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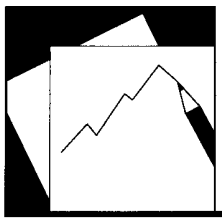

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Inflation Targeting and Fiscal Rules: Do Interactions and Sequencing Matter?

Jean-Louis Combes, Xavier Debrun, Alexandru Minea and René Tapsoba

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Inflation Targeting and Fiscal Rules: Do Interactions and Sequencing Matter?

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Abstract

The paper examines the joint impact of inflation targeting (IT) and fiscal rules (FR) on fiscal behavior and inflation in a broad panel of advanced and developing economies over the period 1990-2009. The main contribution of the paper is to show that, as suggested by the theoretical literature, interactions between FR and IT matter a great deal for policy outcomes. Specifically, the combination of FR and IT appears to deliver more disciplined macroeconomic policies than each of these institutions in isolation. In addition, the sequencing of the monetary and fiscal reforms plays a role: adopting FR before IT delivers stronger results than the reverse sequence.

JEL Classification Numbers:E52, E58, E63, H62

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I. INTRODUCTION

Since the 1990s, many countries have enacted extensive reforms of their macroeconomic policy frameworks. On the monetary side, central bank independence, often along with some form of inflation targeting (IT), is thought to have contributed to lower and more stable inflation both in advanced and in developing economies (see Batini and Laxton, 2007, Gonçalves and Salles, 2008; Lin and Ye, 2009; or de Mendonça and de Guimarães e Souza, 2011, for recent studies). On the fiscal side, governments have tried to tackle chronic excessive deficits and procyclical policies through fiscal policy rules (FR). A growing literature has suggested that well-designed FRs are generally associated with greater fiscal discipline (Alesina and Perotti, 1995; Alesina and others, 1999; Debrun and others, 2008; Hallerberg and others, 2009; Dabla-Norris and others, 2010; Gollwitzer, 2011; or Tapsoba, 2012).[1]

To the best of our knowledge, however, empirical analyses assessing the impact of macroeconomic institutions on policy outcomes have tended to consider monetary and fiscal policy in isolation. This dichotomy is unfounded. First, from a purely empirical perspective, the assumption that the monetary regime has no influence on the conduct of fiscal policy is a restriction that can, and therefore, should be rigorously tested. The same argument applies to the restriction that the framework guiding fiscal choices has no bearing on monetary policy. Either way, existing empirical results may suffer from an omitted-variable bias. Second, those two restrictions are at odds with predictions from standard theories of optimal monetary and fiscal institutions. Clearly, improving the incentives of monetary and fiscal policymakers—the precise objective of these institutional reforms—is bound to affect the outcome of their strategic interaction (Beetsma and Bovenberg, 1997a, b; 1998; Debrun, 2000; Beetsma, Debrun, and Klaassen, 2001 Dixit and Lambertini, 2003; and Castellani and Debrun, 2005). This literature points not only to cross-effects between fiscal (monetary) outcomes and monetary (fiscal) frameworks, but also to interactions between the two types of reforms.

The present paper aims at filling this important gap in the literature on the effects of inflation targeting and fiscal rules on policy performance. Specifically, we look into the interactions between IT and FR in two different ways with potentially first-order policy implications. First, we test the theoretical propositions that IT and FR complement each other by comparing their *joint* effects on inflation and fiscal behavior to isolate their effects. Second, we explore the potential role of the sequencing of IT and FR adoption. In other words, do

[1] IT is characterized by five main criteria, namely (i) public announcement of a medium-term inflation target, (ii) institutional commitment to price stability as the primary goal of monetary policy, (iii) forward-looking strategy for inflation forecasts, (iv) enhanced transparency, and (v) greater accountability of central bank in achieving its inflation target (for an extensive discussion, see, *e.g.*, Svensson, 1997, or Mishkin, 2000). FR are "*a permanent constraint on fiscal policy, expressed in terms of a summary indicator of fiscal performance, such as government budget, borrowing, debt, or a major component thereof*" (Kopits and Symansky, 1998, page 2).

