 34%, for the same level of resources used to achieve the objectives set.

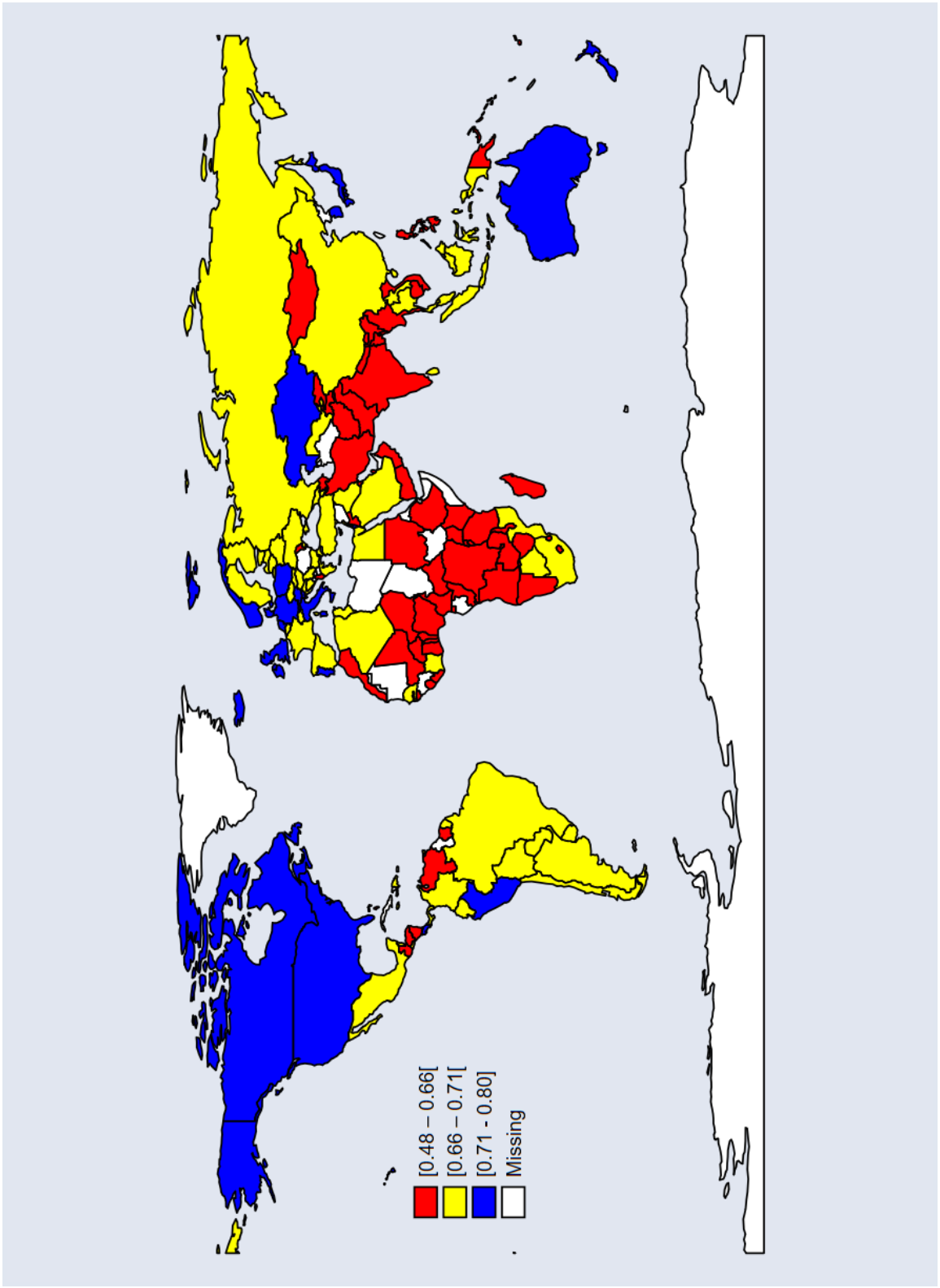

Figure 5.2: Average efficiency scores around the world (1990-2017)

Source: Authors' calculations. **Notes:** This map displays the distribution of the average efficiency scores in the sample. The statistics cover 158 countries of all income levels over 1990-2017. The distribution ranges have been harmonized with the mean scores in the sample to improve the readability of the map. Countries in red register an average score below the sample average (0.66). Those in the yellow report a score above the sample average, but below the average for advanced countries (0.71). Finally, those in blue have a score above or equal to the average for developed countries.

5.5 Determinants of Public Sector Efficiency

5.5.1 Theoretical predictions

This section examines the influence of some factors on government expenditure efficiency, notably: trade globalization, factor productivity, tax revenues, institutional quality, and population density. We further discuss the expected sign of the considered variables before providing some empirical evidence in the next subsection.

The effects of trade globalization on public sector efficiency may be ambiguous. On the one hand, globalization can increase the overall performance of the economy, by promoting the transfer of skills, knowledge, and technologies (Hauner and Kyobe, 2010). Technology transfer in turn may foster technological progress and the adoption of more efficient production techniques and systems that can promote efficient public sector management. In addition, knowledge diffusion resulting from trade globalization — including in the public sector — can contribute to strengthening domestic knowledge and public administration capacities. On the other hand, globalization could indirectly affect government efficiency through taxation, with ambiguous effects. For instance, Schulze and Ursprung (1999) document the literature on the link between globalization and fiscal policy, distinguishing two effects. The efficiency effect refers to the fact that in the context of liberalization, countries wishing to attract more international capital may have an incentive to reduce their domestic tax, thereby lowering their capacity to provide public goods. The compensation effect assumes that globalization, being likely to increase income inequalities, may raise the demand for social insurance programs, which in turn causes an upward shift in taxation and spending levels.[9] That said, whether globalization affects domestic tax revenues positively or negatively, the effect of taxation on expenditure efficiency is itself ambiguous (the next paragraph details this point).

Tax revenue mobilization is a critical issue for both advanced and developing economies. Indeed, population aging faced by advanced economies imposes public spending to be more and more oriented towards social sectors, sometimes raising the fear of a situation of fiscal stress (Leeper and Walker, 2011). On the other hand, developing countries — which are heavily dependent on external financial flows — are implementing reforms to improve tax revenue mobilization, in a context of increasing trade liberalization over the past decades that has led to a loss of tariff revenues. Last, domestic taxation allows these countries to finance their development

[9] See also Dreher et al. (2008b).

and depend less on external financing, to support the core functions of an effective state, create the conditions for economic growth, and encourage governments to be more responsive and accountable for their decisions. From a theoretical point of view, Barro (1990) highlights a non-linear relationship between government spending and economic growth, conditioned by the level of taxation. In this model, an increase in taxes allows for the financing of productive public spending, whereas taxation generates distortions in the economy beyond a certain threshold — in the spirit of Laffer — resulting in a decline in the productivity of private capital. Therefore, in light of this analysis, the effect of taxation on government efficiency may be ambiguous, and potentially driven by a threshold effect. Empirically, for a panel of over 100 countries, Chan et al. (2017) find that value-added taxes enhance the effect of government spending efficiency on economic growth, while for OECD countries over the period 2003-2017, Afonso et al. (2021) show that expenditure efficiency is negatively associated with taxation.

Better factor productivity may reflect technical progress, greater organizational, and technological innovation, or more efficient use of factors of production. As discussed earlier, factors such as technological innovation or technical progress can encourage the adoption of techniques and systems aimed at improving efficiency in the economy, including in public sector management. In addition, productivity gains from improved factors of production can generate additional resources for the government, which may be reallocated to the most productive sectors. Finally, as productivity gains are important components of the growth process (Bosworth and Collins, 2003), increasing factor productivity can help create a more dynamic economy and improve household welfare, especially if the resulting productivity gains are pro-poor.

Institutional quality (approximated here by the level of democracy and government durability) is an important determinant of public sector management. A better institutional framework — such as good governance or stronger democracy — encourages governments to justify their control of the state machinery, promotes greater transparency in the budget approval process and budget regulation, and provides a comprehensive overview of public sector activity. This in turn helps to limit the risk of fraud or misappropriation of public funds. On the other hand, government durability, i.e., the ability of a government to provide consistent policies and services to its citizens over a long period of time, may also be an important determinant of expenditure efficiency, since political volatility is likely to complicate coherent budget planning and undermine efficiency (Hauner and Kyobe, 2010). However,

this argument needs to be nuanced as government durability in autocratic or less democratic regimes may reflect poor institutions, with potentially adverse effects on efficiency, especially as it has been observed that countries with poorer governmental and institutional performance are often those with poor economic performance (Acemoglu et al., 2008b).

Last, Hauner and Kyobe (2010) argued that a higher population, by reducing the cost of public service provision through economies of scale, may improve public sector efficiency. Our reading is that other channels may play a role, making the relationship complex. On the one hand, higher population density can also contribute to pressure on natural resources or public infrastructure such as public services and housing. For instance, in areas where public infrastructures or socio-economic opportunities are limited, this, in turn, can lead to social tensions or conflicts among communities. On the other hand, population density could play an indirect role through the taxation channel, as income or sales taxes may be more difficult to administer in sparsely populated areas (Riezman and Slemrod, 1987). But, as discussed earlier, the link between taxation and expenditure efficiency is itself not clear-cut.

Trade globalization is measured by the KOF index (Dreher, 2006; Gygli et al., 2019), and ranges from 1 to 100 (higher degree of globalization). Total factor productivity measures the share of output that is not explained by the quantity of inputs used in production, and is from the Penn World Table (PWT). Tax revenues — excluding social contributions and natural resources — are from the UNU-WIDER Government Revenue Dataset. The level of democracy is captured by an index varying between 0 (least democratic) and 10 (most democratic), extracted from the Freedom House database. Government durability measures the number of years since the last change in the political regime and comes from the Polity IV dataset. Population density is the mid-year population divided by the area in square kilometers and comes from the World Bank's WDI (World Development Indicators) database.

5.5.2 Empirical results

We conduct econometric estimations through a Tobit analysis, as our dependent variable is censored, i.e., it only takes values between 0 and 1 (the choice of this model is based on previous studies, e.g., Afonso et al., 2010; Afonso and Aubyn, 2006). We regress the expenditure efficiency scores, δ, on the set of potential drivers, Z, as follows:

$$\delta_{i,t} = f(Z_{i,t}) + \varepsilon_{i,t} \tag{5.6}$$

The main estimates are reported in Column [1] of Table 5.1. We find a positive and statistically significant effect of trade globalization, factor productivity, the level of democracy, and government durability on government efficiency, while there is a negative and statistically significant influence of tax revenues on the efficiency scores.

5.6 Robustness

5.6.1 Additional variables

In Columns [2]-[9] of Table 5.1, we augment our baseline model by adding some additional controls. This allows us, on the one hand, to test the robustness of the previous results and, on the other hand, to examine some other potential determinants. In Column [2], instead of the trade globalization index used in the main model, we rely on an alternative measure, that is, the sum of exports and imports as a percentage of GDP. In Columns [3]-[10], we include the following variables: financial development, inflation, government fragmentation, corruption control, ethnic fractionalization, fiscal rules, fiscal councils, and fiscal responsibility law, respectively.[10] Overall, the new estimates support our main findings: there is a positive and statistically significant influence of trade globalization, factor productivity, and institutional quality on expenditure efficiency. However, the negative effect of tax revenues on expenditure efficiency does not appear to be robust. Finally, regarding the additional controls, our data suggest a positive and statistically significant effect of financial development, government fragmentation, corruption control, and fiscal institutions — notably fiscal rules and fiscal councils — on expenditure efficiency.

Appendix A.2 provides some additional robustness by considering alternative measures of public expenditure efficiency. The results remain stable.

[10] In Appendix A.1, we discuss the theoretical relationship between public expenditure efficiency and the additional controls.

Table 5.1: Public Sector Efficiency (PSE) and Determinants

Dependent: PSE	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Trade globalization	0.0010***		0.0008***	0.0009***	0.0011***	0.0005**	0.0011***	0.0008***	0.0009***	0.0010***
	(0.0002)		(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Factor productivity	0.1168***	0.1228***	0.1055***	0.1321***	0.1274***	0.1063***	0.1245***	0.1099***	0.1174***	0.1169***
	(0.0115)	(0.0119)	(0.0118)	(0.0124)	(0.0127)	(0.0145)	(0.0123)	(0.0115)	(0.0115)	(0.0115
Tax revenues (Log.)	-0.0125**	-0.0098	-0.0226***	-0.0109	-0.0141**	-0.0068	-0.0042	-0.0140**	-0.0131**	-0.0126**
	(0.0064)	(0.0065)	(0.0072)	(0.0072)	(0.0070)	(0.0070)	(0.0065)	(0.0063)	(0.0064)	(0.0064)
Democracy	0.0080***	0.0091***	0.0079***	0.0079***	0.0067***	0.0093***	0.0062***	0.0071***	0.0079***	0.0080***
	(0.0012)	(0.0013)	(0.0012)	(0.0013)	(0.0013)	(0.0016)	(0.0013)	(0.0012)	(0.0012)	(0.0012)
Government durability	0.0004***	0.0006***	0.0001	0.0005***	0.0003***	0.0001	0.0004***	0.0003**	0.0003***	0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Population density (Log.)	-0.0036	-0.0003	-0.0062*	-0.0020	-0.0040	-0.0023	-0.0028	-0.0039	-0.0038	-0.0036
	(0.0031)	(0.0030)	(0.0033)	(0.0033)	(0.0032)	(0.0033)	(0.0033)	(0.0030)	(0.0031)	(0.0031)
Trade openness (Log.)		0.0139**								
		(0.0057)								
Financial development			0.0646***							
			(0.0185)							
Inflation				0.0004						
				(0.0004)						
Government fragmentation					0.0143**					
					(0.0070)					
Corruption control						0.0003**				
						(0.0002)				
Ethnic fractionalization							-0.0042			
							(0.0177)			
Fiscal rules								0.0216***		
								(0.0040)		
Fiscal councils									0.0125*	
									(0.0070)	
Fiscal Responsibility Law										-0.0001
										(0.0054)
Observations	2101	2062	2031	1961	2023	1519	1737	2101	2101	2101

Notes: This table reports the correlations between the calculated scores and the main potential determinants, from a Tobit analysis. Results from the main model are reported in Column [1]. Columns [2]-[10] include some additional variables. Standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.6.2 Endogeneity concerns

Our main results are estimated from a Tobit regression, without taking into account endogeneity issues. For instance, there may be a reverse causality between factor productivity and efficiency, as the least efficient governments may implement policies aimed at better organizational or technological innovation, or more efficient use of factors of production for greater efficiency. Likewise, greater efficiency may lead to a reallocation of expenditure to other sectors of the economy, which could indirectly affect the tax system, given the close relationship between public expenditure and tax revenues. Finally, institutional factors can be correlated with aspects such as culture, customs, and ideological or religious orientation, leading to an omission bias. To deal with potential endogeneity in the determinants examined, we re-estimate our main model using the Blundell and Bond (1998) two-step system-GMM estimator. This method allows for addressing endogeneity, using lagged differences and levels of explanatory variables as instruments while accounting for the persistence of government efficiency and controlling for the Nickell bias (Nickell, 1981) that arises in a dynamic panel model. The new results are reported in Column [2] of Table 5.2.[11] We find robust evidence of the positive and significant effect of trade globalization, productivity, and institutional quality on efficiency. In addition, the Hansen test does not reject the hypothesis of instrument validity. Likewise, the AR (1) test for the absence of autocorrelation of the first-order error term and the AR (2) test for the absence of autocorrelation of the second-order error term do not raise concerns about the validity of our estimates.

5.7 Heterogeneity

Table 5.3 expands the analysis by replicating the main model (Column [1] of Table 5.1) for advanced (Column [2]) and developing countries (Column [3]). Evidence suggests a positive and statistically significant influence of trade globalization, factor productivity, and the quality of institutions on efficiency for both advanced and developing countries. Moreover, estimates suggest a negative and statistically significant effect of taxation on efficiency in advanced countries — in line with Afonso et al. (2021) — while this factor does not seem to matter for developing economies. Finally, in the last column (Table 5.3), we deepen the analysis by examining, among the determinants of the main model, those that could explain the

[11] See also Ullah et al. (2018) for GMM advantages.

efficiency gaps between advanced and developing economies. The efficiency gap is calculated as the difference between the average efficiency in advanced countries and the annual efficiency in developing ones. Thus, an increase in this variable reflects a higher efficiency gap in favor of advanced countries. Results suggest that trade globalization, factor productivity, and the level of democracy seem to reduce the efficiency gap between advanced and developing economies. Finally, Appendix B examines the main determinants according to geographical regions and fragile states. We find that factor productivity and the level of democracy seem to be positively correlated with public expenditure efficiency in all the groups considered (Africa, Asia, Latin America, and Europe), while the positive impact of trade globalization on efficiency seems to be driven by Asian and European countries. Likewise, the negative effect of taxation on efficiency seems to be mainly driven by Latin American and European countries. Finally, while government durability seems to promote efficiency in European countries, the opposite effect is observed in fragile states.

5.8 Conclusion

A large body of literature has examined public sector efficiency. Unlike most of the contributions, we provide a large panel dataset on government efficiency using a parametric approach, referring to Kumbhakar et al. (2015). That is, for a panel of 158 countries of all income levels over 1990-2017, we compute efficiency scores for four sectors: education, health, infrastructure, and public administration. We also include three efficiency indicators for the Musgravian tasks for government: allocation, distribution, and stabilization. Next, the study empirically examines some determinants of the scores obtained, considering economic and institutional factors. A Tobit analysis suggests that trade globalization, factor productivity, and institutional quality seem to be positively associated with public sector efficiency. Robustness was checked by using alternative measures of government efficiency, additional controls, and the system-Generalized Method of Moments (GMM) estimator. Furthermore, we examine heterogeneity according to the level of economic development and geographical regions, drawing some conclusions. First, estimates suggest that the positive effect of trade globalization, factor productivity, and institutional quality on efficiency appears to hold in both advanced and developing economies, while tax revenues seem to be negatively associated with government efficiency in advanced economies, but do not seem to count for developing countries. Second, trade globalization, factor productivity, and the level of democracy seem to reduce the efficiency gap between advanced and developing economies. Third, regarding

Table 5.2: Robustness: GMM estimator

Dependent: PSE	Tobit estimates	GMM estimates
	[1]	[2]
Trade globalization	0.0010***	0.0002**
	(0.0002)	(0.0001)
Factor productivity	0.1168***	0.0191**
	(0.0115)	(0.0091)
Tax revenues (Log.)	-0.0125**	-0.0019
	(0.0064)	(0.0033)
Democracy	0.0080***	0.0020**
	(0.0012)	(0.0008)
Government durability	0.0004***	0.0001*
	(0.0001)	(0.0001)
Population density (Log.)	-0.0036	0.0003
	(0.0031)	(0.0011)
Lagged Expenditure efficiency (PSE)		0.7190***
		(0.0482)
Observations	2101	2019
Number of groups/instruments		89/78
AR(1) /AR(2) p-values		0.000/0.116
Hansen overidentification test p-value		0.297

Notes: This table examines the robustness of our main determinants, using a two-step system-GMM (Column [2]). The results of the main model, estimated from a Tobit analysis, are reported in Column [1]. Standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

geographical areas, our data suggest that factor productivity and the level of democracy appear to be positively correlated with public expenditure efficiency in all the groups considered (Africa, Asia, Latin America, and Europe), while the positive impact of trade globalization on efficiency seems to be driven by Asian and European countries. Likewise, the negative effect of taxation on efficiency seems to be mainly driven by Latin American and European countries. Finally, government durability seems to increase efficiency in European countries, while it seems to play negatively in fragile states.

Some policy implications can be drawn from our main findings. First, governments should better grasp the benefits of trade globalization, by promoting better transfer

of skills, knowledge, and technology into the domestic economy, as these factors appear to be important for public sector efficiency. Similarly, policies aimed at promoting factor productivity, such as technological innovation or human capital formation, may lead to more efficient public sector management. Third, governments should further mobilize their efforts to improve the quality of their institutions and promote better fiscal governance and transparency in the management of public funds, through, among others, better supervision of budget execution, better control of financial and accounting reports, and better monitoring of public expenditure. Finally, some important questions remain for future research. For instance, it would be interesting to examine the spillover effects of government efficiency in neighboring countries — using for example a spatial econometric approach — or to conduct an in-depth analysis of the impact of fiscal reforms and frameworks on government efficiency.

A Robustness

A.1 Additional variables

In this section, we discuss the theoretical relationship between public expenditure efficiency and the additional controls included in Columns [3]-[10] of Table 5.1 of the main manuscript: financial development, inflation, government fragmentation, corruption control, ethnic fractionalization, and fiscal institutions (fiscal rules, fiscal councils, and fiscal responsibility law).[12]

A strong financial system promotes financial inclusion and better mobilization of tax revenues (Oz-Yalaman, 2019; Gnangnon, 2021; Santoro et al., 2022; Apeti and Edoh, 2023; Bambe, 2023), allowing countries, especially those in the developing world, to finance their economies and be less dependent on external sources of financing. Additionally, by promoting access to credit and investment by households and firms,

[12]The Financial Development Index measures the level of development of financial institutions and markets in terms of depth, access, and efficiency and is from the IMF Financial Development Index Database. Government fragmentation measures the probability that two deputies picked at random among from the government parties will be of different parties, and is from the Database of Political Institutions (DPI). Corruption control ranges from 0 to 100, where higher values are better, and is from the Worldwide Governance Indicators database. Ethnic fragmentation is taken from Drazanova (2019) and ranges from 0 (total homogeneity) to 1 (total heterogeneity). Data related to fiscal rules are extracted from the IMF Fiscal Rules Dataset. The fiscal rules variable is measured by a dummy equal to 1 when a country i has adopted a fiscal rule in year t, and zero otherwise. Fiscal councils and fiscal responsibility law which come from Fiscal Council Dataset and IMF Fiscal Rules Dataset respectively are measured in the same way.

financial development can be an important determinant of economic growth (e.g., see De De Gregorio and Guidotti, 1995; Khan and Senhadji, 2000).

By reducing the predictability of the business cycle, inflation can discourage investment, or by generating a loss of purchasing power for households, worsening their conditions (Bambe et al., 2022). On the other hand, an inflation surprise can help support economic activity.

Institutional factors such as the control of corruption can be an important determinant of government budget management, as corruption leads to the misuse of public funds. Government fragmentation may also influence public sector management. For instance, Kontopoulos and Perotti (1999) find that fragmentation tends to be associated with larger expenditures in OECD countries, since the most important representatives of individual spending interests in European governments are spending ministers. Similar results were found in other studies (e.g., see Edin and Ohlsson, 1991; Borrelli and Royed, 1995; Franzese, 2000; Volkerink and De Haan, 2001; Balassone and Giordano, 2001; Artés and Jurado, 2018). However, other scholars fail to find any statistically significant effect from government fragmentation (De Haan and Sturm 1994, 1997; Harrinvirta and Mattila, 2001; Ricciuti, 2004).

Substantial literature, early examples being Canning and Fay (1993) and Mauro (1995), considers ethnic fragmentation to have a significant impact on governmental activities and institutional quality. For example, according to Easterly and Levine (1997), Africa's strong ethnic fragmentation explains much of its characteristics such as economic growth, political instability, or poor infrastructure. La Porta et al. (1999) argued that ethnic fragmentation may reduce the quality of government by increasing the cost of public services and benefits, especially due to communication problems.[13] Therefore, one may expect a negative effect of ethnic fragmentation on efficiency.