interactions between IT and FR influence differently inflation and/or fiscal balances depending on whether a country adopts IT before introducing FR, or vice versa?[2] While relevant theories do not provide specific testable proposition—the adoption of IT and FR is either simultaneous or follows the sequence IT-first-then-FR—it is a relevant issue to explore from a practical policy perspective. To this end, we rely on dynamic panel-data techniques (System-GMM) that go a long way in addressing the possible endogeneity in the adoption of IT and FR and in their interactions and sequence of adoption. This approach also accounts for the inherent inertia in inflation dynamics and in fiscal behavior.

Our main findings are as follows. First, IT and FR jointly improve fiscal performance (higher fiscal balances all other things equal) and lower average inflation. The individual effects are stronger than in the cases where FR or IT is adopted in isolation. The policy message is clear: it pays off to adopt stability-oriented institutions in both the monetary and the fiscal realm. Second, sequencing seems to matter. Countries that adopt FR before introducing IT end up performing better in terms of policy outcomes than those implementing the reverse sequence.

The rest of the paper is organized as follows. Section II provides additional motivation by discussing the gaps in the existing literature. Section III discusses the dataset and useful stylized facts. Section IV presents the methodology and the estimation technique. Section V illustrates the main results and their robustness, and section VI concludes.

II. Motivation and Literature Survey

There is a considerable literature showing that institutional reforms aimed at improving monetary and fiscal policymakers' incentives have a profound impact on the overall policy mix. In theory, as soon as one acknowledges the strategic dimension of the interaction between between monetary and fiscal authorities, the establishment of an independent central bank mandated to target inflation should affect the conduct of fiscal policy, while explicit constraints on fiscal discretion should influence the conduct of monetary policy. This section briefly reviews two strands of literature, drawing lessons in terms of our testable propositions.

A. Optimal Macroeconomic Institutions

Dominance

The importance of strategic interactions between monetary and fiscal authorities goes back at least to Sargent and Wallace (1981) who showed how the capacity of one policymaker to commit to a given policy path ultimately forced the other to choose whichever policy was

[2] A comparable strategy was adopted for exploring the complementarities and the optimal order of financial liberalization reforms (see, *e.g.*, Dewatripont and Roland, 1995; or de Macedo and Martins, 2008) or political liberalization versus economic liberalization reforms (see Giavazzi and Tabellini, 2005).

needed to fulfill the government's solvency constraint. When the monetary authority can commit to a certain monetary policy, the fiscal authority will ultimately have to adjust present and future primary surpluses to fulfill the present-value government budget constraint. When the fiscal authority can stick to a given path of primary surpluses, sooner or later, the monetary authority has to give in and generate the seigniorage revenues needed to secure government solvency. Under the latter regime, attempts by the central bank to keep inflation low through tight money issuance cannot last and must ultimately give in to higher inflation in the longer run—the so-called unpleasant monetarist arithmetic.

A modern offspring of the Sargent-Wallace argument is the "fiscal theory of the price level" (FTPL), pioneered by Leeper (1991), Sims (1994) and Woodford (1995, 1998), which unlike Sargent-Wallace, acknowledges the nominal nature of government obligations.[3] The bad regime is also one where the fiscal authority can pre-commit to a certain trajectory of primary balances, with monetary policy correspondingly losing the power to determine the price level since the latter must ensure that real liabilities do not exceed the present value of future primary surpluses. This is the so-called fiscal dominance.

Optimal Central Bank Design and Fiscal Policy

In the late 1990s-early 2000s, another strand of literature aimed at characterizing the key features of optimal monetary and fiscal institutions. Given the inherent complexities of the underlying game-theoretic setting, the choice of macroeconomic institutions is analyzed in highly stylized environments where optimal inflation and fiscal policy are determined by maximizing quadratic objective functions under the constraint of a neo-classical Phillips curve (as in Barro and Gordon, 1983), sometime enriched with a period budget constraint (as in Alesina and Tabellini, 1987). In these models, monetary and fiscal policies are typically linked through at least one of the following channels: (i) distortionary taxes that negatively affect structural employment, increasing the monetary authorities' temptation to boost output; (ii) the positive impact of inflation on the budget financing (inflation tax); and (iii) the fact that both monetary and fiscal policies can affect aggregate demand.

Two common features drive the analysis of optimal macroeconomic institutions in this literature. First, the basic distortion to be addressed by institutional reforms is the time-inconsistency problem arising from policymakers' temptation to use macroeconomic policies to address a structural shortfall in output or employment. Time-consistent inflation is too high, while fiscal policy can also be too expansionary in the short-term. Second, partial institutional reforms—typically the establishment of an independent central bank targeting

[3] See also Aiyagari and Gertler (1985), Sims (1988), Benhabib and others (2001), Uribe, (2006), or Sims (2011) who try to disentangle the relative importance of monetary and fiscal policies in providing the nominal anchor to the economy.

inflation—has negative side effects. The reason is that modifying the incentives' scheme of only one player in the game generally ends up widening the gap between their individual motivations, which creates or aggravates coordination failures.

Notable examples of side effects from partial reforms include the following:

- In a static model with a period budget constraint, Beetsma and Bovenberg (1997a) show that an independent central bank—that can commit and so plays as a Stackelberg leader and ignores the government budget constraint—can have an incentive to keep inflation higher than the socially optimal level. The reason is that higher revenues from the inflation tax encourage the fiscal authority to keep the distortionary tax rate lower, thereby avoiding employment losses—which the central bank also cares about. *Concretely, this suggests that the impact of IT on monetary policy can be contingent on the nature of the fiscal regime.* For instance, a fiscal rule mandating adjustments to the budget constraint to take place on the expenditure side only would break the link between inflation and distortionary taxation and avoid the residual inflation bias.
- In a dynamic variant of the above model where both authorities play Nash, Beetsma and Bovenberg (1997b) demonstrate that if the independent central bank is sufficiently more averse to inflation than the discretionary fiscal authority, the latter may use public debt strategically to extract higher inflation from the central bank. The reason is that higher present public debt will result in higher future taxes and lower employment. The central bank then has an incentive to mitigate the expected rise in distortionary taxes by raising future inflation.[4] Interestingly, the opposite result arises if the independent central bank and the discretionary fiscal authority have broadly similar degrees of inflation aversion. In that case, the fiscal authority will use fiscal restraint to lower future financing needs, encouraging the central bank to reduce inflation along with the distortionary tax rate. *This example shows that IT can have a direct first-order impact on fiscal policy behavior.* Here, a fiscal rule preventing strategic manipulations of public debt would avoid these coordination failures, *suggesting that the impact of introducing IT on inflation dynamics would be contingent on FR.*
- Dixit and Lambertini (2003), using a static model where both monetary and fiscal instruments directly affect output and inflation, suggest that the adverse consequences of discrepancies between monetary and fiscal authorities' incentives may be so severe that it could be more important for both to agree on a common set of objectives. In their setup, fiscal discretion completely negates the benefits that could be expected from central bank independence. *This would point to the need to create a common "culture of stability" supported by joint reforms rather than sequential reforms.*

[4] The logic of the argument is similar in nature to Sargent-Wallace's unpleasant monetarist arithmetic, but a pure Nash game.

- The optimality of joint reforms of monetary and fiscal institutions is also at the core of Castellani and Debrun (2005). In a static model where both monetary and fiscal policies influence inflation in a neo-classical Phillips curve, they show that establishing IT while preserving full fiscal discretion "relocates" the time-inconsistency problem, with excessively loose fiscal policy "making up" for the lower inflationary bias. Assuming that fiscal authorities can credibly pre-commit –e.g. through a strict fiscal rule—is not sufficient to solve the problem. Indeed, a strict form of IT—where the central bank completely neglects other objectives—is needed in that case. Finally, if fiscal discretion remains, they show that a rules-based fiscal framework constraining discretion is required to allow IT to deliver the socially optimal inflation rate.