Last, fiscal institutions such as fiscal rules or fiscal councils are aspects that might matter for public expenditure efficiency. Since the 1990s, fiscal rules have spread considerably around the world and are increasingly shaping fiscal choices. Several studies examining the effects of fiscal rules suggest that they promote fiscal discipline (Debrun et al., 2008; Combes et al., 2018; Asatryan et al., 2018; Caselli and Reynaud, 2020; Caselli and Wingender, 2021) economic growth (Afonso and Jalles, 2013),

[13]A large literature on U.S. localities also documents a negative correlation between ethnic fragmentation and the provision of public goods, participation in social activities, trust, and economic success (e.g., see Alesina et al. 1996; 1999a; 2000; 2002).

mitigate the pro-cyclicality of fiscal policy (Combes et al., 2017), improve the credibility of countries in international markets (Thornton and Vasilakis, 2018), or allow constraining political budget cycles (Gootjes et al., 2021). Fiscal discipline, through deficit or debt reduction, can be achieved by better tax revenue mobilization or by reducing public expenditure. Governments that choose the first option — as accountability and willingness to pay taxes are linked to the quality of public goods provided to taxpayers — should be more concerned with managing public resources to achieve the highest possible outcomes. However, as shown by Asatryan et al. (2018), the disciplining effect of fiscal rules is more likely to stem from the reduction in public spending, as the taxation channel is not statistically significant. Fiscal austerity can affect the composition of expenditure, leading either to a greater reduction in current expenditure or a greater reduction in public investment. The literature on the composition effect of fiscal rules suggests that they tend to protect productive or growth-enhancing spending, in particular public investment (e.g., see Ardanaz et al., 2021). Furthermore, Castro (2011) and Afonso and Jalles (2013) provide evidence that fiscal rules foster economic growth, suggesting that better outcomes could be achieved with the same or fewer public resources. More specifically, the reduction in resources, by limiting the possibilities of debt financing within the framework of fiscal rules, leads governments to reallocate expenditure to productive sectors, i.e., to use less public resources efficiently to achieve better outcomes. Finally, institutions such as independent fiscal councils or fiscal responsibility laws — aimed at strengthening commitments to sustainable public finances or monitoring fiscal aggregates — are also an important factor in public sector management.

A.2 Alternative measures of public sector efficiency

In this section, we check the robustness of our main results in three ways. In Column [2] of Table A1, we re-estimate our efficiency scores following Greene (2005b). Indeed, the model proposed by Kumbhakar et al. (2015) that we use to estimate our efficiency scores has the advantage, in addition to taking into account unobserved heterogeneity across countries, of breaking down inefficiency into persistent (long-term) and transient (short-term) inefficiency, which requires a two-stage estimation procedure. Although Greene (2005b)'s approach does not allow for this decomposition of inefficiency, it does allow for unobserved heterogeneity across countries and offers a one-step specification model, allowing greater flexibility in the econometric procedure. In Column [3] (Table A1), we further exploit a 'subjective' approach of well-being for robustness purposes. More specifically, among

the outcome indicators for economic performance, we replace GDP per capita with a happiness measure. Economic performance, therefore, includes happiness, GDP growth (10-year average), and unemployment rate (10-year average). The happiness index is based on how respondents feel about their well-being, the best possible life for them being a score of 10 and the worst, 0.[14] Finally, a number of studies in the literature on public expenditure efficiency consider only education, health, and public infrastructure (see, among others, Gupta and Verhoeven, 2001; Hauner and Kyobe, 2010; Grigoli and Kapsoli, 2018). As discussed earlier, our approach follows Afonso et al. (2005) and tries to assess the overall efficiency of the public sector, considering not only the three sectors mentioned above but also public administration and the Musgravian tasks of the government. Nevertheless, for robustness, In Column [4] (Table A1) we re-estimate the efficiency scores only from the three sectors (education, health, and public infrastructure), considering the same inputs as in the main model. New estimates suggest a positive, statistically significant, and robust effect of trade globalization, factor productivity, and institutional quality on expenditure efficiency. Similarly, the effect of tax revenues on expenditure efficiency remains negative, statistically significant, and robust.

B Heterogeneity

Some countries may have some degree of geographical, cultural, economic, or institutional similarities. Since these factors can lead to cross-sectional dependencies in government efficiency, one might ask whether our main determinants are sensitive to geographical regions. Hence, in Columns [2]-[5] of Table B1, we examine the main determinants by considering different geographical areas. Furthermore, our full sample includes 20 fragile states, i.e., countries classified by the IMF as having characteristics that significantly undermine their economic and social performance, with weak governance, limited administrative capacity, chronic humanitarian crises, persistent social tensions, and, often, violence or the legacy of armed conflict or civil war. In Column [6] (Table B1) we examine whether the determinants of the main model also matter for public expenditure efficiency in these countries. The results reveal some characteristics of heterogeneity in the main determinants considered. First, factor productivity and the level of democracy appear to be positively correlated with public expenditure efficiency in all the groups considered. Second, the

[14]Data publisher's source: Gallup World Poll surveys (life evaluation question): https://ourworldindata.org/happiness-and-life-satisfaction.

positive impact of trade globalization on efficiency seems to be driven in particular by Asian and European countries. Third, the negative effect of taxation on efficiency seems to be mainly driven by Latin American and European countries. Fourth, while government durability seems to favor efficiency in European countries, the opposite effect is observed in fragile states.

C Limitations and possible extensions

This section briefly discusses the merits and shortcomings of the indicators used in our study. As mentioned in the main manuscript, measuring efficiency in organizational units such as the public sector is challenging, as government objectives are usually poorly defined, complex, and multidimensional. The choice of indicators and dimensions of public sector performance in this study is based on existing literature, notably Afonso et al. (2005), who attempt to approach the public sector through several dimensions, by considering two categories of performance indicators. The opportunity performance includes the following sectors: education, health, infrastructure, and public administration. The Musgravian indicators allow for taking into account the traditional tasks of government, including three dimensions: distribution, stability, and economic performance. As discussed in the main manuscript, education, health, and infrastructure are dimensions affected by the size of government, as public spending in these sectors has been shown to have a significant impact on economic growth, the reduction of poverty and inequality, and business conditions (see, among others, Aschauer, 1989; Barro, 1990; Wilhelm and Fiestas, 2005; Chauvet and Ferry, 2021). Although the education indicators used in this study only take into account public schools, it can be assumed that country-specific characteristics may also be relevant. We believe that these factors are to some extent taken into account in our approach to calculating efficiency scores, which is based on Kumbhakar et al. (2015), as the latter allows distinguishing unobserved heterogeneity across units from inefficiency. Another limitation of the analysis is that the information we have does not allow for taking into account the amount of infrastructure or hospitals built by private companies. Next, regarding public administration, there may be other agencies, institutions, or authorities which, although in the public domain, operate with an independent budget and autonomous management. In the same vein, factors such as the independence of the judiciary, the quality of the government, or the size of the shadow economy are strongly correlated to long-term institutional factors or to the overall performance of the economy. Given these limitations, and the potential shortcomings of the Musgravian indicators, for robustness purposes,

we have re-estimated the efficiency scores only from three sectors (education, health, and public infrastructure) and considering the same inputs as in the main model. The results reported in Column [4] of Table A1 support our baseline model, which includes administration and the Musgravian indicators. In other words, the results of the baseline model scores do not seem to be very sensitive to changes in the measurement of certain outcome indicators. Nevertheless, we expect that over time, the overall measures of government performance will be refined, by taking into account factors not included in this analysis, to better address the shortcomings of this study.

E Government efficiency trends from 1990 to 2017

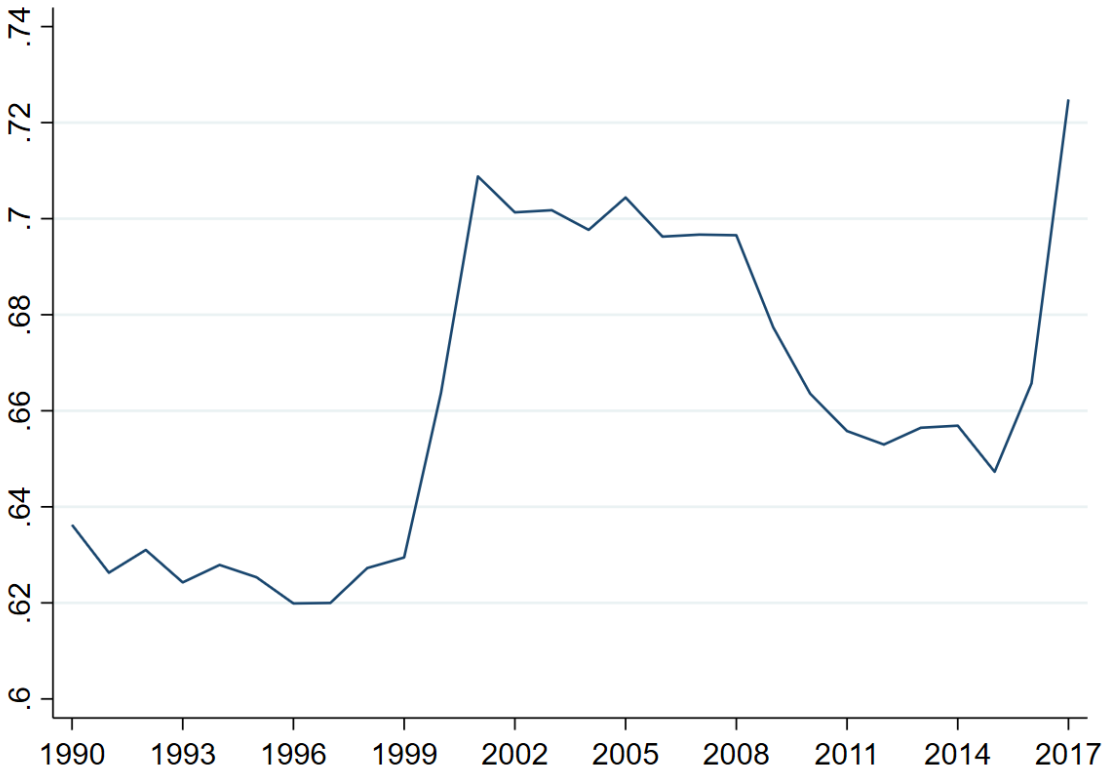

Figure E 1: Overall public sector efficiency

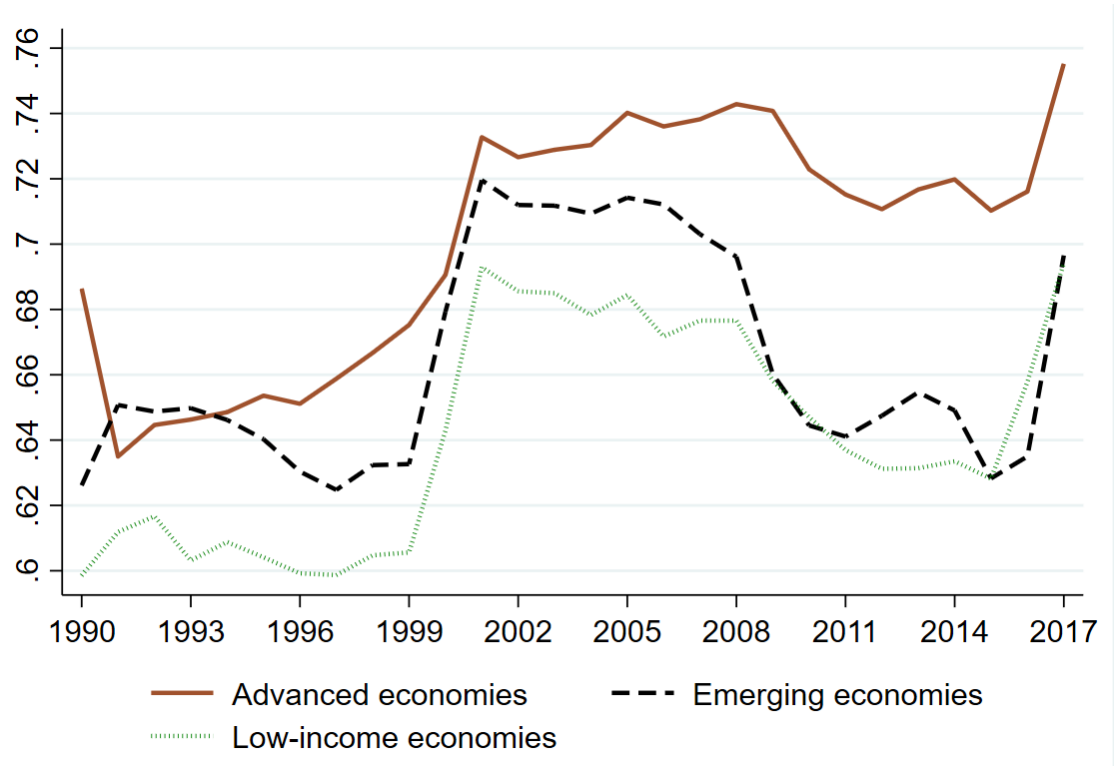

Figure E 2: Public sector efficiency by income group

Table 5.3: Heterogeneity: Advanced versus developing countries

Dependent: PSE	Total sample	Advanced	Developing	Efficiency gap
	[1]	[2]	[3]	[4]
Trade globalization	0.0010***	0.0028***	0.0007***	-0.0008***
	(0.0002)	(0.0004)	(0.0002)	(0.0002)
Factor productivity	0.1168***	0.2520***	0.1019***	-0.1077***
	(0.0115)	(0.0324)	(0.0127)	(0.0136)
Tax revenues (Log.)	-0.0125**	-0.0919***	-0.0063	0.0077
	(0.0064)	(0.0255)	(0.0066)	(0.0070)
Democracy	0.0080***	0.0102	0.0079***	-0.0081***
	(0.0012)	(0.0077)	(0.0013)	(0.0014)
Government durability	0.0004***	0.0013***	-0.0001	0.0001
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Population density (Log.)	-0.0036	0.0005	-0.0055	0.0053
	(0.0031)	(0.0078)	(0.0040)	(0.0042)
Observations	2101	626	1475	1475

Notes: This table reports the correlations between the calculated scores and the main potential determinants, from a Tobit analysis, and distinguishes between advanced (Column [2]) and developing countries (Column [3]). Results from the full sample are reported in Column [1]. The last column re-estimates the main model, using the efficiency gap between advanced and developing countries as the dependent variable. An increase in the dependent variable reflects an efficiency gap in favor of advanced countries. Standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A1: Robustness: Alternative PSE measures

Dependent: PSE	Baseline	Alternative PSE		
	[1]	[2]	[3]	[4]
Trade globalization	0.0010***	0.0008***	0.0009***	0.0010***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Factor productivity	0.1168***	0.1425***	0.0751***	0.0267**
	(0.0115)	(0.0128)	(0.0112)	(0.0129)
Tax revenues (Log.)	-0.0125**	-0.0223***	-0.0193***	-0.0214***
	(0.0064)	(0.0074)	(0.0064)	(0.0080)
Democracy	0.0080***	0.0083***	0.0071***	0.0044***
	(0.0012)	(0.0014)	(0.0012)	(0.0014)
Government durability	0.0004***	0.0005***	0.0004***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Population density (Log.)	-0.0036	-0.0006	-0.0052*	-0.0009
	(0.0031)	(0.0038)	(0.0031)	(0.0062)
Observations	2101	2239	2101	2107

Notes: This table reports the correlations between the calculated scores and the main potential determinants, from a Tobit analysis, and considering alternative measures of public sector efficiency. Results from the main model are reported in Column [1]. Column [2] re-estimates the main model using the scores obtained following Greene (2005b). In Column [3], we include a «subjective» measure of well-being in the economic performance indices. Column [4] re-estimates the efficiency scores, only from the three sectors: education, health, and public infrastructure. Standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B1: Heterogeneity: Geographical regions

Dependent: PSE	Total sample	Africa	Asia	Latin America	Europe	Fragile States
	[1]	[2]	[3]	[4]	[5]	[6]
Trade globalization	0.0010***	0.0001	0.0020***	-0.0006	0.0026***	-0.0007
	(0.0002)	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0010)
Factor productivity	0.1168***	0.1047***	0.1285***	0.1317***	0.1375***	0.0836**
	(0.0115)	(0.0194)	(0.0197)	(0.0432)	(0.0315)	(0.0377)
Tax revenues (Log.)	-0.0125**	-0.0010	0.0141	-0.0568***	-0.0896***	-2.540E-5
	(0.0064)	(0.0109)	(0.0113)	(0.0220)	(0.0310)	(0.0129)
Democracy	0.0080***	0.0078***	0.0147***	0.0103*	0.0314***	0.0113***
	(0.0012)	(0.0018)	(0.0028)	(0.0059)	(0.0108)	(0.0043)
Government durability	0.0004***	0.0006	-0.0002	0.0003	0.0011***	-0.0027**
	(0.0001)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0010)
Population density (Log.)	-0.0036	0.0044	-0.0126	-0.0105	-0.0233	-0.0092
	(0.0031)	(0.0047)	(0.0081)	(0.0068)	(0.0146)	(0.0086)
Observations	2101	483	446	405	604	135

Notes: This table reports the correlations between the calculated scores and the main potential determinants, from a Tobit analysis, and considering different geographical regions. Results from the full sample are reported in Column [1]. Column [2] includes Sub-Saharan African countries. Column [4] includes Latin American and Caribbean countries. Column [6] includes 20 fragile states. Standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D Sample and correlational evidence

Table D1: Countries in the sample

Panel A: Advanced economies			
Australia	Austria	Belgium	Canada
Switzerland	Cyprus	Czech Republic	Germany
Denmark	Spain	Estonia	Finland
France	United Kingdom	Greece	Ireland
Iceland	Israel	Italy	Japan
Korea, Rep.	Lithuania	Luxembourg	Latvia
Malta	Netherlands	Norway	New Zealand
Portugal	Singapore	Slovak Republic	Slovenia
Sweden	United States		
Panel B: Developing economies			
Afghanistan	Angola	Albania	Argentina
Armenia	Azerbaijan	Burundi	Benin
Burkina Faso	Bangladesh	Bulgaria	Bahrain
Bahamas, The	Bosnia and Herzegovina	Belarus	Belize
Bolivia	Brazil	Barbados	Bhutan
Botswana	Central African Republic	Chile	China
Cote d'Ivoire	Cameroon	Congo, Dem Rep	Congo, Rep
Colombia	Cabo Verde	Costa Rica	Dominica
Dominican Republic	Algeria	Ecuador	Egypt, Arab Rep.
Ethiopia	Fiji	Georgia	Ghana
Guinea-Bissau	Equatorial Guinea	Grenada	Guatemala
Honduras	Croatia	Hungary	Indonesia
India	Iran, Islamic Rep.	Iraq	Jamaica
Jordan	Kazakhstan	Kenya	Kyrgyz Republic
Cambodia	Kiribati	Kuwait	Laos
Lebanon	Liberia	Sri Lanka	Lesotho
Morocco	Moldova	Madagascar	Maldives
Mexico	Mali	Myanmar	Mongolia
Mozambique	Mauritius	Malawi	Malaysia
Namibia	Niger	Nigeria	Nicaragua
Nepal	Oman	Pakistan	Panama
Peru	Philippines	Papua New Guinea	Poland
Paraguay	Qatar	Russian Federation	Rwanda
Saudi Arabia	Sudan	Senegal	Solomon Islands
Sierra Leone	El Salvador	Serbia	Suriname
Swaziland	Seychelles	Togo	Thailand
Tajikistan	Timor-Leste	Tonga	Trinidad and Tobago
Tunisia	Turkey	Tanzania	Uganda
Ukraine	Uruguay	Uzbekistan	St Vincent and the Grenadines
Venezuela, RB	Vietnam	Vanuatu	Samoa
Yemen, Rep.	South Africa	Zambia	Zimbabwe

Table D2: Pearson's correlations of the main variables

	PSE	PSE	PSE	PSE	PSE	
Trade globalization	0.3088***					
Factor productivity		0.1478***				
Tax revenues			0.2570***			
Democracy				0.2728***		
Government durability					0.2741***	
Population density						0.0671***

Notes: This table reports the Pearson correlations of the main variables and the public sector efficiency (PSE) scores. *** indicates significance at the 1% threshold.

F Country rankings

Table F1: Country rankings by average efficiency scores: 1990-2017

Country	Score	Rank	Country	Score	Rank	Country	Score	Rank	Country	Score	Rank
United States	0.8011	1	Tunisia	0.688	41	Chile	0.6632	81	Mali	0.6356	121
United Kingdom	0.7733	2	Tonga	0.6873	42	Ivory Coast	0.6623	82	Cameroon	0.6338	122
Australia	0.7468	3	Barbados	0.6849	43	Jamaica	0.6622	83	Mongolia	0.6325	123
Japan	0.7416	4	Laos	0.6849	44	Luxembourg	0.6622	84	Malawi	0.6323	124
New Zealand	0.7359	5	Mauritius	0.6821	45	Trinidad and Tobago	0.6618	85	Lesotho	0.6318	125
Israel	0.7279	6	Argentina	0.6814	46	Algeria	0.6617	86	India	0.6317	126
Germany	0.7259	7	Finland	0.681	47	Armenia	0.6601	87	Ghana	0.6309	127
Netherlands	0.7257	8	Grenada	0.6804	48	Botswana	0.6599	88	Bahamas, The	0.6293	128
Norway	0.7254	9	Latvia	0.6795	49	Paraguay	0.6597	89	Honduras	0.629	129
Ireland	0.7242	10	Thailand	0.6776	50	Sweden	0.6597	90	Central African Republic	0.6285	130
Italy	0.7224	11	Panama	0.6774	51	Saudi Arabia	0.6596	91	Zimbabwe	0.6264	131
Korea, Rep.	0.7223	12	Greece	0.6774	52	Mozambique	0.659	92	Namibia	0.6259	132
Austria	0.7194	13	Mexico	0.6769	53	South Africa	0.6588	93	Liberia	0.6251	133
Iceland	0.7184	14	Seychelles	0.6768	54	Iraq	0.658	94	Benin	0.6245	134
Costa Rica	0.718	15	Egypt, Arab Rep.	0.6767	55	Vanuatu	0.6566	95	Bangladesh	0.6232	135
Denmark	0.7166	16	Hungary	0.6764	56	Nepal	0.6549	96	Iran, Islamic Rep.	0.6222	136
Slovenia	0.7152	17	Republic of Serbia	0.6763	57	Moldova	0.6545	97	Sudan	0.6218	137
Canada	0.7139	18	Samoa	0.6741	58	Tajikistan	0.6543	98	Madagascar	0.6218	138
Malta	0.7133	19	Bosnia and Herzegovina	0.674	59	Fiji	0.654	99	Pakistan	0.6211	139
Singapore	0.7112	20	Uzbekistan	0.6737	60	Philippines	0.6539	100	Afghanistan	0.6191	140
Kazakhstan	0.7098	21	Timor-Leste	0.6726	61	Maldives	0.6539	101	Eswatini	0.6191	141
Peru	0.7092	22	Ecuador	0.6725	62	Qatar	0.6534	102	Nicaragua	0.6171	142
Portugal	0.7083	23	Colombia	0.6722	63	Kyrgyz Republic	0.6531	103	Bhutan	0.6163	143
Poland	0.708	24	Dominica	0.6715	64	Burkina Faso	0.651	104	Kenya	0.6079	144
Brazil	0.7038	25	Belize	0.6713	65	Rwanda	0.649	105	Zambia	0.6072	145
Switzerland	0.7031	26	Georgia	0.6713	66	Jordan	0.6483	106	Myanmar	0.6057	146
China	0.7027	27	Estonia	0.671	67	Morocco	0.6483	107	Equatorial Guinea	0.6042	147
Czechia	0.7014	28	St Vincent and the Grenadines	0.6706	68	Solomon Islands	0.6481	108	Uganda	0.5996	148
France	0.7012	29	Indonesia	0.6689	69	Oman	0.648	109	Burundi	0.5961	149
Lithuania	0.6994	30	Bahrain	0.6688	70	Kuwait	0.6476	110	Republic of the Congo	0.5931	150
Belarus	0.697	31	Ukraine	0.6681	71	Guatemala	0.6461	111	Angola	0.5907	151
Belgium	0.6965	32	Kiribati	0.668	72	Niger	0.6458	112	Papua New Guinea	0.5688	152
Slovak Republic	0.6949	33	Russian Federation	0.6676	73	Vietnam	0.6456	113	Togo	0.5612	153
Lebanon	0.6944	34	Dominican Republic	0.6672	74	Sierra Leone	0.6433	114	Ethiopia	0.5604	154
Cabo Verde	0.6935	35	Bulgaria	0.667	75	Cambodia	0.6429	115	Nigeria	0.5543	155
Cyprus	0.6919	36	Senegal	0.6659	76	Venezuela, RB	0.6415	116	United Republic of Tanzania	0.5467	156
Spain	0.691	37	Bolivia	0.6657	77	Albania	0.6402	117	Yemen, Rep.	0.5429	157
Turkey	0.691	38	Malaysia	0.6654	78	Suriname	0.6379	118	Democratic Republic of the Congo	0.4826	158
Sri Lanka	0.6898	39	El Salvador	0.6651	79	Guinea-Bissau	0.637	119			
Uruguay	0.6897	40	Croatia	0.664	80	Azerbaijan	0.6368	120			

G VARIABLES AND THEIR SOURCES

Table G1: Variables for calculating public expenditure efficiency

Variables	Nature	Sources
1. Public expenditure (inputs)		
Education expenditure (%GDP)	Continuous	Public Expenditures for Economic Development (SPEED)
Infrastructure expenditure (%GDP)	Continuous	SPEED
Health expenditure (%GDP)	Continuous	SPEED
Government final consumption (%GDP)	Continuous	World Economic Outlook (WEO)
2. Sectoral performance indices (outcomes)		
Education		
— Primary enrollment	Continuous	World Development Indicators (WDI)
— Secondary enrollment	Continuous	WDI
— Expected years of schooling	Continuous	WDI
Health		
— Life expectancy at birth	Continuous	World Development Indicators (WDI)
— Infant mortality rate (per 1000 live births)	Continuous	WDI
Infrastructure		
— Total length of roads in kilometers	Continuous	World Telecommunication/ICT Indicators Database
— Number of paved roads (% total roads	Continuous	World Telecommunication/ICT Indicators Database
— Fixed telephone subscriptions (per 100 people)	Continuous	World Telecommunication/ICT Indicators Database
— Fixed broadband subscriptions (per 100 people)	Continuous	World Telecommunication/ICT Indicators Database
— Faults for 100 fixed telephone lines per year	Continuous	World Telecommunication/ICT Indicators Database
— Proportion of households with electricity	Continuous	World Telecommunication/ICT Indicators Database
— Electric power consumption (in kWh per capita)	Continuous	World Telecommunication/ICT Indicators Database
— Electric power transmission and distribution losses (%production)	Continuous	World Telecommunication/ICT Indicators Database
Administration		
— Independence of the judiciary	Continuous	Teorell et al. (2018)
— teorell2018quality of property rights	Continuous	Teorell et al. (2018)
— Quality of government	Continuous	Teorell et al. (2018)
— Level of the shadow economy	Continuous	Teorell et al. (2018)
Stability		
— Standard deviation of the three-year moving average of GDP growth	Continuous	Authors, from WDI
— Standard deviation of the three-year moving of inflation	Continuous	Authors, from WDI
Distribution		
— Gini index	Continuous	Standardized World Income Inequality Database (SWIID)
Economic performance		
— GDP per capita	Continuous	WDI
— GDP growth (10-year average)	Continuous	WDI
— Unemployment rate (10-year average)	Continuous	WDI
3. Main determinants		
Trade globalization	Index ranging from 0 to 100	KOF (Dreher, 2006; Gygli et al., 2019)
Total factor productivity	Continuous	Penn World Table (PWT)
Tax revenues	Continuous	UNU-WIDER Government Revenue Dataset
Democracy Index	Index ranging from 0 to 10	Freedom House database
Government durability	Continuous	Polity IV
Population density	Continuous	WDI, World Bank

Table G2: Main determinants of public expenditure efficiency

Trade globalization is measured by the KOF index (Dreher, 2006; Gygli et al., 2019), and ranges from 1 to 100 (higher degree of globalization).
Total factor productivity measures the share of output that is not explained by the quantity of inputs used in production, and is from the Penn World Table (PWT).
Tax revenues — excluding social contributions and natural resources — are from the UNU-WIDER Government Revenue Dataset.
Democracy is captured by an index varying between 0 (least democratic) and 10 (most democratic), extracted from the Freedom House database.
Government durability measures the number of years since the last change in the political regime and comes from the Polity IV dataset.
Population density is the mid-year population divided by the area in square kilometers and comes from the World Bank's WDI (World Development Indicators) database.