B. Other Relevant Literature

Beyond the game-theoretic analyses of optimal macroeconomic institutions, a number of other studies have also pointed to cross effects of IT and FR on the monetary-fiscal policy mix. On the one hand, Mishkin (2004), Roger (2009), and Freedman and Ötker-Robe (2010), among others, argue that an independent central bank under IT could serve as an agency of restraint for fiscal policy because it is credibly insulated from the pressure to monetize the public debt, which hardens the budget constraint.[5] Minea and Tapsoba (2014) found evidence supporting such a discipline-enhancing effect of IT on fiscal policy, notably in developing countries. On the other hand, fiscal discipline has been identified as a key prerequisite for the effectiveness of IT in achieving price stability (Masson and others, 1997; Sims, 2004; or Bernanke and Woodford, 2004). To the extent that adopting a FR coincides with a lasting shift towards greater fiscal prudence, the favorable inflationary effects attributed to IT in the literature may also be partly related to the presence of FR. By lowering the likelihood of fiscal dominance, FR can buttress the credibility of the IT framework.

An additional motivation for our analysis stems from the fact that both IT and FR can be thought of as belonging to a similar class of reforms of policymaking processes. As such, similarities in the underlying motivation, design, and implementation of both IT and FR, make it natural to study their possible interactions when it comes to establishing their respective causal effects on inflation dynamics and fiscal behavior. Since the late 1980s, the gradual understanding that unconstrained discretion could lead decision makers to systematically opt for suboptimal policies motivated a broad tendency to constrain such discretion through explicit quantitative objectives or limits on key variables (inflation for IT and broad fiscal aggregates for FR). Specifically, IT and FR exhibit clear similarities in their institutional parameters (see Appendix 1). And as pointed out by Kopits (2001), the new

[5] Masson and Pattillo (2002) make a similar point in the context monetary commitments under the West African Economic and Monetary Union could help contain fiscal indiscipline. The argument comes on top of the mechanical reverse-Tanzi effect that could be associated with IT-induced reductions in inflation. The Tanzi effect refers to the erosion in the real value of taxes between the date it comes due and the date of collection (Tanzi, 1992).

wave of FR is backed up by institutional parameters which are also present in IT frameworks, such as transparency and accountability mechanisms.

C. Testable Hypotheses

In reality, policymakers have seemed to internalize the fact that reforming the institutions governing monetary policy cannot be selected independently from the rules characterizing the fiscal policy regime. Prominent cases of institutional reforms suggest that monetary and fiscal reforms were not conceived independently. For instance, IT adoption sometimes went along with the introduction of bold fiscal reforms, including the establishment of FR, to support the IT framework (e.g. in Brazil, Norway, New Zealand or Sweden). In some countries (e.g. Brazil, Chile, Israel, Norway, Poland, Romania or the United Kingdom), legal prohibitions on public debt monetization were adopted to ensure the credibility of the commitment to the inflation target, while in other countries (such as Australia, Canada, the Czech Republic, Ghana, Indonesia, New Zealand, Philippines, South Africa or Turkey), the inflation target is jointly defined by the central bankers and the government, to clearly signal the shared commitment of both fiscal and monetary authorities to stick the IT. Altogether, these examples are symptomatic of a realization in policy circles that the effectiveness of IT and FR in affecting inflation and the fiscal stance may depend on whether IT (FR) is implemented alone or jointly with the introduction of FR (IT).