Chapter 6

Fiscal Rules and Public Expenditure Efficiency

This chapter is joint work with Ablam Estel APETI (LEO and University of Göttingen) and Jean-Louis COMBES (LEO-UCA)

Abstract

We ask whether fiscal rules improve public expenditure efficiency using a panel of 158 countries from 1990 to 2017. Applying the entropy balancing method to mitigate selection issues in policy adoption, we find robust evidence that implementing a fiscal rule increases expenditure efficiency, with economically and statistically significant effects. Further analysis suggests that the effect of fiscal rules on efficiency is subject to some heterogeneity, depending on the types of rules, their design, macroeconomic factors, and time elapsed since the reform adoption. Lastly, we provide some empirical evidence on the underlying mechanisms and show that improved fiscal discipline following the implementation of the rules —via better institutional quality, fiscal balance, and tax revenue mobilization— is the main channel through which fiscal rules affect efficiency.

Keywords: • Fiscal rules • Public expenditure efficiency • Entropy balancing
JEL Classification: E6, H6

"In theory, public spending on goods and services has larger multiplier effects [...]. In practice, the appropriate increase in public spending is constrained by the need to avoid waste. What are the key policy prescriptions?" Spilimbergo et al. (2009)

6.1 Introduction

Since the 1990s, fiscal rules have been widely popularized worldwide and today strongly condition budgetary choices. Fiscal rules are long-lasting constraints on budget aggregates such as deficit, debt, expenditure, or revenue, and aim to correct for policy biases that lead decision-makers to overspend and run up deficits. In other words, fiscal rules are designed to keep public finances on a sustainable path while preserving the counter-cyclical role of fiscal policy or promoting a less procyclical fiscal policy. Numerous studies examining the effects of fiscal rules suggest that they help to promote fiscal discipline through lower debt levels or deficits;[1] reduce fiscal procyclicality (Combes et al., 2017; Guerguil et al., 2017; Gootjes and de Haan, 2022a); improve financial market access or lower sovereign bond spreads (Iara and Wolff, 2014; Badinger and Reuter, 2017; Feld et al., 2017; Thornton and Vasilakis, 2018; Thornton and Vasilakis, 2020; constrain political budget cycles (Rose, 2006; Bonfatti and Forni, 2019; Gootjes et al., 2021); or help mitigate the original sin issue in developing countries (Apeti et al., 2024).

While a long body of literature has examined the effect of fiscal rules on debt, deficits, or public spending, another equally important question is whether such reforms also result in a more efficient use of public expenditure. In other words, we ask whether fiscal rules provide incentives for governments to maximize outcomes in delivering public goods and services while minimizing the resources used or reducing budget waste. This is all the more important as fiscal waste —whether active or passive, as distinguished by Bandiera et al. (2009)— is a key source of inefficiency and fiscal unsustainability in many countries. Active waste refers to corruption in public procurement, implying a lack of transparency in the management of public funds and may contribute to lower tax revenues, higher levels of public spending,

[1] See, among others, Alesina et al., 1999b; Kennedy et al., 2001; Kopits, 2001; Primo, 2006; Hallerberg et al., 2007; Debrun and Kumar, 2007; Debrun et al., 2008; Lledo et al., 2010;Gollwitzer, 2011; Hatchondo et al., 2012; Tapsoba, 2012b; Luechinger and Schaltegger, 2013: Reuter, 2015; Grembi et al., 2016; Badinger and Reuter, 2017; Combes et al., 2018; Asatryan et al., 2018; Heinemann et al., 2018; Caselli and Reynaud, 2020; Barbier-Gauchard et al., 2021; Caselli and Wingender, 2021; Afonso et al., 2022b; Gomez-Gonzalez et al., 2022.

and lower productivity in effective public spending (Ghosh and Neanidis, 2017); while passive waste refers to various types of expenditure with high costs and low social benefits, such as the financing of the so-called white elephants; spending on individual interests (perks); waste through negligence; or cost overruns.

Greater efficiency in spending is crucial for the sustainability of public finances, as the literature underlines that although public spending can have large multiplier effects, its appropriate increase for the provision of public goods and services is limited by the possible existence of fiscal/budget waste. Budget waste is all the more plausible given the lack of competition in public services, as the public choice school has long argued (Jackson and McLeod, 1982). As such, our reading is that constraints such as fiscal rules, which aim to promote fiscal prudence, may encourage governments to reduce inefficiencies in public spending via lower corruption or fiscal waste to adjust the fiscal targets. Governments with fiscal rules may have all the more incentive to reduce corruption and waste to comply with their targets, to preserve their credibility, but also because non-compliance with fiscal rules may be punished by financial markets via a spike in borrowing costs (Kelemen and Teo, 2014; Kalan et al., 2018; Gootjes and de Haan, 2022a; Halac and Yared, 2022). In addition, we can reasonably argue that fiscal savings resulting from lower waste can be reallocated to the most productive sectors or "high-quality" outlays, i.e., (investment) expenditure aimed at boosting economic activity and achieving social well-being (Beetsma and Debrun, 2007). This is all the more plausible as the literature shows that governments with fiscal rules tend to protect public investment (e.g., see Ardanaz et al., 2021) and promote economic growth (Castro, 2011; Afonso and Jalles, 2013).

In contrast to the prevailing literature which examines the effect of fiscal rules on fiscal aggregates such as debt, deficits, or spending, this study follows a slightly different approach, examining their effect on public spending efficiency, using a panel of 158 countries of all income levels from 1990-2017. Public expenditure efficiency is approximated by the Apeti et al. index (Apeti et al., 2023b), which provides a novel measure of public expenditure efficiency, including several dimensions of the public sector and a large sample of countries. Identifying the genuine effect induced by fiscal rules is not so clear-cut, as policy adoption may be correlated with unobservable factors that may also influence the stance of fiscal policy or public sector management. Therefore, to sharpen identification, we mitigate the potential selection bias associated with policy adoption, using the entropy balancing method developed by Hainmueller (2012), which combines both the matching approach and linear

regression. Evidence suggests that implementing a fiscal rule leads to an increase in public expenditure efficiency, with statistically and economically significant effects. Robustness was checked by considering alternative samples, measures, and additional controls. Our conclusions hold when re-estimating our model using alternative estimation methods such as propensity score matching methods, ordinary least squares (OLS), the generalized methods of moments (GMM), the instrumental variables (IV) approach using fiscal rules in neighboring countries, and the Liu et al. (2024) method. We conduct additional placebo tests, re-estimating our main model from fictitious adoption dates or smaller sample windows, and confirm that our results are not driven by unobservables, a spurious trend, the potential effects of other reforms such as inflation targeting, IMF programs, or fiscal consolidation episodes. Taking good notice of the size of our sample, we further explore potential heterogeneity in the relationship between fiscal rules and efficiency according to a series of economic, institutional, and structural factors. First, although deficit, debt, and expenditure rules all have a positive and statistically significant effect on expenditure efficiency, the effect is more amplified for deficit rules and debt rules. Second, we find that formal monitoring, enforcement procedures, coverage, strong legal basis, the level of development, and institutional quality (notably political stability) amplify the positive effect of fiscal rules on expenditure efficiency. Moreover, fiscal rules are more effective when adopted by countries with poor fiscal discipline, and the positive effect of fiscal rules on expenditure efficiency tends to increase over time. Lastly, we empirically examine the underlying mechanisms and show that better fiscal discipline resulting from the introduction of fiscal rules —via improved control of corruption, fiscal balance, and tax revenue mobilization— is the main channel through which the effect of fiscal rules on efficiency is channeled.

Our study contributes to the growing literature on the effects of fiscal rules, showing that besides their beneficial effects on fiscal discipline, fiscal rules also provide incentives for governments to improve the use of public expenditure, striving for better outcomes in the provision of goods and services while minimizing the resources used or fiscal waste. The question of public spending efficiency is all the more important in the post-COVID era, where public deficits have risen sharply in most countries, leaving little room for fiscal policy to respond to socio-economic needs. To put in another way, we live in a world of multiple crises, where governments need to do more with fewer resources, making the search for instruments capable of boosting efficiency particularly important. A closely related study is Afonso and Alves (2023), which examines the impact of fiscal consolidation episodes on public

sector efficiency for 35 OECD countries for the 2007–2020 period. Fiscal rules differ from fiscal consolidation episodes in that they are permanent constraints on fiscal policy, and are often associated with structural reforms, with a strong influence on government behavior.

The remainder of the paper is organized as follows. The following section presents our theoretical predictions. Sections 6.3 describe the Apeti et al. index. Section 6.4 reports some stylized facts. The empirical methodology and the data are discussed in Section 6.5 and 6.6, respectively. The main findings are presented in Section 6.7. Sections 6.8 and 6.9 analyze the sensitivity of our results and present some empirical evidence on the main channels, respectively. A final section concludes.

6.2 Transmission channels

The literature on the effects of fiscal rules is quite extensive. Capitalizing on this literature, we believe that a rule-based fiscal framework may influence public expenditure efficiency for several reasons. One major benefit shared by a large part of the literature is the discipline effect of fiscal rules on fiscal policy, as discussed in the introduction.. Fiscal discipline through lower debt levels or deficits can stem from various areas. First, as emphasized by Bandiera et al. (2009), fiscal waste —whether active or passive— is a key issue in public management, as it generates substantial economic costs with low social benefits, contributing to inefficiency in public spending and a deterioration in the sustainability of public finances. Credible fiscal rules aimed at improving the sustainability of public finances may constrain governments to reduce fiscal drift to comply with their targets, especially as significant deviations from targets undermine the credibility of macroeconomic policies and penalize governments in accessing financial markets. Reducing fiscal drift to preserve fiscal sustainability may involve, among other things, addressing corruption in the public sector and reducing fiscal waste, key drivers of inefficiency. This should increase the desired supply of public goods, potentially beyond the levels that governments would have achieved had they not been constrained by fiscal rules.

Second, as in the literature on monetary delegation, where the loss of monetary financing of deficits (seigniorage) leads the government to increase its efforts to raise taxes or cut public expenditure (Lucotte, 2012; Minea et al., 2021; Apeti et al., 2023g), by limiting the government's ability to incur debt, fiscal rules may drive the latter to either raise taxes or cut public expenditure. For governments that choose the tax option, accountability, and willingness to pay taxes that is linked to

the quality of public goods provided to taxpayers may lead to better management of public resources to reach the highest achievable outcome. However, as shown by Asatryan et al. (2018), the favorable effect of fiscal rules on fiscal discipline is most likely to come from public expenditure cut — the taxation channel not being statistically significant. The cut in public expenditure may have a composition implication in two different ways : (*i*) a larger cut in current expenditure; or (*ii*) a larger cut in public investment. Taking a more skeptical view, Blanchard and Giavazzi (2004) suggest that governments with fiscal rules may be more likely to reduce public investment to comply with numerical targets, especially as investment spending has a lower political cost than current spending. However, the literature on the composition effect of fiscal rules suggests that they have a protective effect on productive or growth-friendly expenditures, particularly public investment (Ardanaz et al., 2021). In addition, Castro (2011) and Afonso and Jalles (2013) provide evidence that fiscal rules promote better output, suggesting that more outcomes could be achieved with the same or less amount of public resources. Specifically, the decline in resources by limiting the opportunity for debt financing under fiscal rules leads governments to reallocate spending to productive sectors, i.e., better use of less public resources for achieving higher results.

Third, the literature on the interaction between the fiscal and monetary spheres establishes that persistent fiscal deficits can create inflationary pressures via the monetary financing of fiscal deficits (Sargent and Wallace, 1981). Yet, beyond their impact on fiscal aggregates, evidence suggests that fiscal rules help to stabilize the macroeconomic environment by lowering inflation. Indeed, the reduction in debt or deficit following the adoption of fiscal rules limits the risk of monetization or inflation tax and thus potential inflationary pressures (Combes et al., 2018) — which may ultimately help improve tax performance. Although the effect of discipline is essentially achieved through public expenditure reduction rather than tax revenue increase, the potential impact on inflation may have a spillover effect on tax revenue. Indeed, by reducing inflation, fiscal rules limit the Oliveira-Keynes-Tanzi effect (Tanzi, 1992), thus stimulating tax revenue collection. Consequently, the accountability generated by taxation may induce the government to use public resources wisely, thus increasing the efficiency of public expenditure.

Putting these arguments —fiscal discipline (via lower corruption and deficit) and tax performance— together, we can assume that fiscal rules may positively influence public expenditure efficiency.

6.3 The Apeti et al. index

Efficiency involves achieving an outcome with an economy of means. The concept was first used in the literature to assess firm performance, before being progressively extended to the debate on the public sector. Measuring public expenditure efficiency allows assessing to what extent public expenditure contributes to the objectives set, in the quest for better management of the public sector. This is all the more relevant as literature shows that, although public spending on goods and services may have larger multiplier effects, its appropriate use is constrained by fiscal waste (Spilimbergo et al., 2009). Indeed, given the lack of competition in public services, governments are likely to be wasteful with their budgets, as argued by the public choice school (Jackson and McLeod, 1982). From an empirical point of view, efficiency is captured by scores estimated from the relative distances of inefficient observations to an ideal frontier, made up of the best-performing units in the sample (see Farrell, 1957). A large and growing body examines public expenditure efficiency (see important contributions from, among others, Eeckaut et al., 1993; Tanzi and Schuknecht 1997, 2000; Worthington, 2000; Gupta and Verhoeven, 2001; Afonso et al. 2005, 2010; Afonso and Fernandes, 2008; Hauner and Kyobe, 2010). Several studies, including those mentioned previously, have focused on education, health, and infrastructure. However, in an article published in Public Choice, Afonso et al. (2005) provide a measure of efficiency for 23 industrialized countries, considering several dimensions of the public sector. In addition to the usual sectors (education, health, and infrastructure), the authors consider another dimension of the public sector relating to administration, but also Musgravian indicators, which measure the traditional tasks for government: distribution, stability, and economic performance.

In a recent article published in Oxford Economic Papers, Apeti et al. (2023b) consider the same dimensions of the public sector as in Afonso et al. (2005), i.e., education, health, infrastructure, and public administration, as well as the Musgravian tasks for the government. The authors, moreover, extend the paper by Afonso et al. (2005) on two main grounds. First, while the literature on efficiency has so far focused on advanced countries, Apeti et al. (2023b) provide a large panel dataset on public expenditure efficiency covering a large sample of 158 countries of all income levels, over the period 1990-2017. Second, in contrast to the prevailing literature which has mainly used non-parametric methods, Apeti et al. (2023b) employ a parametric approach to calculate the efficiency scores, the Stochastic Frontier Analysis (SFA). As emphasized by the authors, unlike non-parametric methods, the SFA approach allows for measurement error and country-independent randomness to distinguish

between inefficiency resulting from exogenous factors and that resulting from public sector mismanagement (see Aigner et al., 1977 and Meeusen and van Den Broeck, 1977; Kumbhakar et al., 2015). For the reasons discussed (probably not exhaustive), this study uses the Apeti et al. index as a proxy for public expenditure efficiency. Information relating to the outcome indicators for each dimension considered and to public resources is summarized in Table A4 (see Apeti et al., 2023b for more details).

6.4 Descriptive statistics and correlational evidence

By construction, the calculated scores can range from 0 (worst performance) to 1 (best performance). We report 3,802 country-year observations with an average score of 0.66 over the sample and the period considered. This suggests that the countries in the sample could, on average, increase the supply of public goods and services by 34%, for the same level of resources used, underlining the significant scope for governments to improve public sector efficiency. Figure 6.1 presents the average scores for 158 countries from 1990-2017, distinguishing between advanced and developing countries. On average, advanced countries are closest to the efficiency frontier, with a score of 0.71, while the average efficiency reported for developing countries is 0.65. Furthermore, statistical tests suggest that the efficiency gap between advanced countries and their developing peers is significant at the usual thresholds (p-value = 0.00; t = -22.55). The top 10 best-performing countries show scores ranging from 0.73 to 0.79 and are all advanced economies, while the 10 worst-performing countries display scores between 0.56 and 0.60 and most are African economies (see Table A3).

Over the study period, 80 countries have adopted at least one fiscal rule, 29 advanced economies, and 51 developing counties and emerging markets. Deficit or budget balanced rules are the most adopted (76 countries) followed by debt rules (63) and expenditure rules (44), while revenue rules do not seem to be in vogue as they are only adopted by 14 countries in the sample and over the study period. Figure 6.2 displays the evolution of the number of countries with fiscal rules over the study period. There is an increasing number of countries around the world introducing fiscal rules from the late 1990s onwards—in both advanced and developing economies (Figure 6.3)— with a strong preference for deficit and debt rules, respectively. The trend in expenditure rules, although relatively weaker, seems to be increasing from

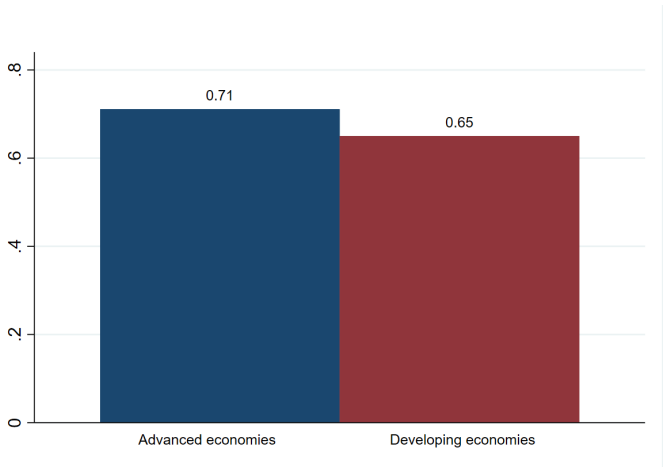

Figure 6.1: Average government efficiency scores (1990-2017)

Notes: The statistics cover 158 countries from 1990-2017, including 34 advanced and 124 developing economies.

the 2000s onwards, with a stronger push after the 2008-2009 global financial crisis. Revenue rules, despite a slight increase from the late 1990s, appear to have stagnated since the 2000s until the end of the study period.

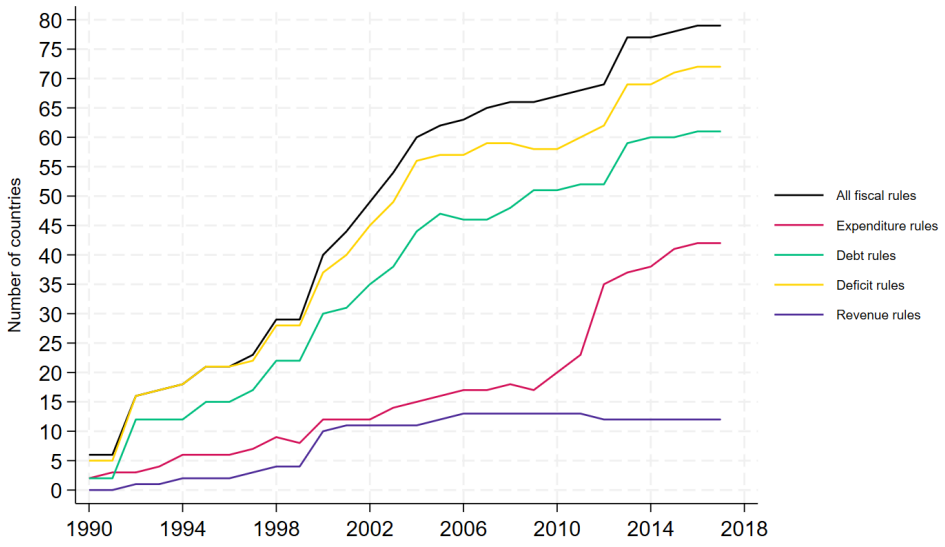

Figure 6.2: Trend in the number of countries with fiscal rules

Source: Authors, from the IMF Fiscal Rules Dataset.

We then report correlational evidence linking public expenditure efficiency and fiscal rules in our sample. Over the study period, we report 1,349 treated (with fiscal rules) and 2,486 untreated observations. Figure 6.4 shows, on average, a higher score for treated observations compared with untreated observations (0.69 vs. 0.65). This difference of 0.04 points may seem small, but it should be put in perspective with

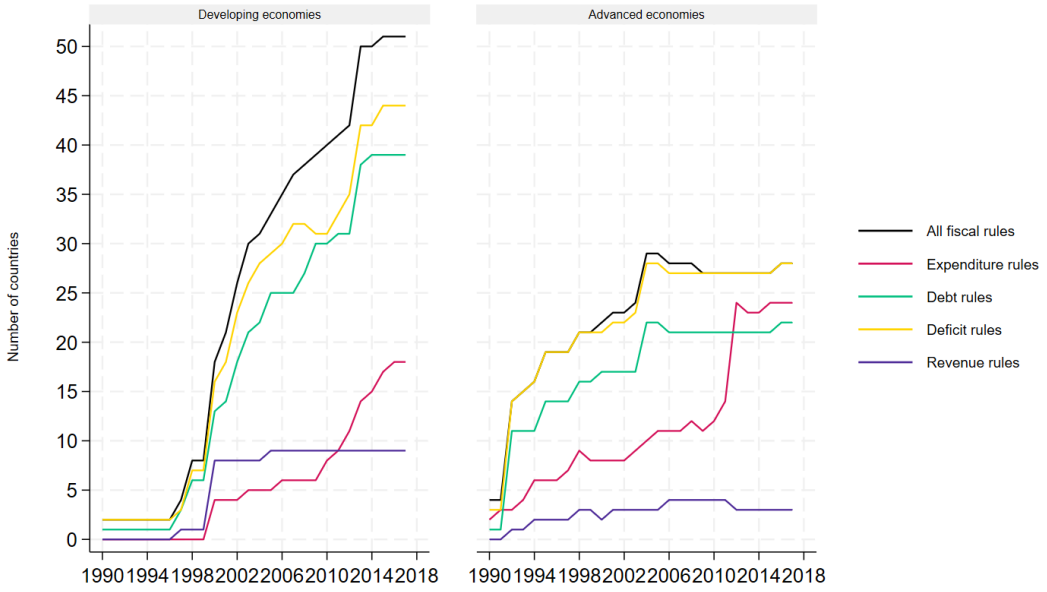

Figure 6.3: Trend in the number of countries with fiscal rules: Advanced vs. developing economies

Source: Authors, from the IMF Fiscal Rules Dataset.

the efficiency index, which ranges from 0 to 1. Moreover, the efficiency gap between the two groups is statistically significant at the usual thresholds (p-value = 0.00; t = -16.07). This stylized fact correlates fiscal rules with efficiency scores, but does not provide any information about the causal effect of the reform. Therefore, the remainder of the study employs an econometric approach to attempt to identify a potential causal impact of fiscal rules on efficiency.

6.5 Methodology

We examine the impact of fiscal rules (FR) on public expenditure efficiency. Identifying and tracing down precisely any genuine effects induced by fiscal rules adoption on the macro-variables of interest is challenging, given the potential selection issue that arises from policy adoption. Fiscal rules may be correlated with unobserved factors that can also affect the country's fiscal orientation, which would make it difficult to distinguish between the effect induced by fiscal rules and that due to other reforms underlying the implementation of fiscal rules. Thus, as stated by Heinemann et al. (2018), the potential endogeneity of fiscal rules — given the interdependencies

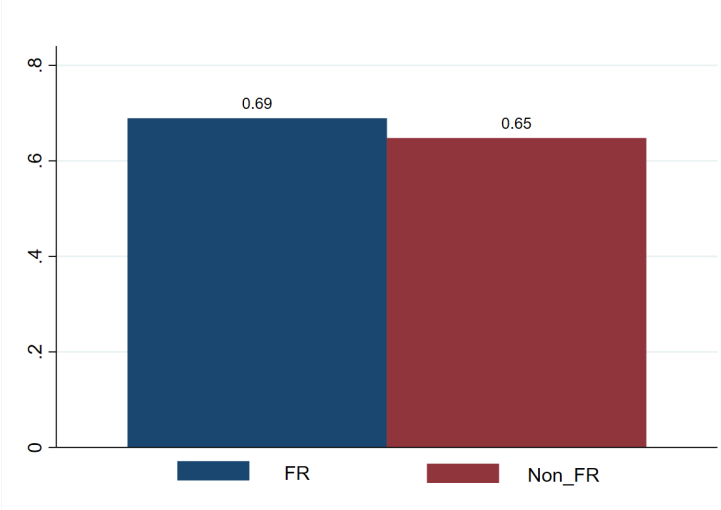

Figure 6.4: Average efficiency scores (1990-2017) in countries with and without fiscal rules

Notes: This graph displays the average efficiency scores between treated (with fiscal rules —FR) and untreated (without fiscal rules —Non-FR) observations. We report 1,349 treated and 2,486 untreated observations for the 158 countries in our sample and over our study period (1990-2017).

between the latter and fiscal policies — must be seriously considered, otherwise it would lead to biased estimates. Several papers rely on a matching approach to address the endogeneity of fiscal rules (e.g., see Tapsoba, 2012b; Guerguil et al., 2017; Barbier-Gauchard et al., 2021; Caselli and Wingender, 2021; Apeti et al., 2024). Based on these studies, we follow the program evaluation methodology which consists in estimating the average treatment effect on the treated (ATT), which is the difference in efficiency between treated units (with fiscal rules) and untreated units (without FR). The ATT is defined as follows:

$$ATT = E[(Y_{i1}|T_i = 1)] - E[(Y_{i0}|T_i = 1)] \tag{6.1}$$

T_i is a dummy variable equal to 1 if a country i has adopted a fiscal rule in year t, and zero otherwise. Y_{i0} represents the outcome for the untreated units (without FR or $T_i = 0$) and Y_{i1} is the outcome associated with $T_i = 1$ (treated units). The treatment effect is therefore the difference in expenditure efficiency between the situation when a fiscal rule is adopted and the situation without adoption. This approach would suffer from a counterfactual problem, as it is not possible to observe how the country would have evolved if it had not adopted the fiscal rule. Hence, we adopt a counterfactual framework consisting of untreated observations, but which otherwise represent a potential control group for the treated observations. Since the

treatment assignment is not random, a simple difference in the outcome between the treated units and the control group would pollute the estimates, given the potential selection bias discussed above. Thus, the matching approach consists of reproducing a situation close to a context where units are randomly assigned to the treatment. The latter are therefore matched with those not exposed to the treatment, based on their pre-observable characteristics, which are as similar as possible. The ATT resulting from matching can be formalized as follows:

$$ATT(\chi) = E\left[Y_{i1}|T_i = 1, X = \chi\right] - E\left[Y_{i0}|T_i = 0, X = \chi\right] \tag{6.2}$$

where χ is a set of pre-treatment covariates correlated with the treatment and potentially with the outcome variable. $E\left[Y_{i1}|T_i = 1, X = \chi\right]$ is the expected outcome for the treated observations, and $E\left[Y_{i0}|T_i = 0, X = \chi\right]$ is the expected outcome for the best counterfactuals of the treated units.

In this study, we rely on the entropy balancing method developed by Hainmueller (2012) to match treated units with their untreated counterfactuals. Used by Neuenkirch and Neumeier (2016) to assess the impact of US sanctions on poverty, entropy balancing has equally been employed by Caselli and Wingender (2021) to analyze the effect of fiscal rules on public deficits using the Maastricht treaty's fiscal criterion as an example, or Apeti et al. (2024) to examine the impact of fiscal rules on government debt in foreign currency.[2] Entropy balancing is a two-step estimation method. The first step is to calculate and apply weights to untreated units so that the mean of the pre-treatment variables in the control group is not statistically different from their mean in the treated group (see Neuenkirch and Neumeier, 2016). This step creates a synthetic group, unexposed to treatment, but with observable pre-treatment characteristics close to the treated group. Then, in the second step, the weights resulting from the entropy balancing are used in a regression analysis with the treatment indicator as an explanatory variable. We briefly discuss some merits of the method used. First, unlike competitive matching approach, entropy balancing is a non-parametric approach, thus requiring no specification of the functional form of the empirical model or of the treatment assignment procedure, which may avoid specification errors. Second, the weight system orthogonalizes the covariates with respect to the treatment, which limits multicollinearity issues. Third, the method

[2]See other studies, among others, using the same approach: Balima (2017); Ogrokhina and Rodriguez (2019); Balima et al. (2021); Bambe (2023); Apeti (2023a); Apeti and Edoh (2023); Combes et al. (2024).

ensures a suitable balance of pre-treatment characteristics between the treatment and control groups, even in the presence of a small sample or a limited number of untreated units. This allows the construction of an appropriate control group, representing a near-perfect counterfactual of the treated one. Last, in the second step, the estimator exploits the panel structure of data by including country and time effects to control for unobserved heterogeneity. The inclusion of country effects allows us to take into account any characteristics specific to each country, invariant over time, which could be correlated with both fiscal rules and the outcome variable.

Although entropy balancing is a suitable approach for dealing with selection issues, we take notice of the fact that other studies in the literature rely on other methods to control for endogeneity. These include propensity score matching (e.g., see Tapsoba, 2012b; Guerguil et al., 2017; Barbier-Gauchard et al., 2021), instrumental variables using fiscal rules in neighboring countries to instrument national rules (Caselli and Reynaud, 2020; Ardanaz et al., 2021; or Luechinger and Schaltegger, 2013 for a similar approach); or the system-GMM estimator (Combes et al., 2018; Gootjes et al., 2021). As such, we rely on those alternative estimation methods for robustness. In addition, the regression part of entropy balancing may be vulnerable to some criticisms in light of recent literature, notably the issue of negative weighting in a two-way fixed effects regression, assumption of no feedback, and constant treatment effects. To address these issues, we complement our alternative methods with the one recently developed by Liu et al. (2024).

6.6 Data

Our dataset consists of 158 developed and developing countries from 1990 to 2017. Public expenditure efficiency is proxied by the Apeti et al. index and can range from 0 to 1 (higher values indicate better performance). The treatment variable is a dummy equal to 1 if a country i has adopted a fiscal rule in year t, and zero otherwise. Based on the literature on fiscal rules, we use a set of variables potentially correlated with FR adoption and the outcome variable, accounting for both macroeconomic and political factors. First, we include lagged public debt to consider the country's past fiscal condition, as the latter is an important determinant of the government's ability to achieve the fiscal targets (Calderón and Schmidt-Hebbel, 2008; Tapsoba, 2012b). In other words, the past debt-to-GDP ratio would be negatively correlated with the probability of adopting FR. Second, in the same vein, since better economic performance (proxied by GDP per capita growth and inflation) would also affect

the likelihood of FR adoption (Kumar et al., 2009; Budina et al., 2012), one would expect a positive (negative) influence of per capita growth (inflation) on FR adoption. Third, following Tapsoba (2012b), we include capital account openness, as in some countries fiscal rules have been adopted as part of more comprehensive economic reforms, including financial liberalization. Fourth, we consider the exchange rate regime, since a large literature highlights a strong correlation between the exchange rate regime and fiscal discipline, embodied in fiscal rules (e.g., see Masson et al., 1991; Giavazzi and Pagano, 1988; Elbadawi et al., 2015).

We further consider a series of institutional variables —such as the level of democracy, corruption control, and government fragmentation — which may be important determinants for FR adoption. A better institutional framework encourages governments to justify their control of the state apparatus, promotes greater transparency in the budget approval process and budget regulation, and provides an overview of public sector activity. Moreover, institutional factors such as corruption control can be an important determinant of government budget management, as corruption leads to the misuse of public funds. Therefore, a better democratic framework and better control of corruption, by promoting better fiscal discipline, should be positively associated with the likelihood of adopting FR. Last, a large literature has examined the effect of government fragmentation on fiscal outcomes. For example, Kontopoulos and Perotti (1999) find that fragmentation tends to be associated with higher spending in OECD countries, as the most important representatives of individual spending interests in European governments are spending ministers. Other studies have found similar results (see for example Edin and Ohlsson, 1991; Borrelli and Royed, 1995; Franzese, 2000; Volkerink and De Haan, 2001; Balassone and Giordano, 2001; Artés and Jurado, 2018). Given the potentially negative influence of this variable on public finances, it can be argued that fiscal laxity may reflect the unwillingness of the state to adopt sound but binding reforms. On the other hand, in a fragmented government, voters may support reforms such as fiscal rules in the quest for greater fiscal discipline. The effect of government fragmentation on the likelihood of FR adoption could, therefore, be ambiguous.

Most of our variables are from the World Bank's WDI (World Development Indicators) database. Data related to fiscal rules are extracted from the IMF's Fiscal Rules Dataset. Public debt is measured as a percentage of GDP and comes from Abbas et al. (2011). Financial openness is approximated by an index between approximately -2 and 2 and comes from Chinn and Ito (2008). The exchange rate regime is constructed from Ilzetzki et al. (2017)'s classification and is captured by

a dummy equal to 1 if a country i is classified as having a fixed exchange rate regime in year t, and zero otherwise. Corruption control ranges from 0 to 100, where higher values are better, and is from the Worldwide Governance Indicators (WGI) database (Kaufmann et al., 2011). The level of democracy is captured by the Polity IV democracy score, ranging from -10 (absolute autocratic regime) to 10 (absolute democratic regime). Government fragmentation measures the probability that two deputies picked at random from the government parties will be of different parties, and is from the Database of Political Institutions (DPI).

6.7 Results

6.7.1 Covariates balance

Table 6.1 displays descriptive statistics relating to the first stage equation. Panel A shows a simple comparison of pre-weighting sample means of all matching covariates between treated (Column [2]) and control (Column [1]) units, which represent the potential synthetic group. On average, treated observations report lower inflation and GDP growth, greater debt and financial openness, better institutional quality (notably a higher level of democracy and greater control of corruption), and tend to be more oriented towards a fixed exchange rate regime. The differences between the two groups are statistically significant (Column [5]), except for public debt, which seems to corroborate the hypothesis of a potential selection bias between treated units and their untreated peers, thus supporting the use of matching methods. Therefore, in Panel B (Column [1]), we construct a synthetic control group by reweighting the control units using the pre-treatment covariates of the baseline specification. This approach allows making the pre-treatment covariates of the synthetic group on average as comparable as possible to those of the treated units. Column [5] of Panel B shows that the weighting eliminated any significant pre-treatment differences between the means of the treated and synthetic covariates, as all p-values after weighting are above the usual thresholds. Therefore, we can consider the synthetic group as a "near perfect" counterfactual of the treated group.

6.7.2 Treatment effects

Next, we assess the effect of fiscal rules on expenditure efficiency, estimating the following econometric model:

$$Y_{i,t} = \alpha + \beta FR_{i,t} + \eta X_{i,t} + \mu_i + \psi_t + \epsilon_{i,t} \tag{6.3}$$

Table 6.1: Descriptive statistics and covariate balancing

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A : Descriptive statistics	**Non_FR**	**FR**	**Difference**	**t-Test**	**p-Val.**
Lag Debt	52.9	55.19	-2.29	-1.26	0.21
Lag GDP per capita growth	3.16	2.33	0.83	3.23	0.00
Lag Inflation	10.09	3.67	6.42	4.91	0.00
Lag Capital openness	0.03	1.20	-1.17	-16.99	0.00
Fixed exchange rate dummy	0.32	0.51	-0.19	-8.01	0.00
Democracy	3.22	7.4	-4.18	-16.93	0.00
Corruption control	41.12	64.89	-23.77	-19.43	0.00
Government fragmentation	0.19	0.31	-0.12	-9.41	0.00
Observations	***859***	***903***			
	[1]	**[2]**	**[3] = [1] - [2]**	**[4]**	**[5]**
Panel B : Covariate balancing	**Non-treated**	**Treated**	**Difference**	**t-Test**	**p-Val.**
Lag Debt	55.23	55.19	0.04	-0.02	0.99
Lag GDP per capita growth	2.33	2.33	0.00	-0.01	1.00
Lag Inflation	3.89	3.67	0.22	-0.70	0.48
Lag Capital openness	1.19	1.2	-0.01	0.09	0.93
Fixed exchange rate dummy	0.51	0.51	0.00	0.05	0.96
Democracy	7.39	7.40	-0.01	0.05	0.96
Corruption control	64.78	64.89	-0.11	0.05	0.96
Government fragmentation	0.31	0.31	0.00	-0.00	1.00
Observations	***859***	***903***			
Total of weights	***903***	***903***			

Notes : We lag all covariates by one year, except the exchange rate regime and institutional variables, to circumvent problems of reverse causality.

where $Y_{i,t}$ is the outcome variable (expenditure efficiency) for country i in year t. FR is a dummy variable equal to 1 for a country i having adopted a fiscal rule in year t, and zero otherwise. X_{it} is the set of the covariates described above. μ_k and ψ_j represent country and time-fixed effects, respectively, capturing unobserved heterogeneity. $\epsilon i, t$ is the idiosyncratic error term. Using the weights computed in Panel B of Table 6.1, we estimate Equation 6.3 from weighted least squares regressions, in which the dependent variable is public expenditure efficiency and FR is the treatment. Panel A of Table 6.2 presents the main results, using different sets of specifications. Column [1] displays the baseline results of the FR effect on

expenditure efficiency. Columns [2]-[4] include country, time, and country-time fixed effects. In Columns [5]-[8], we include all control variables. Column [8] reports the main model results. The estimates suggest that adopting a fiscal rule increases expenditure efficiency, by approximately 4.1 percentage points, with a statistically significant effect at the 1% threshold. Moreover, since the estimated effect is about 51% of the standard deviation of the efficiency score variable (equal to 0.08), we can reasonably conclude that the economic gain from FR adoption is economically significant. With regard to controls, Column [1] of Table 6.3, which reports all the covariates of the baseline model, indicates a positive and statistically significant influence of GDP growth, the fixed exchange rate regime, control of corruption, and government fragmentation on efficiency.

Table 6.2: The effect of FR on public expenditure efficiency

Panel A: Entropy balancing	[1] Baseline	[2] Adding Country/FE	[3] Adding Time/FE	[4] Adding Country/ Time/FE	[5] Adding controls	[6] Adding Country/FE	[7] Adding Time/FE	[8] Adding Country/ Time/FE	[9] Adding Country/ Time/FE/Trend
FR dummy	0.026***	0.045***	0.026***	0.042***	0.026***	0.044***	0.019***	0.041***	0.041***
	(0.0045)	(0.0053)	(0.0047)	(0.0054)	(0.0042)	(0.0060)	(0.0036)	(0.0056)	(0.0056)
Observations	1746	1746	1746	1746	1746	1746	1746	1746	1746
R-squared	0.039	0.4253	0.13	0.541	0.2867	0.463	0.3981	0.5665	0.5665

Panel B: Alternative samples	[1]	[2]	[3]	[4]
FR dummy	0.041***	0.041***	0.040***	0.036***
	(0.0056)	(0.0058)	(0.0057)	(0.0069)
Observations	1728	1547	1600	1205
R-squared	0.5675	0.5545	0.5491	0.6116
Country, Time FE & Controls	Yes	Yes	Yes	Yes

Panel C: Propensity score matching	N-nearest-Neighbors Matching				Radius Matching		Kernel Matching	Local Linear Regression
	N=1	N=2	N=3	r=0.005	r=0.01	r=0.05		
	0.029***	0.024***	0.026***	0.023***	0.024***	0.025***	0.025***	0.025***
	(0.0056)	(0.0049)	(0.0051)	(0.0049)	(0.0044)	(0.0041)	(0.0041)	(0.0039)
Observations	1746	1746	1746	1746	1746	1746	1746	1746
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bootstrap replications	500	500	500	500	500	500	500	500
Pseudo R^2	0.023	0.014	0.015	0.009	0.010	0.008	0.008	0.023
Rosenbaum bounds sensitivity tests	2.00	1.90	2.10	1.90	2.00	2.20	2.20	2.30

Notes: This table reports estimates of the impact of FR on expenditure efficiency. Panel A uses weighted least squares regressions. Panel B estimates the main equation using alternative samples. In the first column of Panel B, we exclude from the sample any episode of hyperinflation. Columns [2] and [3] ignore the 2008-2009 financial crisis and fragile states, respectively. In the last column, we exclude years in which countries with a fiscal rule in place also joined an IMF program, adopted monetary reforms such as inflation targeting, or implemented fiscal consolidations. Panel C re-estimates the main model using propensity score matching methods. All specifications include the variables of the baseline model: lag public debt, lag GDP per capita growth, lag inflation, lag capital openness, fixed exchange rate dummy, democracy, corruption control, and government fragmentation. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6.8 Sensitivity

6.8.1 Robustness

A. Alternative samples and specifications

Combined entropy balancing and trend. As fiscal rules have become very popular worldwide in recent decades, in the last column of Panel A (Table 6.2) we augment our baseline model by introducing a linear trend to account both for the popularity of fiscal rules around the world and the trend in efficiency. The new estimates remain similar to those of the baseline model (Panel A, Column [9]).

Alternative subsamples. In Panel B of Table 6.2, we re-estimate our main model using alternative subsamples. First, we exclude from the sample any episode of hyperinflation, i.e., years when the inflation rate was 40% or more. Second, we drop the 2008-2009 financial crisis, during which many countries have experienced major economic deficits and imbalances. Third, we exclude fragile states, i.e., countries classified by the IMF as having characteristics that significantly undermine their economic and social performance, with weak governance, limited administrative capacity, chronic humanitarian crises, persistent social tensions, and, often, violence or legacy of armed conflict and civil war. Fourth, we exclude years in which countries with a fiscal rule in place also joined an IMF program, adopted monetary reforms such as inflation targeting, or implemented fiscal consolidations.[3] New results, reported in Columns [1]-[4], respectively, remain positive and statistically significant, with coefficients ranging from 3.6 to 4.1 percentage points, i.e., comparable to our benchmark estimates. Moreover, excluding other reforms does not alter our results, suggesting that our main finding is not likely to be confounded/polluted by the effects of other reforms such as IMF programs, inflation targeting, or fiscal consolidation episodes.

Alternative measures of efficiency. For robustness purposes, Apeti et al. (2023b) provide other measures of efficiency. The authors re-estimate the efficiency scores using Greene (2005b)'s approach instead of Kumbhakar et al. (2015)'s approach as in the main model.[4] Next, they replace, among the outcome indicators for economic

[3]Following Afonso et al. (2022a), we define fiscal consolidation episodes as those that show at least a positive annual change in the Cyclically Adjusted Primary Balance (CAPB) of 0.5% of GDP for two consecutive years.

[4]The authors argue that although Greene (2005b)'s approach does not allow inefficiency to be broken down into persistent (long-term) and transient (short-term) inefficiency, it does take into account unobserved heterogeneity across countries and offers a one-step specification model, which

performance, GDP per capita with a happiness measure. Last, they remove public administration from the dimensions of the public sector considered in the main model, to keep only education, infrastructure, and health. Therefore, we re-estimate our main model using these alternative measures. New estimates are reported in Columns [2]-[4] of Table 6.3, where the baseline model result is reported in Column [1]. Again, the results hold.

Additional controls. Next, we augment our main specification by including additional covariates. Taking due note of the fact that our study includes a large sample of countries, with different levels of income, in Column [5] of Table 6.3 we include GDP per capita (as a proxy for economic development) to control for this. In Columns [6]-[12], we further consider the following variables: labor force participation, trade openness, credit rating, a monetary union dummy, an inflation targeting regime dummy, the political system, and political checks and balances.[5] The results of the first-stage equation (not reported, but available on request) show that entropy balancing provides a balanced sample after matching. More importantly, the new estimates show a positive and statistically significant impact of fiscal rules, with a magnitude very similar to the baseline model, i.e., coefficients ranging between 3.3 and 4.2 percentage points. Regarding the new controls, we find a positive and statistically significant influence of GDP per capita, labor force participation, debt

allows for greater flexibility in the econometric procedure.

[5]As economic development is positively correlated with institutional quality, governments of better-developed countries are more likely to adopt rules-based fiscal frameworks. Labor force participation may indirectly impact FR adoption via its impact on fiscal balances, tax revenues or inflation (Dolls et al., 2017; Juselius and Takáts, 2021; Apeti et al., 2023g). Since fiscal rules have been adopted as part of broader economic reforms, notably liberalization, trade openness should encourage FR adoption. The effect of debt ratings on the probability of adopting a fiscal rule is not clear-cut. As high ratings reflect a sound fiscal reputation, the most disciplined governments may be more likely to adopt a credible fiscal rule. On the other hand, given the positive effect of fiscal rules on access to financial markets (Thornton and Vasilakis, 2018; Afonso and Jalles, 2019), one may argue that low-rated countries would also have an incentive to adopt rules-based fiscal frameworks to benefit from better access conditions to financial markets. As argued in Guerguil et al. (2017) and Debrun et al. (2008), supranational fiscal rules aimed at preventing free-riding behavior between member states of a monetary union can, in turn, catalyze the implementation of national rules. Likewise, given the disciplining effect of inflation targeting and the complementarity between this regime and fiscal rules (Minea and Tapsoba, 2014; Combes et al., 2018), one would naturally expect a positive influence of this variable on the probability of adopting FR. Since there is a strong rigidity between the political parties in the decision-making process in a presidential regime (Tsebelis, 2000; Gerring et al., 2005), the latter would be negatively correlated with FR adoption. Finally, sharing policies among a larger number of decision-makers can lead to problems of negotiation, agency, coordination, and collective action (Franzese Jr, 2002), which can complicate the adoption of reforms such as fiscal rules. On the other hand, power-sharing may constrain some of the government's budgetary choices, avoiding for instance certain lax or purely ideological expenditures.

ratings, and checks and balances on efficiency, while presidential system is negatively associated.