The testable hypotheses explored in this paper directly echo the vast literature reviewed in this section. First, FR and IT would be expected to matter in their own right for both monetary and fiscal behavior. *We would therefore expect to reject the null hypotheses that IT does not affect fiscal performance and that FR does not affect inflation.* Second, the literature points to side effects of partial reforms of the macroeconomic framework. In particular, IT may be less effective in anchoring inflation to low levels without FR, while FR may not lead to the optimal fiscal policy unless IT exhibits certain features. *Empirically, this means that we would expect to reject the null hypotheses that interaction effects between IT and FR do not influence inflation and fiscal performance.* Third and finally, an interesting empirical question derived from the presumption of rich interactions between the two sets of institutions is the issue of reform sequencing. The literature points to the desirability of simultaneous reforms or assumes that IT comes first; it usually does not compare the impact of alternative sequences, although it may matter in practice.

III. Data and Stylized Facts

To test our three hypotheses, we consider a broad panel of 152 developed and developing countries over the period 1990-2009 (see Appendix 2). The number of countries in the sample reflects data availability, especially regarding outcome variables, namely fiscal balances (primary or overall) and the inflation rate. Regarding the time coverage, the sample starts in 1990 because reliable fiscal and institutional data prior to 1990 are scarce, especially in developing countries, which are well represented in our sample.

A. Variables of Interest: Inflation Targeting and Fiscal Rules

IT is captured by a dummy variable equal to 1 if in a given year a country's monetary policy framework can be characterized as IT, and zero otherwise. Data on the starting dates of IT come from Rose (2007), and were updated with data from Roger (2009) for recent experiences of IT adoption, namely between 2005 and 2009. Rose (2007) defines two different dates for each country, namely a *default* starting year and a *conservative* starting year. The difference between the two dates reflects the fact that some central banks initially adopted "soft or informal" IT (Vega and Winkelried, 2005), in which the central bank's reaction to a deviation from the inflation target is slower compared to that under an explicit "full-fledged or formal" IT. The *default* starting dates (or soft IT) are those announced by central banks themselves, while *conservative* starting dates (or full-fledged IT) are those considered by external analysts as the year when the central bank fulfilled the criteria of an Inflation Targeter (ITer). For robustness reasons, we carry out the analysis with both dates. Among the 152 countries in the sample, 29 experienced IT by the end of 2009 (see the first column of Appendix 3 for the list of 29 ITers along with their starting dates).[6]

We measure FR by a dummy variable taking the value 1 if at a given year a country placed a numerical constraint on fiscal aggregates (budget balance, spending, revenue or debt) at the national level. Data on the starting dates of FR come from the 2009 vintage of the IMF's Fiscal Affairs Department's Fiscal Rules Dataset, which provides a comprehensive overview on FR experiences around the world. Among the 152 countries in the sample, 51 enacted Fiscal Rules (FRers) by the end of 2009 (see the second column of Appendix 3 for the list of 51 FRers and their starting dates).[7]

B. The Interaction between IT and FR and the Sequence of Adoption

To explore the potential impact of the *interaction* between IT and FR and of the *sequence* (timing) *of adoption* of IT and FR, we build 5 dummy variables (see columns three to seven in Appendix 3). Indeed, we cannot measure interactions using traditional interactive variables, such as IT*FR, because the product of these two variables equals either IT or FR alone.

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[6] Serbia adopted IT in 2006, but due to lack of data on the fiscal balance, it was dropped from the sample. Note that 3 countries, namely Finland, Spain and the Slovak Republic, adopted IT in 1993, 1995 and 2005 respectively, but the first two abandoned IT to join the Euro area in 1999, while the third did so in 2009. Consequently, we consider them as ITers only from their IT adoption date to their entrance date to the Euro area.

[7] Armenia, Comoros, Hong Kong, Liberia, and Timor-Leste enacted FR in 2008, 2001, 1997, 2004 and 2005 respectively, but due to lack of data on fiscal balances and/or inflation they are dropped from our sample. Remark that the United States introduced FR in 1990, but abandoned it in 2002, so as Belgium in 1992 and 1999 respectively. Consequently, we consider the United States as a FRer for the 1990-2002 period and Belgium as a FRer for the 1992-1999 period.