B. Alternative estimation methods

Other studies examining the effect of fiscal rules employ alternative econometric approaches to correct for endogeneity, such as propensity score matching (PSM); the system-GMM (Generalized Moment Method) estimator; or the instrumental variables (IV) approach.

PSM estimates. The propensity score matching method consists of two steps. First, we calculate the likelihood of a country adopting FR, conditional on the covariates used in the baseline model. In the second step, the propensity scores obtained are used to match treated and untreated observations, and then the ATTs are computed to estimate the effect of fiscal rules. In line with the existing literature, we draw upon four propensity score matching methods to pair up treated with comparable untreated observations: the N-nearest-Neighbors method (with N ranging from 1 to 3 nearest neighbors), the radius method (with R = 0.005; 0.01; and 0.05, respectively), the Kernel Method, and the Local Linear Regression. Moreover, we impose the common support, which allows matching each treated observation with at least one untreated counterfactual that is as similar as possible. New ATTs are reported in Panel C (Table 6.2), with the tests relating to the quality of the matching. The coefficients obtained from PSM do not differ much from those of entropy balancing. Moreover, all the Pseudo-R^2 in our estimates are less than 10%, suggesting that the matching provided balanced scores. In other words, our findings are robust regarding the hypothesis of common support. Lastly, our findings are also robust regarding the Conditional Independence Assumption (CIA), since the cutting points from Rosenbaum sensitivity tests at the usual thresholds hover between 1.9 and 2.3, i.e., comparable with existing studies (see e.g., Aakvik, 2001 or Rosenbaum, 2002, page 188).

OLS estimates. Next, we re-estimate our baseline model using the Ordinary Least Squares (OLS) or a panel fixed-effects regression. Results reported in Column [1] of Table B1 suggest a positive and statistically significant effect of fiscal rules on efficiency, with a magnitude of about 2 percentage points. A closer look at the coefficient shows that its amplitude is smaller than that of entropy balancing, i.e. 2 versus 4.1 percentage points. As Neuenkirch and Neumeier (2016) stressed, the coefficient of simple OLS can be smaller than entropy balancing, as entropy balancing compared to the regression approach, i.e. OLS, doesn't impose a restriction on

the functional form of the model. Moreover, treatment effect estimates based on entropy balancing do not suffer from multicollinearity, as the reweighting scheme orthogonalizes the covariates with respect to the treatment indicator, whereas estimates based on panel regression are likely to be subject to multicollinearity.

IV estimates. Caselli and Reynaud (2020) exploit the geographical diffusion of fiscal rules across countries as an instrumental variable for fiscal rules, arguing that reforms in neighboring countries can influence the adoption of domestic reforms, for example through peer pressure or through an imitation effect to send a credibility signal on international markets, as Balvir (2022) shows. Along these lines, we instrument fiscal rules by the number of fiscal rules in place in countries with common borders with respect to the national economy.[6] The results of the first stage equation (not reported, but available on request), where the fiscal rule dummy is regressed on the instrument and all other explanatory variables of the baseline model, show that the instrument ("Contiguity") positively and significantly explains the treatment, suggesting the instrument used is relevant. Column [2] of Table B1 reports the results of the impact of fiscal rules on efficiency, after instrumentation. The results suggest that adopting a fiscal rule significantly improves expenditure efficiency, at the 5% threshold. Moreover, the estimated effect (4.9 percentage points) remains comparable to that of the baseline model when using entropy balancing (4.1 percentage points). Lastly, the Cragg-Donald F-statistic, well above the Stock-Yogo critical value for weak instruments at the usual threshold, suggests that the instrument used is strong.

GMM estimates. The Blundell and Bond (1998) two-step system-GMM dynamic panel estimator allows accounting for the persistence of public expenditure efficiency while controlling for the Nickell bias (Nickell, 1981).[7] New results presented in

[6]The instrument is defined as follows:

$$contiguity_{i;t} = \sum_{j \neq = i}^{n-i} FR_{j,t} * X_{j,i,t} \tag{6.4}$$

where j is the neighboring country of the domestic country i. $FR_{j,t}$ is a dummy equal to 1 when the country j has a fiscal rule at the time t, and zero otherwise. $X_{j,i,t}$ is equal to zero when countries have no common borders, and sums the number of countries with common borders. $contiguity_{i;t}$ is our instrument and captures the number of fiscal rules in place in countries with common borders with respect to the national economy.

[7]This approach combines equations in levels and first differences in a system and estimates them with an extended system-GMM estimator that allows using lagged differences and levels of explanatory variables as instruments. Compared to the Difference GMM estimator, system-GMM makes it possible to introduce more instruments by adding a second equation, which should

Column [3] of Table B1 lead to qualitatively similar conclusions to the baseline results. Furthermore, regarding the instrument selection criteria, the Hansen test does not reject the hypothesis of instrument validity. Likewise, the AR (1) test for the absence of autocorrelation of the first-order error term and the AR (2) test for the absence of autocorrelation of the second-order error term do not raise concerns about the validity of our estimates.[8]

Entropy Balancing for continuous treatments. So far, we have considered as treatment variable a dummy equal to 1 if a country i at time t has adopted a fiscal rule, and zero otherwise. Other studies rely on an alternative measure of fiscal rules, considering continuous indicators (see, among other examples, Debrun et al., 2008; Gootjes et al., 2021; Gootjes and de Haan, 2022a). Such an approach, while having the advantage of capturing the "strength" of the fiscal regime, encounters a major issue regarding the endogeneity of the treatment variable. In other words, using continuous indicators involves finding external instruments, to go beyond GMM methods. Reform measures — as in this study — allow using impact evaluation methods to better correct for endogeneity issues. The prevailing literature on treatment effects analysis generally uses reform variables, i.e., binary measures. Recent studies have attempted to extend these methods to continuous treatments. Against this background, Tübbicke (2022) extends the entropy balancing method of Hainmueller (2012) to continuous treatments.[9] Thus, relying on Tübbicke (2022), we test the robustness of our results using a continuous treatment, i.e., a measure of

improve estimation efficiency. To tackle the problem of instrument proliferation raised by the above method (Roodman, 2009), the instrument matrix is collapsed. Moreover, to avoid downward-biased standard errors, we use the Windmeijer (2005) finite-sample correction to reduce the possibility of spurious precision.

[8]The stationarity tests conducted led us to reject the null hypothesis of non-stationarity for all our variables. Results are available on request.

[9]See Tübbicke (2022) for technical details.

the strength of the rule.[10] Table 6.4 reports the effects of fiscal rules on expenditure efficiency, using a continuous index of the rule, applying entropy balancing and a fixed effects model in Columns [1] and [2], respectively. Once again, new estimates show a positive and statistically significant treatment effect.[11]

[10]Following Gootjes et al. (2020), we construct a fiscal rule index, considering national and supranational fiscal rules for four categories: balanced budget rules, debt rules, expenditure rules, and revenue rules. The indicator is constructed as follows:

$$FRI = Coverage + Legal\ basis + Supporting\ procedures + Enforcement + Flexibility \quad (6.5)$$

where FRI (Fiscal Rules Index) represents the strength of the rule. Coverage identifies the level of government (central or general) covered by the rule. Legal basis considers the legal basis of the rule, ranging from political agreements to legislative statutes to constitutional rules. Supporting procedures are the sum of the existence (or absence) of multiannual expenditure ceilings, a law on fiscal responsibility, and an independent fiscal body that sets budgetary assumptions and monitors their implementation. Enforcement is measured as the sum of having a formal enforcement procedure in place. Flexibility determines whether there is a well-defined exemption clause, whether the balanced budget target is cyclically adjusted, and whether public infrastructure spending is excluded from the expenditure ceiling. We normalize each of the five components to unity so that the index ranges from 0 to 5.

[11]Drawing on the instrumental approach previously discussed, we estimated the effect of continuous fiscal rules using the neighborhood instrument. Results not reported in this paper but available on request lead to the same conclusions.

Table 6.3: The effect of FR on public expenditure efficiency: Robustness

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
FR dummy	0.041***	0.043***	0.037***	0.020***	0.036***	0.041***	0.041***	0.037***	0.042***	0.041***	0.041***	0.042***	0.033***
	(0.0056)	(0.0076)	(0.0055)	(0.0052)	(0.0055)	(0.0056)	(0.0055)	(0.0056)	(0.0057)	(0.0055)	(0.0055)	(0.0055)	(0.0053)
Lagged Public debt	-1.229e-05	1.752e-04*	1.315e-04**	-1.274e-04***	3.954e-05	-2.504e-05	-1.710e-05	2.993e-04***	-1.539e-05	-1.251e-05	-1.694e-05	-9.569e-06	3.137e-04***
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Lagged GDP per capita growth	0.003***	0.003***	0.002***	0.001***	0.003***	0.003***	0.002**	0.001**	0.003***	0.003***	0.003***	0.003***	0.001
	(0.0007)	(0.0007)	(0.0008)	(0.0004)	(0.0008)	(0.0007)	(0.0008)	(0.0005)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0005)
Lagged inflation	-0.001	0.000	-0.001	-0.001**	-0.001	-0.001	-0.001**	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.0004)	(0.0008)	(0.0004)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0005)
Lagged Capital openness	9.027e-05	7.944e-03**	6.160e-04	-6.229e-03**	-2.501e-04	-1.300e-03	-2.854e-04	-9.645e-04	2.220e-04	1.687e-04	-6.648e-04	-4.805e-04	-4.265e-03
	(0.0030)	(0.0038)	(0.0029)	(0.0029)	(0.0030)	(0.0031)	(0.0030)	(0.0031)	(0.0030)	(0.0030)	(0.0030)	(0.0031)	(0.0030)
Fixed exchange rate regime	0.021***	0.005	0.023***	0.019***	0.020***	0.020***	0.012**	0.017***	0.019**	0.020***	0.021***	0.021***	0.010
	(0.0074)	(0.0104)	(0.0072)	(0.0057)	(0.0073)	(0.0074)	(0.0062)	(0.0064)	(0.0076)	(0.0076)	(0.0075)	(0.0075)	(0.0069)
Democratic system	1.664e-04	6.100e-04	-9.671e-04	4.489e-05	-2.656e-05	5.196e-04	1.673e-04	8.502e-04	3.742e-04	2.943e-04	9.885e-05	-5.755e-04	-7.472e-04
	(0.0009)	(0.0014)	(0.0010)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0011)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0012)
Corruption control	0.001**	0.001***	0.001**	0.000	0.001*	0.001**	0.001**	0.001	0.001**	0.001**	0.001**	0.001**	0.001
	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)
Government fragmentation	0.025**	0.029*	0.026**	0.020**	0.026**	0.025**	0.029***	0.033***	0.025**	0.024**	0.027***	0.021*	0.029***
	(0.0105)	(0.0152)	(0.0103)	(0.0088)	(0.0103)	(0.0106)	(0.0101)	(0.0106)	(0.0105)	(0.0106)	(0.0106)	(0.0110)	(0.0110)
Lagged Log.GDP per capita					0.064***								0.079***
					(0.0209)								(0.0210)
Lagged Labor force participation						0.002**							0.002**
						(0.0008)							(0.0009)
Lagged Trade openness							0.011						0.007
							(0.0106)						(0.0116)
Lagged Credit ratings								0.005***					0.004***
								(0.0010)					(0.0012)
Currency union									0.022*				0.005
									(0.0118)				(0.0111)
Full inflation targeting										-0.009			-0.001
										(0.0096)			(0.0117)
Presidential system											-0.026*		-0.030**
											(0.0137)		(0.0147)
Checks and balances												0.004***	0.004***
												(0.0014)	(0.0014)
Observations	1746	1762	1746	1626	1746	1746	1708	1382	1746	1746	1746	1732	1361
R-squared	0.5665	0.4006	0.5662	0.7844	0.5724	0.5686	0.5885	0.6049	0.5678	0.5668	0.5677	0.5688	0.6391
Country & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the results of various robustness tests of the effect of FR on efficiency, using the entropy balancing method. Column [1] displays the baseline model results. In Column [2], the expenditure efficiency scores are re-estimated following Greene (2005a). In Column [3], among the outcome indicators for economic performance, GDP per capita is replaced with a happiness measure. In Column [4], the efficiency scores are re-estimated considering only the three sectors: education, health, and infrastructure. In Columns [5]-[13] we include the following variables: GDP per capita, labor force participation, trade openness, credit rating, a monetary union dummy, an inflation-targeting regime dummy, presidential rule, and political checks and balances, respectively. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C. Placebo tests

Our results suggest that implementing a fiscal rule significantly improves efficiency. The robustness tests conducted so far support our conclusions. In Panel A of Table 6.5, we further conduct some falsification tests. Specifically, we perform a random assignment to the treatment within the treated countries, considering false adoption dates. Random assignment to treatment leads to no statistically significant effect, suggesting that our results are not driven by confounding factors, reinforcing the robustness of our findings. Lastly, we conduct an additional test which consists in constraining the treatment period. The effects obtained so far from the implementation of a fiscal rule are a comparison of conditional efficiency averages in periods when the rules are in place versus periods when they are not. The effect captured in this paper may suffer from some problems. Indeed, adopting fiscal rules can trigger a change in the economic, political, institutional, and social environment of countries. In this sense, it can be argued that the effect captured may not be due to the fiscal rules but to changes in institutional, political, social, or economic conditions after its adoption. Similarly, any other characteristic that may determine the adoption of fiscal rules, but not included in the econometric specification, may be a source of endogeneity. To circumvent these problems, it would be interesting to compare the results obtained from the full sample period with those around a smaller period. A narrower sample window should provide a more robust estimate of the effects of the rule, since confounding factors such as the implementation of other reforms or change in political regime are more likely to play out over time , or to put it differently, these factors may be stable over a small window (Neuenkirch and Neumeier, 2015; Apeti and Edoh, 2023). Hence, we change our initial sample, considering a window of two, three, four, and five years, respectively. Results are presented in Panel B of Table 6.5 (Columns [1]-[4]). Overall, the coefficients obtained from a smaller window are around those obtained from the full sample. Therefore, it seems unlikely that the estimated effect of fiscal rules is due to a fortuitous change in the policy or institutional environment of the treated country.

D. Treatment heterogeneity

Our baseline specification is based on entropy balancing, which combines a weighting approach with a diff-in-diff regression based on ordinary least squares. In other words, it combines a matching approach based on weight with a regression approach. With this approach, we follow the traditional diff-in-diff method, where we compare 1's (treated) and 0's (control)—like the other methods used for robustness—, i.e., the unit of observation is country-years.[12] In this way, a country that will be treated could be itself a potential control. Moreover, the adoption of fiscal rules is heterogeneous, and due to the notion of credibility, which is developed over time, the fiscal rule may have a lag effect, i.e., the treatment may have reversals. All these considerations create several problems that are highlighted in new developments in the diff-in-diff literature, notably De Chaisemartin and d'Haultfoeuille (2020); Callaway and Sant'Anna (2021); Sun and Abraham (2021); Baker et al. (2022); Tang et al. (2022); Liu et al. (2024). Based on the literature, we have tested the possible presence of bias due to the heterogeneous treatment design. The heterogeneous treatment diff-in-diff method, i.e., the staggered diff-in-diff technique, widely used in the literature, estimates the weighted sums of the mean treatment effects in each group (treatment and control) and each period, with weights that may be negative. Due to these negative weights, the regression coefficient may, for example, be negative while all average treatment effects are positive. The origin of this problem is that, since we are in a panel and the unit of observation is the country year, the untreated observations of the units already treated, i.e., the pre-adoption situation defined by a 0, can serve as a comparison unit for the newly treated observations in the staggered difference analysis. To check the potential existence of these biases, De Chaisemartin and d'Haultfoeuille (2023) proposes to test the existence of negative weights. The results based on the authors' approach show that 319 out of 898 ATTs receive negative weights, i.e., 36%. In addition, our baseline specification estimates an average effect that does not take into account the fact that time in treatment may play a role. In sum, the traditional diff-in-diff model, i.e. the regression part of our entropy balancing method, suffers from three major problems, namely, negative weights, assumption of no feedback, and constant treatment effects.

To address these issues, we tested the robustness of our results using a diff-in-diff method recently proposed by Liu et al. (2024). The results are shown in Figure

[12]However, despite its advantages, this method may be vulnerable to some criticism or have some limitations.

6.5. The conclusions suggest a positive effect of fiscal rules on public expenditure efficiency. The effect appears in the third year—supporting the hypothesis of a potential time lag in reform before generating any effect (Apeti et al., 2024)— and increases over time, to reach a peak around the 7th year. In other words, the effect increases from the date of adoption to reach its peak in year 7, highlighting a long-term rather than short-term effect. Finally, an examination of the pre-treatment period shows the presence of a parallel trend, as no statistically significant effect can be distinguished before the introduction of the reform. These results, which support the robustness of our conclusions, attest to the consistency of our results with regard to the choice of method. In other words, the use of a method that takes into account the potential biases discussed in the recent diff-in-diff literature does not alter our conclusion: fiscal rules improve public expenditure efficiency.

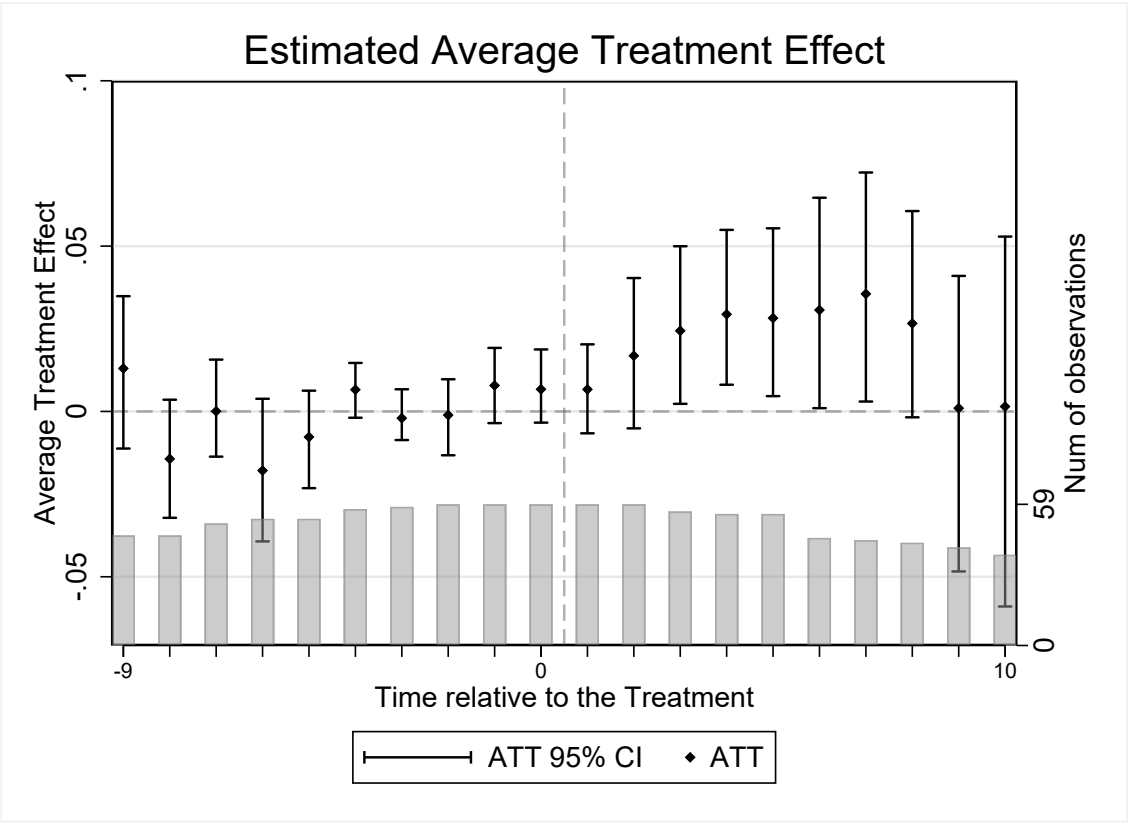

Figure 6.5: Fiscal rules and public expenditure efficiency: accounting for treatment heterogeneity.

6.8.2 Heterogeneity

The types of fiscal rule. This subsection explores some heterogeneity in the effect of the reform, depending on the different types of rules. As observed earlier, over our

study period, budget balanced rules (BBR) are the most widespread, followed by debt rules (DR) and expenditures rules — ER — (Figure 6.2). BBR, by setting a ceiling or numerical target for the government's budget balance, aim to promote greater fiscal discipline. DR set an explicit limit on the stock of government debt to ensure convergence to a debt target. ER, by limiting total, primary or current expenditure, directly target the size of government (Schaechter et al., 2012). Finally, revenue rules (RR) consist of constraining, often numerically, public revenues. Columns [1]-[4] of Table 6.6 suggest that BBR, DR, and ER all have a positive and statistically significant effect on efficiency, while the coefficient for RR, although positive, is not significant.[13] Moreover, we find that DR and BBR have a greater effect on expenditure efficiency compared to ER.

Design of the rules. Second, we explore other sources of heterogeneity by examining conditional effects. We consider our main specification, augmented as follows :

$$Y_{i,t} = \alpha + \beta FR_{i,t} + \phi FR_{i,t} * V_{i,t} + \eta X_{i,t} + \mu_i + \psi_t + \epsilon_{i,t} \tag{6.6}$$

where V represents the vector of variables that may be a source of heterogeneity. A positive (negative) and statistically significant sign of (ϕ) suggests that the benefit of the reform is amplified (reduced) in the presence of the variable considered. First, we check for possible heterogeneity due to the design of fiscal rules. We consider the following factors: monitoring, enforcement, coverage, legal basis, supporting procedures, independent fiscal institutions (fiscal councils), and flexibility.[14] Evidence reported in Table 6.7 (Columns [1]-[7]) suggests that formal monitoring, enforcement

[13]Over our sample and study period, only 14 countries have adopted RR: Australia (1998), Belgium (1992), Benin (2000), Burkina Faso (2000), Denmark (2001), France (2006), Guinea-Bissau (2000), Kenya (1997), Mali (2000), Netherlands (1994), Niger (2000), Senegal (2000), Timor-Leste (2005) and Togo (2000).

[14]The design variables of the rules were constructed following Gootjes et al. (2021). Monitoring captures to what extent national compliance monitoring outside of government is implemented. Enforcement is measured as the sum of having a formal enforcement procedure in place. Coverage identifies the level of government (central or general) covered by the rule. Legal basis considers the legal basis of the rule, ranging from political agreements to legislative statutes to constitutional rules. Supporting procedures are the sum of the existence (or absence) of multiannual expenditure ceilings, a law on fiscal responsibility, and an independent fiscal body that sets budgetary assumptions and monitors their implementation. Fiscal councils provide information on whether independent public institutions that aim to strengthen commitments to sustainable public finances are in place. Finally, flexibility determines whether there is a well-defined exemption clause, whether the balanced budget target is cyclically adjusted, and whether public infrastructure spending is excluded from the expenditure ceiling.

arrangements, and coverage, as well as a strong legal basis for the rule, amplify the positive effect of FR on expenditure efficiency. It may seem surprising that fiscal rules are not necessarily more effective at increasing efficiency when flexibility is introduced, since the literature shows that flexibility in rules increases productive investment and fiscal countercyclicality (Guerguil et al., 2017). However, this result should be interpreted with caution, as it simply suggests that fiscal rules, whether flexible or not, are effective in improving efficiency, since the effect of the variable in level, i.e. the effect of the fiscal rule dummy, remains statistically significant.

Macroeconomic and institutional factors. Next, we examine other sources of heterogeneity, looking at the role of macroeconomic and institutional factors. Column [8] of Table 6.7 reveals that the positive effect of fiscal rules is amplified for countries with high per capita income, potentially because more developed economies are likely to introduce more credible reforms (Apeti et al., 2024). In Column [10], we examine whether the effect of the reform is conditioned by institutional quality, proxied by political stability. There is suggestive evidence that fiscal rules are most effective when adopted by countries with good institutions, especially those with good political stability. This result is in line with that of Columns [8] since countries with weak institutions have been found to have poorer government performance (La Porta et al., 1999; Acemoglu et al., 2002; Acemoglu et al., 2008b). In Column [11], we cross the treatment with a fiscal transparency variable, extracted from Wang et al. (2015). The coefficient for the interaction is not statistically significant, albeit positive. Finally, the last column explores heterogeneity according to fiscal discipline. The term "Low fiscal discipline" is a dummy equal to 1 when a country i, at a time t, has a sovereign debt rating below its long-term average (over 1990-2017), and zero otherwise. Results suggest that fiscal rules are more effective when adopted by countries with relatively poor fiscal discipline, probably because the latter have greater room for improvement.

6.9 Some empirical evidence on the mechanisms

As discussed in Section 6.2, fiscal discipline —via lower fiscal deficit/balance, corruption/waste and better tax performance——is a plausible channel through which the favorable effect of fiscal rules on efficiency may transit. To the best of our knowledge, the literature does not provide a measure of passive waste, while active waste can be approximated by the level of corruption. We follow previous studies (e.g., see Gutmann et al., 2021; Bambe, 2023; Apeti, 2023a; Apeti and Edoh, 2023;

Combes et al., 2024; Bambe et al., 2024) and proceed as follows. Simple Pearson correlations provided in Panel A of Table 6.8 suggest that fiscal balance, corruption control, and tax revenue mobilization are positively associated with efficiency. In Panel B, regressions performed with entropy balancing and considering the baseline model show that fiscal rules improve fiscal balance, corruption control, and tax revenue mobilization. This suggests that improved fiscal discipline resulting from FR adoption —(in part) due to better control of corruption, fiscal deficit and tax revenue mobilization— is a key channel through which FR improve public expenditure efficiency.

6.10 Conclusion

Widespread in both industrialized and developing countries, fiscal rules have often been successful, at least so far, given their ability to promote strong fiscal discipline. Unlike the existing literature, which focuses on discretionary factors such as debt, deficits, or public spending, this paper assesses the effect of fiscal rules on public expenditure efficiency. Using a panel of 158 developed and developing countries over the period 1990-2017 and relying on the entropy balancing method to mitigate selection bias issues, we find that implementing a fiscal rule significantly improves expenditure efficiency, with economically significant effects. Heterogeneity analyses suggest that formal monitoring, enforcement arrangements, coverage, strong legal basis, the level of per capita income, as well as institutional quality (notably political stability) amplify the positive effect of fiscal rules on expenditure efficiency; fiscal rules are more effective when adopted by countries with poor fiscal discipline; and their favorable effect tends to increase over time. Lastly, the transmission channel analysis suggests that greater fiscal discipline, via improved fiscal deficit, institutional quality and tax revenue mobilization, is the main channel through which the effect of fiscal rules on efficiency is transmitted.

Adding up to the evidence in favor of significant effects on fiscal discipline, our results show that fiscal rules also matter for public expenditure efficiency for both advanced and developing countries.

Table 6.4: Robustness: Fiscal rules index and public expenditure efficiency

Dependent: Efficiency	[1]	[2]
	Entropy balancing	OLS
Fiscal rules index	0.027***	0.021***
	(0.0052)	(0.0032)
Lagged Public debt	-0.000	-0.000
	(0.0001)	(0.0001)
Lagged GDP per capita growth	0.004***	0.002***
	(0.0009)	(0.0006)
Lagged inflation	-0.000	0.000
	(0.0003)	(0.0000)
Lagged Capital opennes	0.006*	0.001
	(0.0033)	(0.0026)
Lagged exchange rate regime	0.019**	0.021***
	(0.0079)	(0.0076)
Democratic system	0.003*	0.002***
	(0.0014)	(0.0007)
Corruption control	0.001***	0.001***
	(0.0003)	(0.0002)
Government fragmentation	0.019*	0.005
	(0.0113)	(0.0089)
Observations	1746	1746
R-squared	0.6216	0.5289
Country & Time FE	Yes	Yes

Notes: This table displays the results of the impact of fiscal rules on public expenditure efficiency. We use as a variable of interest a fiscal rule strength index described as follows: Fiscal Rules Index = Coverage + Legal basis + Supporting procedures + Enforcement + Flexibility (see Equation 6.5). Column [1] reports the results based on entropy balancing for continuous treatments. Column [2] reports the results using the OLS estimator. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.5: Fiscal rules and expenditure efficiency: falsification tests

Panel A : Placebo tests	[1]			
Random treatment	-0.004			
	(0.0031)			
Panel B: Constraining the treatment period	[1]	[2]	[3]	[4]
FR dummy [-2, 2]	0.021***			
	(0.0053)			
FR dummy [-3, 3]		0.031***		
		(0.0055)		
FR dummy [-4, 4]			0.038***	
			(0.0059)	
FR dummy [-5, 5]				0.042***
				(0.0059)

Notes: This table reports the results of the causal impact of fiscal rules on public expenditure efficiency, using entropy balancing. Panel A performs a random assignment to the treatment within the treated countries, considering false adoption dates. Columns [1]-[4] constrain the period of adoption, considering a window of two, three, four, and five years, respectively. The specifications include the variables of the baseline model: lag public debt, lag GDP per capita growth, lag inflation, lag capital openness, fixed exchange rate dummy, democracy, corruption control, and government fragmentation. Robust standard errors are in parentheses. * p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01

Table 6.6: Heterogeneity: types of rules

Dependent: Expenditure efficiency	[1]	[2]	[3]	[4]
	BBR	DR	ER	RR
ATT	0.038***	0.044***	0.012***	0.003
	(0.0056)	(0.0067)	(0.0037)	(0.0132)
Observations	1746	1746	1746	1746
R-squared	0.5549	0.568	0.6076	0.6465
Country, Time FE & Controls	Yes	Yes	Yes	Yes

Notes: This table presents the results of the causal impact of fiscal rules on expenditure efficiency, by type of rule and using the baseline model. The equation is estimated from the baseline model, using entropy balancing. We consider budget balanced rules (BBR), debt rules (DR), expenditures rules (ER), and revenue rules (RR), respectively. All specifications include the variables of the baseline model: lag public debt, lag GDP per capita growth, lag inflation, lag capital openness, fixed exchange rate dummy, democracy, corruption control, and government fragmentation. Robust standard errors are in parentheses. * p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01

Table 6.7: Heterogeneity: Design of the rule and macroeconomic factors

Dependent: Expenditure efficiency	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
FR dummy	0.027***	0.033***	0.019***	0.029***	0.039***	0.040***	0.035***	0.031***	0.042***	0.036***	0.036***	0.036***
	(0.0059)	(0.0056)	(0.0060)	(0.0088)	(0.0057)	(0.0055)	(0.0066)	(0.0064)	(0.0062)	(0.0063)	(0.0100)	(0.0058)
Design of the rule												
FR * Monitoring	0.084***											
	(0.0119)											
FR * Enforcement		0.078***										
		(0.0167)										
FR * Coverage			0.087***									
			(0.0153)									
FR * Legal basis				0.015*								
				(0.0092)								
FR * Supporting procedures					0.013							
					(0.0098)							
FR * Fiscal councils						0.019**						
						(0.0080)						
FR * Flexibility							0.008					
							(0.0067)					
Macroeconomic factors												
FR * GDP per capita								0.003***				
								(0.0011)				
FR * Natural resources									-0.001			
									(0.0013)			
FR * Political stability										0.013***		
										(0.0046)		
FR * Fiscal transparency											0.000	
											(0.0003)	
FR * Low fiscal discipline												0.013*
												(0.0070)
Observations	1746	1746	1746	1746	1746	1746	1746	1746	1742	1622	1088	1746
R-squared	0.5828	0.575	0.5777	0.5673	0.567	0.5682	0.567	0.5729	0.5918	0.5658	0.6464	0.571
Controls, Country & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the results of the heterogeneity effects of fiscal rules. The equation is estimated by considering the main model augmented by the interactive term. Vector X variables in isolation (without interaction with FR) and controls are included but not reported for space purposes. All specifications include the variables of the baseline model: lag public debt, lag GDP per capita growth, lag inflation, lag capital openness, fixed exchange rate dummy, democracy, corruption control, and government fragmentation. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.8: Transmission channels

Panel A	[1]	[2]	[3]
	Efficiency	Efficiency	Efficiency
Fiscal balance	0.0728***		
Corruption control		0.4325***	
Tax revenues			0.2627***
Panel B	[1]	[2]	[3]
	Fiscal balance	Corruption control	Tax revenues
FR dummy	1.381***		
	(0.3680)		
FR dummy		1.285**	
		(0.5406)	
FR dummy			0.471**
			(0.2217)
Observations	1707	1762	1687
R-squared	0.5321	0.9706	0.9514
Controls, Country & Time FE	Yes	Yes	Yes

Notes: This table reports the results of the main channels through which fiscal rules may affect efficiency. Panel A reports simple Pearson correlations linking the potential channels to efficiency. Panel B estimates the impact of fiscal rules on the channels considered, using the baseline model estimated by entropy balancing. All regressions include the baseline model controls and the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A Data and sample

Table A1: List of Fiscal Rules (FR) and Non-FR countries

FR	Dates	FR	Dates	FR	Dates	FR	Dates
Argentina	2000	Germany	1990	Italy	1992	Netherlands	1992
Armenia	2002	Dominica	1998	Jamaica	2010	Norway	2001
Australia	1998	Denmark	1992	Japan	1990	New Zealand	1994
Austria	1995	Ecuador	2003	Kazakhstan	2013	Pakistan	2005
Burundi	2013	Spain	1992	Kenya	1997	Panama	2002
Belgium	1992	Estonia	1993	Liberia	2009	Peru	2000
Benin	2000	Finland	1995	Sri Lanka	2003	Poland	1997
Burkina Faso	2000	France	1992	Lithuania	2004	Portugal	1992
Bulgaria	2003	Georgia	2013	Luxembourg	1990	Paraguay	2015
Brazil	1998	Guinea-Bissau	2000	Latvia	2004	Russian Federation	2007
Botswana	2003	Equatorial Guinea	2002	Maldives	2013	Rwanda	2013
Central African Republic	2002	Greece	1992	Mexico	2006	Senegal	2000
Canada	1998	Grenada	1998	Mali	2000	Singapore	1990
Switzerland	2003	Croatia	2009	Malta	2004	Serbia	2011
Chile	2001	Hungary	2004	Mongolia	2013	Slovenia	2000
Cameroon	2002	Indonesia	1990	Mauritius	2008	Sweden	1995
Colombia	2000	India	2004	Malaysia	1990	Togo	2000
Cabo Verde	1998	Ireland	1992	Namibia	2001	Timor-Leste	2005
Costa Rica	2001	Iceland	2004	Niger	2000	Uganda	2013
Cyprus	2004	Israel	1992	Nigeria	2007	Uruguay	2006
Non FR							
Afghanistan	Jordan	Sierra Leone	Congo, Rep				
Angola	Cambodia	El Salvador	Congo, Dem Rep				
Albania	Kiribati	Suriname	Iran, Islamic Rep.				
Azerbaijan	Kuwait	Seychelles	Yemen, Rep.				
Bangladesh	Lebanon	Thailand	Bolivia				
Bahrain	Lesotho	Tajikistan	Kyrgyz Republic				
Bosnia and Herzegovina	Morocco	Tonga	Slovak Republic				
Belarus	Madagascar	Trinidad and Tobago	St Vincent and the Grenadines				
Belize	Myanmar	Tunisia	United States				
Barbados	Mozambique	Turkey	Laos				
Bhutan	Malawi	Ukraine	Hong Kong				
China	Nicaragua	Uzbekistan	United Kingdom				
Dominican Republic	Nepal	Vanuatu	Tanzania				
Algeria	Oman	Samoa	Korea, Rep.				
Ethiopia	Philippines	South Africa	Egypt, Arab Rep.				
Fiji	Papua New Guinea	Zambia	Bahamas, The				
Ghana	Qatar	Zimbabwe	Swaziland				
Guatemala	Saudi Arabia	Czech Republic	Venezuela, RB				
Honduras	Sudan	Moldova	Vietnam				
Iraq	Solomon Islands	Cote d'Ivoire					

Table A2: Descriptive statistics of the main variables

Varibable	**Obs.**	**Mean**	**Sd**	**Min**	**Max**
Expenditure efficiency scores	3,802	0.6645	0.0777	0.2466	0.8961
Public debt	3,319	61.7045	61.0421	0.4744	2092.92
GDP per capita growth	3,733	2.2738	6.1851	-64.9924	140.3708
Inflation	3,390	21.3332	194.2163	-18.1086	7481.664
Financial openness	3,554	0.2934	1.5655	-1.9166	2.3467
Fixed exchange rate dummy	3,455	0.3916	0.4882	0	1
Government fragmentation	3,381	0.2496	0.2863	0	1
Corruption control	2,961	49.5717	28.9048	0	100
Democratic system	3,341	4.1963	6.2759	-10	10

Table A3: Country rankings by average efficiency scores: 1990-2017

Country	Score	Rank	Country	Score	Rank	Country	Score	Rank	Country	Score	Rank
United States	0.8011	1	Tunisia	0.688	41	Chile	0.6632	81	Mali	0.6356	121
United Kingdom	0.7733	2	Tonga	0.6873	42	Ivory Coast	0.6623	82	Cameroon	0.6338	122
Australia	0.7468	3	Barbados	0.6849	43	Jamaica	0.6622	83	Mongolia	0.6325	123
Japan	0.7416	4	Laos	0.6849	44	Luxembourg	0.6622	84	Malawi	0.6323	124
New Zealand	0.7359	5	Mauritius	0.6821	45	Trinidad and Tobago	0.6618	85	Lesotho	0.6318	125
Israel	0.7279	6	Argentina	0.6814	46	Algeria	0.6617	86	India	0.6317	126
Germany	0.7259	7	Finland	0.681	47	Armenia	0.6601	87	Ghana	0.6309	127
Netherlands	0.7257	8	Grenada	0.6804	48	Botswana	0.6599	88	Bahamas, The	0.6293	128
Norway	0.7254	9	Latvia	0.6795	49	Paraguay	0.6597	89	Honduras	0.629	129
Ireland	0.7242	10	Thailand	0.6776	50	Sweden	0.6597	90	Central African Republic	0.6285	130
Italy	0.7224	11	Panama	0.6774	51	Saudi Arabia	0.6596	91	Zimbabwe	0.6264	131
Korea, Rep.	0.7223	12	Greece	0.6774	52	Mozambique	0.659	92	Namibia	0.6259	132
Austria	0.7194	13	Mexico	0.6769	53	South Africa	0.6588	93	Liberia	0.6251	133
Iceland	0.7184	14	Seychelles	0.6768	54	Iraq	0.658	94	Benin	0.6245	134
Costa Rica	0.718	15	Egypt, Arab Rep.	0.6767	55	Vanuatu	0.6566	95	Bangladesh	0.6232	135
Denmark	0.7166	16	Hungary	0.6764	56	Nepal	0.6549	96	Iran, Islamic Rep.	0.6222	136
Slovenia	0.7152	17	Republic of Serbia	0.6763	57	Moldova	0.6545	97	Sudan	0.6218	137
Canada	0.7139	18	Samoa	0.6741	58	Tajikistan	0.6543	98	Madagascar	0.6218	138
Malta	0.7133	19	Bosnia and Herzegovina	0.674	59	Fiji	0.654	99	Pakistan	0.6211	139
Singapore	0.7112	20	Uzbekistan	0.6737	60	Philippines	0.6539	100	Afghanistan	0.6191	140
Kazakhstan	0.7098	21	Timor-Leste	0.6726	61	Maldives	0.6539	101	Eswatini	0.6191	141
Peru	0.7092	22	Ecuador	0.6725	62	Qatar	0.6534	102	Nicaragua	0.6171	142
Portugal	0.7083	23	Colombia	0.6722	63	Kyrgyz Republic	0.6531	103	Bhutan	0.6163	143
Poland	0.708	24	Dominica	0.6715	64	Burkina Faso	0.651	104	Kenya	0.6079	144
Brazil	0.7038	25	Belize	0.6713	65	Rwanda	0.649	105	Zambia	0.6072	145
Switzerland	0.7031	26	Georgia	0.6713	66	Jordan	0.6483	106	Myanmar	0.6057	146
China	0.7027	27	Estonia	0.671	67	Morocco	0.6483	107	Equatorial Guinea	0.6042	147
Czechia	0.7014	28	St Vincent and the Grenadines	0.6706	68	Solomon Islands	0.6481	108	Uganda	0.5996	148
France	0.7012	29	Indonesia	0.6689	69	Oman	0.648	109	Burundi	0.5961	149
Lithuania	0.6994	30	Bahrain	0.6688	70	Kuwait	0.6476	110	Republic of the Congo	0.5931	150
Belarus	0.697	31	Ukraine	0.6681	71	Guatemala	0.6461	111	Angola	0.5907	151
Belgium	0.6965	32	Kiribati	0.668	72	Niger	0.6458	112	Papua New Guinea	0.5688	152
Slovak Republic	0.6949	33	Russian Federation	0.6676	73	Vietnam	0.6456	113	Togo	0.5612	153
Lebanon	0.6944	34	Dominican Republic	0.6672	74	Sierra Leone	0.6433	114	Ethiopia	0.5604	154
Cabo Verde	0.6935	35	Bulgaria	0.667	75	Cambodia	0.6429	115	Nigeria	0.5543	155
Cyprus	0.6919	36	Senegal	0.6659	76	Venezuela, RB	0.6415	116	United Republic of Tanzania	0.5467	156
Spain	0.691	37	Bolivia	0.6657	77	Albania	0.6402	117	Yemen, Rep.	0.5429	157
Turkey	0.691	38	Malaysia	0.6654	78	Suriname	0.6379	118	Democratic Republic of the Congo	0.4826	158
Sri Lanka	0.6898	39	El Salvador	0.6651	79	Guinea-Bissau	0.637	119			
Uruguay	0.6897	40	Croatia	0.664	80	Azerbaijan	0.6368	120			

Table A4: Sources of variables for the calculation of efficiency scores (from Apeti et al., 2023b)

Variables	Nature	Sources
1. Public expenditure (inputs)		
Education expenditure (%GDP)	Continuous	Public Expenditures for Economic Development (SPEED)
Infrastructure expenditure (%GDP)	Continuous	SPEED
Health expenditure (%GDP)	Continuous	SPEED
Government final consumption (%GDP)	Continuous	World Economic Outlook (WEO)
2. Sectoral performance indices (outcomes)		
Education		
— Primary enrollment	Continuous	World Development Indicators (WDI)
— Secondary enrollment	Continuous	WDI
— Expected years of schooling	Continuous	WDI
Health		
— Life expectancy at birth	Continuous	World Development Indicators (WDI)
— Infant mortality rate (per 1000 live births)	Continuous	WDI
Infrastructure :		
— Total length of roads in kilometers	Continuous	World Telecommunication/ICT Indicators Database
— Number of paved roads (% total roads	Continuous	World Telecommunication/ICT Indicators Database
— Fixed telephone subscriptions (per 100 people)	Continuous	World Telecommunication/ICT Indicators Database
— Fixed broadband subscriptions (per 100 people)	Continuous	World Telecommunication/ICT Indicators Database
— Faults for 100 fixed telephone lines per year	Continuous	World Telecommunication/ICT Indicators Database
— Proportion of households with electricity	Continuous	World Telecommunication/ICT Indicators Database
— Electric power consumption (in kWh per capita)	Continuous	World Telecommunication/ICT Indicators Database
— Electric power transmission and distribution losses (%production)	Continuous	World Telecommunication/ICT Indicators Database
Administration		
— Independence of the judiciary	Continuous	Teorell et al. (2021)
— Quality of property rights	Continuous	Teorell et al. (2021)
— Quality of government	Continuous	Teorell et al. (2021)
— Level of the shadow economy	Continuous	Teorell et al. (2021)
Stability		
— Standard deviation of the three-year moving average of GDP growth	Continuous	Authors, from WDI
— Standard deviation of the three-year moving of inflation	Continuous	Authors, from WDI
Distribution		
— Gini index	Continuous	Standardized World Income Inequality Database (SWIID)
Economic performance		
— GDP per capita	Continuous	WDI
— GDP growth (10-year average)	Continuous	WDI
— Unemployment rate (10-year average)	Continuous	WDI

Table A5: Fiscal rules and expenditure efficiency: sources of variables

Variables	Nature	Sources
1. Main model variables		
Public expenditure efficiency	Scores ranging from 0 to 1	Authors, from data in Table A4
Fiscal rules	Dummy	IMF Fiscal Rules Dataset
Public debt (%GDP)	Continuous	Abbas et al. (2011)
Inflation	Continuous	WDI
GDP per capita growth	Continuous	WDI
Financial openness	Index ranging approximately from -2 to 2	Chinn and Ito (2006)
Fixed exchange rate regime	Dummy	Authors, from Ilzetzki et al. (2017)
Corruption control	Index ranging from 0 to 100	Worldwide Governance Indicators database (Kaufmann et al., 2011)
Democratic regime	Index ranging from -10 to 10	Polity
Government fragmentation	Index ranging from 0 to 1	Database of Political Institutions (DPI)
2. Additional variables		
Annual GDP growth	Continuous	WDI
Trade openness	Continuous	WDI
GDP per capita	Continuous	WDI
Credit rating	Index ranging from 1 to 21	Kose et al. (2017)
Inflation targeting	Dummy	Rose (2007); Roger (2009); Jahan (2012) and Ciżkowicz-Pękała et al. (2019)
Presidential system	Dummy	Database of Political Institutions
Political checks and balances	Continuous	Database of Political Institutions
Natural resources	Continuous	WDI
Fiscal transparency	Index ranging from 0 to 100	Wang and Alvi (2011)
Political stability	Index ranging from -2 to 2	Worldwide Governance Indicators database (Kaufmann et al., 2011)

B Robustness

Table B1: Results from OLS, IV, and GMM estimators

Dependent: Public expenditure efficiency	[1]	[2]	[3]
	OLS	IV	GMM
FR dummy	0.019***	0.049**	0.069*
	(0.0056)	(0.0215)	(0.0390)
Lagged Public debt	0.000	0.000	-0.000
	(0.0001)	(0.0001)	(0.0001)
Lagged GDP per capita growth	0.002***	0.002***	0.001***
	(0.0006)	(0.0003)	(0.0004)
Lagged inflation	-0.000	-0.000	0.000
	(0.0000)	(0.0000)	(0.0005)
Lagged Capital opennes	0.002	0.000	-0.011
	(0.0026)	(0.0028)	(0.0093)
Fixed exchange rate regime	0.025***	0.025***	0.034
	(0.0074)	(0.0073)	(0.0730)
Democratic system	0.002***	0.002**	-0.005
	(0.0007)	(0.0009)	(0.0072)
Corruption control	0.001***	0.001***	0.001
	(0.0002)	(0.0002)	(0.0009)
Government fragmentation	0.009	0.009	0.008
	(0.0089)	(0.0077)	(0.0301)
Lagged Expenditure efficiency			0.662***
			(0.2245)
Observations	1746	1746	1738
R-squared	0.5191	0.5107	
Stock-Yogo stat.		16.38	
Cragg-Donald Wald stat.		113.384	
Number of countries			108
Number of instruments		1 (Contiguity)	64
AR(1) p-value			0.002
AR(2) p-value			0.101
Hansen p-value			0.710
Country & Time FE	Yes	Yes	Yes

Notes: This table reports estimates of the impact of fiscal rules on expenditure efficiency. Column [1] reports the results obtained with the OLS estimator. Column [2] relies on an instrumentation strategy, using as an instrument the number of fiscal rules in place in countries with common borders with respect to the national economy ("Contiguity"). Column [3] reports the results obtained using a two-step system and relying on internal instruments. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Chapter 0

General Conclusion

The literature dealing with the interaction between the fiscal and monetary spheres teaches us that, in the long term, monetary policy cannot be independent of government behavior, since in the event of fiscal insolvency, the government can pressure the central bank to finance its deficits through money creation. To put it another way, lasting stability is unlikely if the government behaves irresponsibly. The main implication of this literature is that fiscal policy must be complemented by formal rules to promote fiscal sustainability, which may reduce the risks of fiscal dominance. Conversely, fiscal frameworks need to be combined with a monetary regime constraining the central bank to focus on its price stability objective. As such, the 1990s witnessed the emergence of new monetary and fiscal reforms, including inflation targeting and fiscal rules, to influence policymakers' behavior and promote the credibility of domestic macroeconomic policies. Inflation targeting and fiscal rules have now become popular tools for the conduct of fiscal and monetary policies in many countries. A substantial body of literature shows that, by strongly anchoring inflation expectations, the inflation-targeting framework helps to improve the credibility of monetary policy, thereby reducing macroeconomic uncertainty or volatility, particularly in developing countries. Meanwhile, on the fiscal side, a vast body of literature shows that well-designed fiscal rules help to improve fiscal discipline in both advanced and developing countries, through lower debt or deficits.

The thesis contributes to the existing literature by examining some aspects related to inflation targeting and fiscal rules, with a particular focus on emerging and developing economies, given that they differ from their advanced peers in several ways. For example, emerging and developing economies are characterized, among other things, by low per capita income relative to industrialized countries, limited structural transformation, poor access to financial markets, high macroeconomic instabilities, and low institutional quality. We examine the impact of fiscal rules and inflation targeting on certain key economic aspects of these countries. Moreover,

we take good notice of the fact that, even in developing countries, there is still some heterogeneity, and therefore conduct several heterogeneity analyses. However, in Chapters 5 and 6, which deal with public spending efficiency, we also include advanced countries, to enable international comparison, as efficiency is a relative measure. Similarly, in Chapter 3, which deals with the impact of financial openness on inflation deviations from the central bank target, we have also included advanced countries, as inflation deviations are also frequent in these economies.

The thesis consists of two parts. The first part examines the effects of inflation targeting. In Chapter 1, we examine the effect of inflation targeting on private domestic investment in developing countries and apply propensity score matching to reduce selection issues related to policy adoption. The analysis conducted on a panel of 62 developing countries over the period 1990–2019 shows that inflation targeting promotes private sector investment, with statistically and economically significant effects. Heterogeneity analyses show that inflation deviations from the central bank's target attenuate the favorable effect of inflation targeting, while this beneficial effect is amplified in countries with sound fiscal discipline. Lastly, the transmission channel analysis suggests that improved macroeconomic stability resulting from inflation-targeting adoption (i.e., a reduction in inflation and its volatility, interest rate, and exchange rate volatility) is the main channel through which the monetary framework improves private sector investment. In Chapter 2, we examine the impact of inflation targeting on the private sector at a more disaggregated level, i.e., on firm performance. The analysis is conducted on a sample of 31,027 firms from 47 developing countries surveyed over the period 2006-2020 and employs entropy balancing to address endogeneity issues related to policy adoption. The results suggest that inflation targeting improves firm performance (measured by sales growth and productivity growth) and that this effect is attenuated when the central bank deviates from its inflation target, while it increases over time and in countries with good institutions and fiscal discipline. The transmission channel analysis also suggests that improved macroeconomic stability resulting from inflation targeting is the main channel through which the effect of the monetary framework transits. Chapter 3 examines the mechanisms likely to reduce inflation deviations from the central bank's target, focusing on the role of financial openness. The analysis conducted on a sample of 36 advanced and developing inflation-targeting countries over the period 1990–2021 shows that financial openness significantly reduces inflation deviations from the central bank's target, and that the effect is economically significant and robust. Furthermore, we find that the favorable effect

of financial openness on the effectiveness of the monetary framework is mainly driven by capital outflows, rather than inflows; that capital mobility tends to reduce positive deviations (above the target) rather than negative deviations; and that the favorable effect of capital mobility is amplified when inflation deviations are large, and in countries with good fiscal discipline and a more independent central bank. Finally, we empirically examine some underlying mechanisms and find that the disinflationary effect of capital mobility, coupled with better fiscal discipline, are important channels through which capital mobility improves the effectiveness of the inflation-targeting framework.

The second part of the thesis focuses on fiscal policy, in particular, fiscal rules. Chapter 4 examines the effect of fiscal rules on foreign currency debt in developing countries. The analysis conducted on a panel of 59 countries over the period 1990-2020, and using the entropy balancing method, suggests that by promoting fiscal discipline, fiscal rules are associated with a greater probability of issuing debt in local currency, thus reducing foreign currency debt. Heterogeneity analyses suggest that debt rules and expenditure rules have a slightly greater effect than budget balance rules. In addition, the strengthening of fiscal rules, better fiscal discipline before reform adoption, financial development, financial openness, exchange rate regime flexibility, and institutional quality amplify the effect of fiscal rules in reducing foreign currency debt. Finally, the transmission channel analysis suggests that improved credibility of fiscal and monetary policies resulting from the adoption of fiscal rules (i.e., improved fiscal discipline and reduced inflation and volatility) is an important mechanism through which the reform contributes to reducing foreign currency borrowing. Chapter 5 provides an original indicator of public expenditure efficiency, i.e., the performance of the public sector in providing goods and services, given the resources used. The analysis covers a panel of 158 advanced and developing countries over the period 1990-2017 and employs one of the most recent SFA (Stochastic frontier analysis —SFA) approaches proposed by Kumbhakar et al. (2015), which captures the impact of stochastic shocks and accounts for unobserved time-invariant heterogeneity. The analysis of the determinants of the efficiency scores suggests that trade openness, factor productivity, and institutional quality positively affect efficiency in both advanced and developing countries, while taxation seems to play negatively in advanced countries. Furthermore, we find that factor productivity and the level of democracy positively impact efficiency in all the regions considered (Africa, Asia, Latin America, and Europe), while the positive impact of trade openness seems to hold only for Asian and European countries.

Similarly, the negative effect of taxation holds only for Latin America and Europe. Chapter 6 examines the effect of fiscal rules on public spending efficiency. The analysis is conducted on a panel of 158 advanced and developing countries over the period 1990-2017 and employs the entropy balancing method to deal with selection bias. We find that by promoting fiscal discipline, fiscal rules are associated with lower fiscal waste and greater efficiency in the provision of public goods and services. Heterogeneity tests suggest that the effect of deficit rules and debt rules is greater than that of expenditure rules. Moreover, monitoring and enforcement mechanisms, wider coverage of the rule, the level of economic development, and institutional quality amplify the positive effect of fiscal rules on expenditure efficiency. We also find that fiscal rules are more effective when adopted by countries with low fiscal discipline, and that the positive effect of fiscal rules tends to strengthen over time. Finally, we examine some transmission channels and find that improved fiscal discipline and institutional quality are important channels through which fiscal rules promote spending efficiency.

The thesis provides several economic policy implications for policymakers and scholars. First, a monetary framework oriented towards price stability, such as inflation targeting, can significantly help promote the private sector's contribution to development objectives, via higher domestic investment or firm performance. This is crucial for developing countries, whose frequent macroeconomic instabilities represent an additional constraint for the private sector, which is nevertheless a crucial driver of investment, job creation, and other important aspects of the economy. Second, it also emerges that sound fiscal policy and stronger institutions (especially in Chapter 2) amplify the beneficial effect of inflation targeting, while inflation deviations from the target play negatively. This suggests some degree of complementarity between the fiscal and monetary spheres —as Combes et al. (2018) have explicitly shown— and highlights the importance of institutions in the effectiveness or success of reforms, as discussed in Acemoglu et al. (2008a). This leads us to relate the results of this thesis to a forthcoming paper, where we show that inflation targeting has not significantly improved inflation performance in Africa, because institutional capacity, notably central bank independence, has remained weak compared to other developing countries where the monetary framework has been successful. In other words, policymakers must pay particular attention to institutional preconditions to ensure greater credibility and effectiveness of the reforms they adopt. Turning to inflation deviations from the target, the implication is clear: while the explicit announcement of an inflation target can strongly anchor

inflation expectations, inflation deviations from the target contribute just as much to reducing the desired anchoring objective. We therefore draw policymakers' attention to the need to implement the necessary measures to get closer to the announced targets, for example by improving their communication strategy and the transparency of their policy. In the same vein, in the search for mechanisms to promote inflation convergence towards the central bank's target, we show that capital mobility can play a role in both advanced and developing countries, through its disciplining effect on domestic macroeconomic policies. We are aware of the debate on the effects of liberalization on economic performance, with many studies claiming a positive impact, and others taking a more skeptical view. As such, our results do not imply that policymakers should undertake capital account liberalization without caution, but they do provide evidence that capital mobility can to some extent improve the effectiveness of domestic policies.

Several implications also emerge on the fiscal side. First, by constraining policymakers' behavior, fiscal rules can help improve fiscal discipline and the confidence of domestic and international investors, enabling developing countries to increase their likelihood of issuing debt in local currency, thus reducing the share of foreign currency debt. This is of crucial importance for these countries, which are often prone to the original sin problem, sometimes exposing them to the risks of debt crises, with disastrous consequences for their economies. In the same vein, well-designed fiscal rules can both improve fiscal discipline and promote greater efficiency in the use of public spending in both advanced and developing countries. The quest for greater spending efficiency, for example through lower fiscal waste, is a key issue for governments, especially as they have limited funding and must meet their high financing needs, while preserving the sustainability of public finances. This is all the more important in the post-Covid era, where the increase in public deficits has been large-scale in most countries. Second, it also emerges from the thesis that fiscal rules are complementary to mechanisms such as monitoring and enforcement procedures, and institutional quality. In other words, well-designed rules need to be complemented by additional mechanisms for greater effectiveness. However, we are also aware that a proliferation of complementary mechanisms can impede the applicability and readability of the rules. It is therefore important for decision-makers to avoid "spaghetti bowl effects", that is, to strike the right balance between simplicity and effectiveness. Third, in the quest for mechanisms to promote greater public spending efficiency, our results also suggest that better exploitation of the benefits of trade globalization (for example, a better transfer of skills, knowledge, and

technology into the national economy); policies to promote factor productivity (such as technological innovation or human capital formation); better fiscal governance and transparency in the management of public funds (through, among other things, improved supervision of budget execution, better control of financial and accounting reports, and better monitoring of public expenditure); would enable both advanced and developing economies to significantly promote their spending efficiency.

The thesis offers a series of perspectives for future research. First, the role of inflation targeting (or monetary policy) in anchoring inflation expectations deserves further exploration. More specifically, we believe that exploring the multiple and complex consequences of the inflation-targeting framework at a more disaggregated level, for example at the firm level as we do in Chapter 2, or even at the household level, to better understand the consequences of monetary policy, is an interesting avenue for future research. Second, while it has been established that inflation expectations contribute significantly to shaping actual inflation, inflation resulting from weather-related supply shocks and import/export price shocks remain major determinants of inflation in certain regions of the world, such as sub-Saharan Africa. We, therefore, believe that the literature should further examine the extent to which monetary authorities could equip themselves with a framework that accounts for the effects of climate or terms-of-trade shocks in their objective function and forecasting exercises. This may help limit inconsistency problems in the face of such shocks, especially as climate-related shocks are expected to become more pronounced. If supply shocks become more prevalent than demand shocks, the conduct of monetary policy will be made more difficult, since raising interest rates to combat inflation will accentuate the negative effects of the supply shock on output. All these issues point to the fact that, in the real world, "divine coincidence" (i.e., the absence of trade-offs between stabilizing inflation and stabilizing output) does not exist due to real imperfections (Blanchard and Galí, 2007). On the other hand, climate policies are likely to increase the carbon price (through carbon taxes, regulations, or quota markets), thereby raising production costs, boosting inflation, and causing a decline in economic activity. If an inflation-targeting central bank reacts by raising its interest rate, it may contribute to an even steeper decline in GDP. If, on the other hand, the central bank is concerned not only with inflation but also with the output gap (Taylor rule), its monetary reaction to climate policy may be less drastic. It is therefore possible that in the coming years, the design of climate policies and the choice of monetary regimes will be considered simultaneously. Third, many advanced countries entered the 2008-2009 and COVID-19 crises with historically low interest

rates, sometimes reaching zero. Such a situation contributes to tying monetary authorities' hands in times of crisis, resulting in the need for greater reliance on fiscal policy and higher deficits, compared to what deficits would have been in the absence of such a constraint. Higher average inflation and therefore higher average nominal interest rates before the crisis would have reduced the zero interest rate constraint by giving monetary policy greater room for maneuver during the crisis, thereby limiting the increase in deficits. An important question, then, is whether the experience of previous crises justifies setting a higher inflation target in the future to prevent the zero interest rate constraint. We believe that this line of research deserves to be further explored, although a few works in the literature exist on the subject.

We conclude our proposals for future research, turning now to fiscal policy. First, so far, the literature examining the economic consequences of fiscal rules has mainly focused on macroeconomic data. In a recent paper, Pahula et al. (2024) examine the effect of fiscal consolidations on firm performance in developing countries. We believe that work exploring the role of fiscal rules could be an interesting line of research, especially as, using macroeconomic data, Sawadogo (2024) shows that fiscal rules help to promote private-sector investment decisions in developing countries. Second, the structure of fiscal rules has significantly changed in the wake of the COVID-19 crisis, with suspensions in many countries. The latter face additional challenges. How can the old rules be reformed? Should governments return to previous targets? Third, in the era of climate change, it is important to question the role of fiscal policy in protecting green public investments over the long term. For example, in a forthcoming paper, we show that fiscal rules in advanced countries tend to reduce environmental spending, another important question is whether this reduction is associated with greater efficiency in the use of such spending. We believe that this literature could be explored further from several perspectives, including the role of the policy mix in preserving the environment. Lastly, it would be interesting, based on the novel indicator provided in Chapter 5, to deepen the analysis of mechanisms likely to improve the efficiency of public spending, by examining the role of various political, economic, and structural factors.

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Chapter 0

Résumé extensif en français

0.1 Contexte

Le processus décisionnel démocratique peut conduire à des dérives budgétaires ou à ce que la littérature a appelé le biais de déficit, qui consiste pour les gouvernements à dévier d'une politique budgétaire optimale en faisant des dépenses excessives ou en laissant filer les déficits. La première dérive provient du cycle électoral : les gouvernements ont tendance à faire des relances budgétaires avant les élections pour maximiser leurs chances d'être réélus, créant ainsi des cycles politico-économiques et creusant les déficits budgétaires. La deuxième dérive provient de la concurrence électorale : anticipant la possibilité d'être remplacés, les gouvernements peuvent être incités à réduire la marge de manœuvre de leur successeur en faisant de la dépense publique excessive par émission stratégique de dette publique. La troisième dérive provient du problème du "common pool": étant donné que de nombreux décideurs sont impliqués dans le processus budgétaire, chacun d'entre eux peut être soumis à des pressions de la part de groupes d'intérêts spécifiques ou dépendre de ceux-ci et ne pas internaliser les coûts actuels et futurs de ses choix. Il en résulte une forte probabilité de dépenses et de déficits avec le nombre de décideurs.

D'un autre côté, la littérature traitant de la délégation de la politique monétaire établit que le régime discrétionnaire conduit à un biais inflationniste, car la banque centrale tend à créer des surprises d'inflation afin de soutenir l'activité économique, compte tenu des préférences de la société en matière d'inflation et d'emploi. En outre, les comportements du gouvernement ne sont pas sans impact sur la conduite de la politique monétaire. Au contraire, selon l'arithmétique monétariste déplaisante, une politique budgétaire laxiste peut être source d'incohérence temporelle de la part de la banque centrale, car les gouvernements qui enregistrent des déficits persistants doivent tôt ou tard financer leurs déficits par la création monétaire, générant ainsi de l'inflation. L'expérience montre également que l'inflation résultant des

situations de dominance budgétaire a été particulièrement importante dans les pays en développement, en raison d'un certain nombre de caractéristiques structurelles, entre autres, une faible indépendance de la banque centrale, des sources de recettes fiscales concentrées et instables, de mauvaises procédures de collecte des impôts, une répartition asymétrique des revenus, un accès plus limité aux emprunts extérieurs, et l'instabilité politique.

La principale (potentielle) implication de la littérature traitant des interactions entre les politiques budgétaire et monétaire est que l'indépendance de la banque centrale est une condition nécessaire, mais non suffisante pour assurer la stabilité des prix, car elle doit être complétée par des réformes visant à assurer la viabilité des finances publiques, telles que des règles budgétaires. Inversement, pour réduire les déficits, les règles budgétaires doivent être combinées à un régime monétaire contraignant. Dans la quête des mécanismes susceptibles d'agir sur les comportements des décideurs afin de promouvoir la crédibilité des politiques macroéconomiques domestiques, les années 1990 ont été marquées par l'adoption de nouvelles réformes monétaires et budgétaires dans le contexte d'une inflation galopante et de l'accroissement des déficits dans de nombreux pays du monde. Parmi ces réformes ont également émergé les règles budgétaires et la politique de ciblage de l'inflation, aujourd'hui devenues des outils populaires de la conduite des politiques budgétaire et monétaire dans de nombreux pays, y compris dans les pays émergents et en développement. Les règles budgétaires sont des contraintes durables sur la politique budgétaire, pouvant être numériques ou procédurales. Elles peuvent porter sur la dette, les déficits, les dépenses, ou les revenus, et ont pour but de « lier les mains » des gouvernements afin de garantir une politique budgétaire saine. Le ciblage de l'inflation quant à lui implique l'annonce explicite par la banque centrale d'un niveau quantitatif d'inflation, ainsi que son engagement à atteindre cet objectif afin d'assurer la stabilité des prix, par exemple en améliorant la transparence de sa politique et en renforçant sa communication avec le public. L'annonce explicite d'un objectif d'inflation permet à la banque centrale de fournir au public un point de repère sur l'orientation future de la politique monétaire, ce qui contribue à ancrer les attentes en matière d'inflation, renforçant ainsi la crédibilité de la politique monétaire.

Depuis le milieu années 1990, le ciblage de l'inflation et les règles budgétaires ont été adoptés par de nombreux pays dans le monde afin de promouvoir la crédibilité des politiques macroéconomiques domestiques. Aujourd'hui, presque 40 pays opèrent sous le régime de ciblage de l'inflation, plus de la moitié étant des économies émergentes et en développement. Du côté budgétaire, selon les dernières données

du FMI, 105 pays avaient adopté des règles budgétaires numériques (nationales et supranationales) en 2021, dont 71 pays émergents et en développement. Les règles sur les déficits sont les plus en vogue, implémentées par 92 pays en 2021, suivies des règles sur la dette (84 pays) et les dépenses (55 pays). Les règles sur les revenus, bien que peu populaires comparées aux autres types de règles, ont été implémentées par 17 pays en 2021.

L'inflation mondiale est repartie à la hausse durant la pandémie de COVID-19, atteignant 10% en 2020 dans les économies émergentes et en développement, contre une moyenne pré-pandémique (2010-2019) d'environ 6%, certains pays reportant des taux supérieurs à 20%. Sur le plan budgétaire, les niveaux d'endettement, qui étaient déjà à la hausse dans de nombreux pays, ont encore augmenté pendant la pandémie de COVID-19. La dette publique a atteint 65,18% du PIB en 2020 dans les économies en développement, contre une moyenne de 47,11% du PIB avant la pandémie (2010-2019). En conséquence, les déficits ont augmenté pour atteindre 4,58% du PIB, contre une moyenne pré-pandémique (2010-2019) de 1,08% du PIB. En 2020, de nombreux pays en développement ont reporté des ratios d'endettement supérieurs à 100% du PIB, et certains pays des taux supérieurs à 150% du PIB. L'expérience des crises récentes nous montre clairement que l'inflation n'est pas un problème du passé, au contraire, la politique monétaire a un rôle important à jouer dans la stabilisation macroéconomique. Un meilleur ancrage des anticipations est crucial pour contrôler l'inflation et la stabiliser sur une trajectoire descendante au cours des prochaines années. Cela implique donc que les banques centrales ont un rôle important à jouer, en termes de communication de leur objectif d'inflation et de transparence de leur politique. Du côté budgétaire, il est également clair que la croissance tendancielle de la dette et des déficits compromet la viabilité des finances publiques et les perspectives économiques futures. Pourtant, le rôle de la politique budgétaire pour financer le développement et assurer la stabilité macroéconomique est cruciale, en particulier pour les pays en développement, qui ont des revenus domestiques limités et une forte demande d'investissement. En d'autres termes, les décideurs politiques (des pays en développement) doivent faire un compromis entre le financement de leurs économies et la préservation de la viabilité budgétaire à moyen terme, d'autant plus que les crises de la dette sont très coûteuses et conduisent à des déséquilibres économiques majeurs. Un cadre budgétaire approprié et une meilleure gestion de la politique budgétaire sont donc importants pour assurer la viabilité des finances publiques et promouvoir la crédibilité des politiques macroéconomiques, en particulier pour les pays en développement.

0.2 Contributions à la littérature et résultats

Selon la littérature, le cadre de ciblage de l'inflation et les règles budgétaires ont globalement permis de favoriser une plus grande stabilité macroéconomique et une meilleure discipline budgétaire dans les économies émergentes et en développement, du moins jusqu'ici. Ces dernières se caractérisent, entre autres, par un faible revenu par tête par rapport aux pays industrialisés, une transformation structurelle limitée, un faible accès aux marchés financiers, de fortes instabilités macroéconomiques, et une faible qualité institutionnelle. En outre, comme mentionné précédemment, si les déficits budgétaires se sont creusés dans de nombreuses économies au cours de ces dernières décennies, le défi est encore plus important pour les décideurs politiques des pays émergents et en développement, qui sont confrontés à un compromis entre le financement de leur économie et la préservation de la viabilité budgétaire à moyen terme. Il y a donc de fortes raisons de croire que les pays en développement ne se comportent pas comme leurs homologues développés. C'est pourquoi cette thèse examine plusieurs questions liées au ciblage de l'inflation et aux règles budgétaires, en mettant un accent particulier sur les économies émergentes et en développement. Plus précisément, nous examinons certaines questions qui n'ont pas encore été abordées dans la littérature, mais qui sont d'une importance cruciale pour ces économies. Cependant, étant donné que, même au sein des pays en développement, il existe toujours une certaine hétérogénéité, la thèse examine, dans chaque chapitre, diverses analyses d'hétérogénéité relatives aux caractéristiques économiques, institutionnelles et structurelles. En outre, certains chapitres de la thèse considèrent un échantillon plus large, incluant également les pays avancés, par exemple lorsqu'il s'agissait d'examiner les déterminants de l'efficience des dépenses publiques (Chapitres 5 et 6). L'efficience étant une mesure relative, nous avons jugé important de considérer l'échantillon le plus large possible afin de fournir une comparaison internationale. De même, dans le Chapitre 3, qui examine l'impact de la mobilité des capitaux sur les déviations d'inflation par rapport à la cible de la banque centrale, nous avons considéré les pays avancés, étant donné que les déviations sont également une question cruciale pour les banques centrales de ces économies. Toutefois, ici encore, plusieurs analyses d'hétérogénéité sont examinées, y compris une distinction entre les pays avancés et les pays en développement.

Dans les Chapitres 1 et 2, nous examinons l'effet du ciblage de l'inflation sur l'investissement domestique privé et la performance des firmes dans les pays en développement, respectivement. Contrairement à la littérature existante qui examine l'effet du cadre monétaire en se focalisant sur les agrégats des secteurs monétaire et

budgétaire, ces deux chapitres analysent les effets secondaires du régime monétaire, en s'intéressant plutôt au secteur privé, dans la mesure où ce secteur dans les pays en développement est entravé par de nombreux obstacles, y compris les fréquentes instabilités macroéconomiques auxquelles ces économies sont confrontées. Nous avons donc estimé qu'il était important d'examiner dans quelle mesure ce secteur pouvait bénéficier des effets favorables d'un cadre axé sur la stabilité des prix, tel que le ciblage de l'inflation. En outre, dans le Chapitre 2, nous combinons des données macroéconomiques avec des données au niveau des firmes, contribuant ainsi à une large littérature axée sur des analyses macroéconomiques. Ensuite, bien que la littérature montre que le ciblage de l'inflation a généralement des effets favorables sur la stabilité macroéconomique, en particulier dans les pays en développement, nous constatons que les déviations d'inflation par rapport à l'objectif de la banque centrale sont fréquentes tant dans les pays avancés que dans les pays en développement. Ces déviations réduisent l'objectif d'ancrage et donc l'efficacité du régime monétaire. Dans la recherche de mécanismes susceptibles de promouvoir la convergence de l'inflation vers l'objectif de la banque centrale, nous examinons le rôle de l'ouverture financière. Par exemple, de nombreux travaux montrent que l'ouverture financière contribue à discipliner les politiques macroéconomiques domestiques et, dans une certaine mesure, conduit à la désinflation. L'idée sous-jacente est que, en présence de mobilité des capitaux, les ménages et les entreprises peuvent substituer la monnaie nationale à la monnaie étrangère s'ils n'ont pas confiance dans les autorités monétaires. En outre, une plus grande ouverture du compte de capital implique un risque plus élevé de perdre des capitaux internationaux en cas de politiques inflationnistes, en raison de la forte concurrence entre les pays pour attirer les investisseurs étrangers. La littérature établit également que la mobilité des capitaux encourage les gouvernements à discipliner leur politique budgétaire, de peur d'être pénalisés par les marchés internationaux de capitaux, mais aussi parce qu'une plus grande mobilité des capitaux rend plus difficile l'imposition du capital en raison de la concurrence fiscale. Cela peut avoir des effets secondaires importants sur la politique monétaire, d'autant plus que l'une des sources d'incohérences temporelles des banques centrales provient des déficits budgétaires persistants des gouvernements.

Les trois derniers chapitres de la thèse portent sur la politique budgétaire, en particulier sur l'impact des règles budgétaires. Dans le Chapitre 4, nous examinons l'impact des règles budgétaires sur la dette publique en devises étrangères dans les pays en développement. Cette question est cruciale pour ces derniers qui, compte tenu de leurs emprunts importants en devises étrangères, souffrent de ce que la

littérature appelle le péché originel : en cas de chocs, la dépréciation de leur monnaie augmente le coût de la dette, les exposant parfois au risque d'insolvabilité. Par conséquent, ce chapitre examine si, en favorisant la discipline budgétaire, les règles budgétaires augmentent la probabilité d'émettre de la dette en monnaie locale, atténuant ainsi le problème du péché originel. Dans le même ordre d'idées, si la littérature existante montre que les règles budgétaires réduisent généralement les déficits, une question différente est de savoir si l'amélioration de la discipline budgétaire est associée à une meilleure gestion des dépenses publiques, par exemple à une réduction du gaspillage budgétaire. Le Chapitre 6 répond à cette question en examinant l'effet des règles budgétaires sur l'efficience des dépenses publiques, c'est-à-dire la performance du secteur public dans l'offre des biens et services par rapport aux ressources utilisées. En outre, dans le Chapitre 5, nous fournissons un indicateur original d'efficience des dépenses publiques, couvrant un panel de 158 pays avancés et en développement sur la période 1990-2017, et nous examinons une série de déterminants des scores calculés. L'indicateur est accessible sur la plateforme d'Oxford (Oxford Economic Papers) et peut être utilisé par d'autres chercheurs.

La thèse s'appuie sur des hypothèses dérivées d'analyses théoriques pour identifier les canaux par lesquels le ciblage de l'inflation et les règles budgétaires peuvent affecter nos différentes variables de résultat, et teste empiriquement les principaux canaux discutés. L'exercice empirique utilise des méthodes économétriques appropriées pour traiter les questions d'endogénéité. En effet, l'identification de l'effet induit par l'adoption d'une réforme économique est rendue difficile, car les différences de performance entre les pays ayant adopté la réforme et leurs pairs pourraient être influencées par d'autres facteurs non observables, d'autant plus que l'adoption des réformes économiques peut être associée à une série de mesures alternatives. Par conséquent, dans le Chapitre 1, nous suivons les études précédentes et appliquons la méthode d'appariement des scores de propension, qui est appropriée pour atténuer les problèmes de sélection discutés précédemment par rapport à la méthode des moindres carrés ordinaires ou à la méthode des doubles différences. L'approche consiste à apparier le groupe des pays ayant adopté une politique de ciblage de l'inflation avec celui des pays n'ayant pas adopté la réforme, sur la base de variables observables résumées dans les scores de propension ou la probabilité d'un pays d'adopter la politique. Ensuite, après l'appariement, la différence de résultat entre un pays traité (pays ayant adopté la politique) et un contrefactuel apparié peut être attribuée à la réforme. Cela dit, le processus d'appariement permet d'imiter une expérience randomisée, en utilisant un groupe de contrôle. Dans les Chapitres

2, 4, et 6, nous utilisons une approche d'appariement relativement plus récente (entropy balancing). Cette méthode est de plus en plus utilisée dans la littérature sur l'évaluation des politiques économiques, en raison des avantages qu'elle présente par rapport aux méthodes plus traditionnelles. Par exemple, contrairement à l'approche d'appariement par score de propension, l'entropy balancing est une approche non paramétrique, ne nécessitant donc aucune spécification de la forme fonctionnelle du modèle empirique ou de la procédure d'affectation du traitement, ce qui permet d'éviter les problèmes de mauvaise spécification. En outre, la régression linéaire dans la deuxième étape permet d'exploiter la structure de panel des données en incluant des effets fixes pour tenir compte de l'hétérogénéité non observée. De plus, dans les Chapitres 4 et 6, à titre de robustesse, nous nous appuyons sur une littérature récente et instrumentons les règles budgétaires par le nombre de règles dans les pays voisins. L'idée sous-jacente est que les pays peuvent souvent être incités à adopter les mêmes réformes que leurs voisins, en raison d'effets de pression des pairs ou du fait d'une simple imitation pour envoyer un signal de crédibilité sur les marchés internationaux. Dans le même ordre d'idées, dans le Chapitre 3, nous renforçons nos tests de robustesse en instrumentant l'ouverture financière avec l'ouverture moyenne dans les pays voisins. Nous montrons que l'instrument est robuste et fournit une variation exogène, atténuant ainsi les problèmes d'endogénéité. Dans le Chapitre 5, les scores d'efficience sont calculés à l'aide de l'une des approches paramétriques les plus récentes (Stochastic frontier analysis-SFA), proposée par Kumbhakar et al. (2015). Contrairement aux méthodes non paramétriques, l'approche que nous adoptons capture l'influence des chocs stochastiques et prend en compte les caractéristiques non observées spécifiques à chaque pays et invariantes dans le temps (culture, idéologie, chocs exogènes, etc.) qui pourraient affecter l'efficience, indépendamment de la gestion du secteur public. Enfin, la conclusion de la thèse propose une discussion sur les implications de politiques économiques découlant de nos résultats et plusieurs perspectives de recherche future. En outre, nous pensons que l'approche adoptée dans le Chapitre 2, qui combine des données macro avec des données microéconomiques, est une voie intéressante pour la recherche future, et que le nouvel indicateur d'efficience que nous fournissons dans le Chapitre 5 sera largement exploité par d'autres chercheurs.

Nos résultats révèlent des effets favorables du cadre de ciblage de l'inflation sur l'investissement domestique du secteur privé et la performance des firmes (mesurée par la croissance des ventes et de la productivité) dans les pays en développement. L'analyse souligne aussi l'importance pour les banques centrales de se rapprocher

des cibles annoncées, étant donné que les écarts d'inflation à la cible atténuent l'effet favorable du ciblage de l'inflation sur la performance du secteur privé. En outre, dans la quête des mécanismes pouvant améliorer l'efficacité du cadre monétaire, nous trouvons que la mobilité des capitaux contribue à favoriser la convergence de l'inflation vers la cible de la banque centrale. Du côté budgétaire, nous trouvons que des règles budgétaires bien conçues peuvent non seulement aider les pays en développement à améliorer leur discipline budgétaire, mais peuvent également atténuer les problèmes liés au péché originel et améliorer l'efficience des dépenses publiques. Enfin, nous fournissons un indicateur permettant de mesurer l'efficience des dépenses publiques, c'est-à-dire la performance du gouvernement dans l'offre des biens et services publics compte tenu des ressources utilisées, et montrons que l'ouverture commerciale, la productivité des facteurs, et la qualité des institutions sont des déterminants importants de l'efficience des dépenses publiques dans les pays avancés et en développement. L'indicateur couvre un panel de 158 pays avancés et en développement sur la période 1990-2017 et est accessible sur la plateforme d'Oxford (Oxford Economic Papers). Nous sommes convaincus que cette thèse apporte une contribution intéressante à la littérature sur les politiques monétaire et budgétaire et que les implications de politiques découlant de nos analyses pourraient améliorer la conduite de la politique économique, notamment dans les pays en développement.

Partie I: Analyse des conséquences économiques du cadre de ciblage de l'inflation

Le secteur privé est essentiel à la réalisation des objectifs de développement, car il est un acteur crucial dans les investissements économiques, dans la création d'emplois, et dans d'autres aspects importants de l'économie. Or ce secteur se heurte à plusieurs difficultés dans les pays en développement, parmi lesquelles les fortes instabilités macroéconomiques auxquelles ces économies font face. Par exemple, il ressort dans plusieurs études qu'en générant de l'incertitude, l'inflation contribue à réduire l'investissement, la croissance des ventes et la productivité des entreprises dans les pays en développement. Par conséquent, la première partie de cette thèse contribue à la littérature en examinant dans quelle mesure le secteur privé dans les pays en développement peut bénéficier des externalités positives d'un cadre monétaire axé sur la stabilité des prix, tel que le ciblage de l'inflation. Plus précisément, dans le Chapitre 1, nous examinons l'impact du ciblage de l'inflation sur l'investissement du secteur privé dans les pays en développement. Comme souligné précédemment, identifier l'effet induit par l'implémentation des réformes et politiques économiques

n'est pas trivial. En effet, l'adoption de la politique de ciblage de l'inflation peut être corrélée à des facteurs non observables qui affectent également la performance globale de l'économie, y compris l'investissement domestique. Pour réduire les biais potentiels d'endogénéité, nous faisons recours aux méthodes d'analyse d'impact, notamment la méthode d'appariement par score de propension (propensity score matching). L'approche consiste, dans un premier temps, à apparier le groupe des pays traités (pays ayant adopté un cadre de ciblage de l'inflation) avec celui des pays non-traités, à partir d'un certain nombre de facteurs mesurables (observables) résumés dans les scores de propension ou la probabilité d'adoption du cadre monétaire. Après appariement, nous calculons l'effet moyen du traitement, qui est la différence moyenne du taux d'investissement entre les deux groupes de pays. L'analyse conduite sur un panel de 62 pays en développement sur la période 1990-2019 montre que l'adoption du ciblage de l'inflation favorise les décisions d'investissement du secteur privé, avec des effets statistiquement et économiquement significatifs. Plus précisément, le ciblage de l'inflation augmente l'investissement domestique privé, avec des coefficients allant de 2,80 à 3,26 points de pourcentage. Nous conduisons ensuite une série de tests d'hétérogénéités et montrons que, bien que le cadre de ciblage de l'inflation ait des effets favorables sur les décisions d'investissement, les déviations d'inflation par rapport à la cible de la banque centrale atténuent cet effet. Nous trouvons également que les pays ayant une bonne discipline budgétaire bénéficient davantage de l'effet positif du ciblage de l'inflation sur l'investissement domestique, probablement parce que les risques de dominance budgétaire sont plus faibles dans ces pays. Enfin, nous examinons empiriquement les mécanismes susceptibles d'expliquer nos résultats principaux et montrons que l'amélioration de la crédibilité de la politique monétaire suite à l'adoption du cadre monétaire, conduisant à plus grande stabilité macroéconomique (c'est-à-dire à une réduction de l'inflation et de sa volatilité, de la volatilité du taux d'intérêt, et du taux de change) est le canal principal par lequel l'effet du ciblage de l'inflation transite. Nos résultats ont une implication importante pour les pays en développement. Un cadre monétaire axé sur la stabilité des prix, tel que le ciblage de l'inflation, peut leur permettre d'accroitre significativement la contribution du secteur privé dans les objectifs de développement.

Le Chapitre 2 étend le premier chapitre en examinant l'influence du cadre de ciblage de l'inflation sur le secteur privé à un niveau plus désagrégé, c'est-à-dire sur la performance des firmes. Les hypothèses avancées sont similaires à celles émises dans le chapitre précédent : compte tenu de ses avantages sur la stabilité macroéconomique, le ciblage de l'inflation pourrait favoriser la performance des entreprises dans les

pays en développement. Pour traiter les problèmes d'endogénéité liés à l'adoption de la réforme, ce chapitre se distingue du premier en utilisant une méthode d'analyse d'impact relative plus récente, l'entropy balancing. Comme mentionné plus haut, cette méthode est de plus en plus utilisée dans la littérature sur l'évaluation des politiques économiques, compte tenu de ses avantages par rapport aux méthodes un peu plus anciennes. Par exemple, contrairement à la méthode d'appariement par score de propension, l'entropy balancing est une approche non paramétrique, qui ne nécessite donc aucune spécification de la forme fonctionnelle du modèle empirique ou de la procédure d'affectation du traitement, ce qui permet d'éviter les problèmes de spécification. De même, la régression linéaire dans la deuxième étape permet d'exploiter la structure panel des données en incluant des effets fixes afin de prendre en compte l'hétérogénéité non observée. L'analyse conduite sur un échantillon de 31 027 entreprises enquêtées dans 47 pays en développement au cours de la période 2006-2020 suggère que l'adoption du ciblage de l'inflation améliore la performance des firmes (mesurée par la croissance des ventes et de la productivité), avec des effets statistiquement et économiquement significatifs. Plus précisément, le ciblage de l'inflation augmente la croissance des ventes et de la productivité de 3 points de pourcentage et 13 points de pourcentage, respectivement, par rapport aux pays n'ayant pas adopté la réforme. Ces résultats corroborent donc ceux du chapitre précédent lorsque nous menons l'analyse à un niveau plus agrégé. Les résultats des analyses d'hétérogénéités soutiennent également un certain nombre de résultats obtenus dans le premier chapitre. Nous trouvons que l'effet bénéfique du cadre monétaire sur la performance des firmes est atténué lorsque la banque centrale dévie de sa cible d'inflation, et amplifié dans les pays ayant de bonnes institutions et une bonne discipline budgétaire. Un autre résultat important est que l'effet positif du ciblage de l'inflation s'amplifie avec le temps, probablement parce que la crédibilité de la politique monétaire tend à se renforcer avec l'expérience du cadre monétaire. Enfin, l'analyse des canaux de transmission suggère que l'amélioration de la stabilité macroéconomique résultant de l'adoption du ciblage de l'inflation est le principal canal par lequel l'effet du cadre monétaire transite, corroborant les mécanismes mis en évidence dans le premier chapitre. L'originalité principale de cette étude tient à la combinaison des données macro et micro, contribuant ainsi à une littérature largement axée sur des données macroéconomiques. Nous pensons que l'exploration des conséquences multiples et complexes du cadre de ciblage de l'inflation à un niveau plus désagrégé constitue une piste de recherche intéressante pour des recherches futures.

Dans les deux chapitres précédents, nous avons montré que l'effet bénéfique du cadre de ciblage de l'inflation sur le secteur privé est fortement atténué lorsque la banque centrale dévie de sa cible d'inflation. Autrement dit, ce résultat suggère que bien que l'annonce explicite d'un objectif d'inflation soit importante pour ancrer les attentes en matière d'inflation, les déviations d'inflation par rapport à la cible affectent négativement la crédibilité de la banque centrale, affaiblissant l'objectif d'ancrage recherché. Une question importante est alors de savoir quels sont les mécanismes économiques susceptibles de réduire ces incohérences temporelles. Une littérature importante montre que l'ouverture financière contribue à discipliner les politiques macroéconomiques domestiques et conduit dans une certaine mesure à la désinflation. L'idée sous-jacente est qu'en présence de la mobilité des capitaux, les ménages et entreprises peuvent substituer la monnaie nationale à la monnaie étrangère s'ils n'ont pas confiance dans les autorités monétaires. En outre, une plus grande ouverture du compte de capital implique un risque plus élevé de perdre des capitaux internationaux en présence d'une politique inflationniste, en raison de la forte concurrence entre les pays pour attirer les investisseurs étrangers. Enfin, la littérature établit aussi que la mobilité des capitaux incite les gouvernements à discipliner leur politique budgétaire, de peur d'être pénalisés par le marché international des capitaux, mais aussi parce qu'une plus grande mobilité des capitaux rend plus difficile l'imposition du capital en raison de la concurrence fiscale. Ceci peut en retour avoir des effets secondaires importants sur la politique monétaire, d'autant plus que l'une des sources d'incohérences temporelles des banques centrales provient des déficits budgétaires persistants du gouvernement. À ce titre, le Chapitre 3 fournit une analyse détaillée de l'impact de l'ouverture financière sur les déviations d'inflation par rapport à la cible de la banque centrale, en incluant un échantillon de 36 pays avancés et en développement cibleurs d'inflation sur la période 1990-2021. Nous montrons que l'ouverture financière réduit significativement les déviations d'inflation par rapport à l'objectif de la banque centrale, et que l'effet obtenu est économiquement significatif et robuste. Plus précisément, une augmentation d'une unité de l'indice de Chinn and Ito (2008) entraîne une réduction de 0,65 points de pourcentage des écarts d'inflation par rapport à l'objectif de la banque centrale. Nous renforçons l'analyse en conduisant une série de tests d'hétérogénéités. Premièrement, les résultats suggèrent que l'effet favorable de l'ouverture financière sur l'efficacité du cadre monétaire est notamment dû aux flux sortants, plutôt qu'aux flux entrants de capitaux. Deuxièmement, la mobilité des capitaux tend à réduire les écarts positifs (au-dessus de la cible) plutôt que ceux négatifs, probablement du fait du mécanisme de désinflation de l'ouverture financière. Troisièmement, l'effet favorable de la mobilité des capitaux

est amplifié lorsque les écarts d'inflation sont importants, et dans les pays ayant une bonne discipline budgétaire et où la banque centrale est plus indépendante. Enfin, nous examinons empiriquement quelques mécanismes sous-jacents et trouvons que l'effet de désinflation de la mobilité des capitaux, couplé à une meilleure discipline budgétaire, sont des canaux importants par lesquels la mobilité des capitaux agit sur l'efficacité du cadre de ciblage de l'inflation. Ce chapitre montre que la libéralisation financière peut contribuer dans une certaine mesure à favoriser l'efficacité du cadre de ciblage de l'inflation, y compris dans les pays en développement.

Partie II: Analyse des conséquences économiques des règles budgétaires

De nombreuses études ont examiné l'effet des règles budgétaires en se focalisant sur des facteurs discrétionnaires tels que la dette, les déficits, ou les dépenses publiques. Nous nous distinguons de la littérature en adoptant une approche légèrement différente, c'est-à-dire en examinant quelques effets secondaires étroitement liés à l'objectif d'efficacité et de discipline des règles budgétaires. Le Chapitre 4 examine l'effet des règles budgétaires sur la dette en devises étrangères dans les pays en développement. Nous conduisons l'analyse sur un panel de 59 pays sur la période 1990-2020 et appliquons la méthode de l'entropy balancing pour atténuer les biais de sélection. Nous trouvons qu'en favorisant la discipline budgétaire, les règles budgétaires sont associées à une plus grande probabilité d'émettre des dettes en monnaie locale, contribuant à réduire la dette en devises étrangères. L'introduction de règles budgétaires réduit la part des devises étrangères dans la dette publique des pays en développement de 2,9 points de pourcentage par rapport aux autres pays en développement qui n'ont pas introduit de règles budgétaires, l'effet étant à la fois statistiquement et économiquement significatif. Nous conduisons ensuite plusieurs analyses d'hétérogénéités et mettons en évidence quelques résultats supplémentaires. Premièrement, nous trouvons que les règles portant sur la dette et les dépenses ont un effet légèrement plus important comparé aux règles sur le solde budgétaire. Deuxièmement, le renforcement des règles budgétaires (saisi par l'indice de force des règles), une meilleure discipline budgétaire avant l'adoption de la réforme, le développement financier, l'ouverture financière, la flexibilité du régime de change, ainsi que la qualité des institutions amplifient l'effet bénéfique des règles budgétaires dans la réduction de la dette en devises étrangères. Enfin, nous examinons empiriquement les mécanismes sous-jacents et montrons que l'amélioration de la crédibilité des politiques budgétaires et monétaires résultant de l'adoption de règles budgétaires (c'est-à-dire une amélioration de la discipline budgétaire et une réduction

de l'inflation et sa volatilité) est un mécanisme important par lequel la réforme contribue à réduire les emprunts en devises étrangères. Les résultats de ce chapitre ont une implication clé pour les pays en développement : en promouvant la discipline budgétaire, des règles budgétaires crédibles peuvent leur permettre de réduire le problème du péché originel auquel ils sont souvent confrontés.

Les dépenses publiques ont fortement augmenté dans de nombreux pays du monde depuis les années 1990, afin de promouvoir la croissance et de répondre aux besoins socio-économiques, et ont connu une nouvelle hausse pendant la pandémie de COVID-19 et la guerre en Ukraine, compte tenu des plans de relance budgétaire pour soutenir les entreprises et les mesures sociales. Bien que les dépenses publiques puissent contribuer à promouvoir une croissance soutenue et durable, la littérature nous enseigne que leur utilisation inappropriée peut conduire à une perte d'efficience, par exemple en cas de gaspillage. En d'autres termes, l'augmentation appropriée des dépenses pour la fourniture de biens et de services publics est limitée par la nécessité d'éviter le gaspillage. Dans ce contexte, une littérature importante et grandissante examine les scores d'efficience des dépenses publiques, qui mesurent la performance du secteur public dans l'offre des biens et services publics, compte des ressources utilisées. Le Chapitre 5 contribue à cette littérature en fournissant des scores d'efficience des dépenses publiques pour un panel de 158 pays avancés et en développement sur la période 1990-2017. L'analyse emploi l'une des approches SFA (Stochastic frontier analysis —SFA) les plus récentes, celle proposée par Kumbhakar et al. (2015). Cette dernière permet de saisir l'influence des chocs stochastiques et de prendre en compte les caractéristiques non observées spécifiques à chaque pays et invariantes dans le temps (culture, idéologie, chocs exogènes, etc.) qui pourraient affecter l'efficience, indépendamment de la gestion du secteur public. Ensuite, nous examinons une série de déterminants des scores obtenus et conduisons plusieurs analyses d'hétérogénéités. Premièrement, nous trouvons que l'ouverture commerciale, la productivité des facteurs, et la qualité des institutions affectent positivement l'efficience à la fois dans les pays avancés et en développement, tandis que la taxation semble agir négativement dans les pays avancés. Deuxièmement, la productivité des facteurs et le niveau de démocratie affectent positivement l'efficience dans tous les groupes considérés (Afrique, Asie, Amérique latine, et Europe), tandis que l'impact positif de l'ouverture commerciale ne semble valable que pour les pays asiatiques et européens. De même, l'effet négatif de la fiscalité ne semble valable que dans les pays d'Amérique latine et d'Europe. Ce chapitre examine non seulement des aspects économiques et institutionnels pouvant améliorer la gestion du public,

mais fournit également un indicateur original et publiquement accessible pouvant enrichir l'état de la littérature sur ce sujet, notamment dans une ère post-Covid où les discussions relatives à la gestion des dépenses publiques ne cessent d'alimenter les débats économiques et politiques.

Le Chapitre 6 examine si, en favorisant la discipline budgétaire, les règles budgétaires s'accompagnent d'un faible gaspillage budgétaire et d'une plus grande efficacité dans l'offre des biens et services publics. Autrement dit, nous évaluons l'effet des règles budgétaires sur l'efficience des dépenses publiques. L'analyse est conduite sur panel de 158 pays avancés et en développement sur la période 1990-2017, en utilisant les scores d'efficience fournis dans le chapitre précédent et en appliquant la méthode de l'entropy balancing pour atténuer les biais de sélection. Les résultats suggèrent que l'introduction des règles budgétaires augmente l'efficience des dépenses d'environ 3,8 points de pourcentage et que l'effet est statistiquement et économiquement significatif. Nous conduisons ensuite une série d'analyses d'hétérogénéités, en distinguant l'effet selon les types de règles et en examinant le rôle d'une série de facteurs macroéconomiques, institutionnels, et structurels. Premièrement, nous trouvons que l'effet des règles sur les déficits et la dette est plus important comparé aux règles sur les dépenses. Deuxièmement, les dispositifs de suivi et de contrôle d'application de la règle, l'élargissement du champ de la couverture de la règle, le niveau de développement économique, et la qualité institutionnelle amplifient l'effet positif des règles budgétaires sur l'efficience des dépenses. En outre, les règles budgétaires sont plus efficaces lorsqu'elles sont adoptées par des pays ayant une faible discipline budgétaire. Troisièmement, nous trouvons que l'effet positif des règles budgétaires tend à se renforcer avec le temps. Enfin, nous examinons quelques canaux de transmission et trouvons que l'amélioration de la discipline budgétaire et de la qualité des institutions est un canal important par lequel les règles budgétaires favorisent l'efficience des dépenses. L'implication principale des résultats de ce chapitre est que des réformes telles que les règles budgétaires peuvent non seulement favoriser la discipline budgétaire, mais aussi une meilleure efficacité dans l'usage des dépenses publiques, y compris dans les pays en développement.