- A dummy variable, called IT only, equal to 1 after IT adoption in countries having *adopted only IT* (these countries did not adopt FR throughout the entire time coverage of the sample, namely 1990–2009), and 0 otherwise. For instance, South Africa adopted IT in 2000 and did not experience FR at all over 1990-2009; accordingly, for South Africa, IT only equals 0 for 1990-1999, and 1 for 2000-2009;

- A dummy variable, called FR only, equal to 1 after FR adoption in countries having *only enacted FR* (these countries did not adopt IT throughout the entire time period of the sample, namely 1990-2009), and 0 otherwise. For example, India adopted FR in 2004 and did not experience IT at all over 1990-2009; accordingly, for India, FR only equals 0 for 1990-2003, and 1 for 2004-2009;

- A dummy variable, called IT_and_FR, equal to 1 after the adoption of either IT or FR in the countries having ultimately adopted *both* IT_ and_ FR during the sample period, and 0 otherwise. This dummy captures the effect of the first regime and together with the two sequencing dummies described below, it is essential to identify the extent to which the effectiveness of IT is conditional upon the adoption of FR or vice versa. For example, Australia adopted both IT and FR, the former in 1993 (default starting date) and the latter in 1998; accordingly, for Australia, IT_and_FR equals 0 for 1990-1992 and 1 for 1993 to 2009. Similarly, Poland adopted both frameworks, but first introduced FR in 1997 and then IT in 1998; accordingly, for Poland, IT_and_FR equals 0 for 1990-1996 and 1 for 1997-2009;

- A dummy variable, called IT_after_FR, capturing the *sequence of adoption*, and equal to 1 after IT adoption by countries having first enacted FR and then adopted IT, and 0 otherwise. For example, Poland enacted FR in 1997 before adopting IT in 1998; accordingly, for Poland, IT_after_FR equals 0 for 1990-1997 and 1 for 1998-2009;

- A dummy variable, called FR_after_IT, capturing the *sequence of adoption*, and equal to 1 after FR adoption by countries having first adopted IT and then enacted FR and 0 otherwise. For example, Australia adopted IT in 1993 before enacting FR in 1998; accordingly, for Australia, FR_after_IT equals 0 for 1990-1997 and 1 for 1998-2009.

C. Outcome Variables

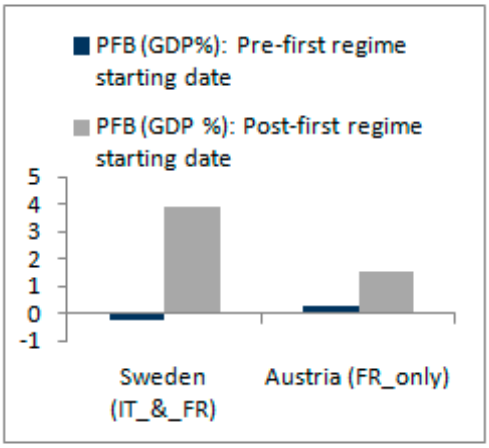
We consider three outcome measures: the primary and the overall fiscal balances (PFB and FB) of the general government, and the rate of inflation. The primary balance is generally thought to better capture fiscal behavior, as it excludes interest payments, which the government does not control. It is also a key indicator as regards public debt sustainability. The inflation rate (Inflation) is defined as the growth rate of the Consumer Price Index (yearly average). Appendices 4 and 5 provide details on data definitions and descriptive statistics.

D. Stylized Facts

In the full sample of 152 countries, 92 countries (60.5 percent) kept fully discretionary regimes (neither IT nor FR) over the entire period. Among the 29 ITers, 9 countries (31 percent) adopted only IT (*i.e.* they did not enact FR in addition to IT at any time during the sample period), while 31 out of the 51 FRers (60.8 percent) enacted only FR. As a result, from the 60 countries having adopted either IT or FR, a third of them (20) opted for both IT and FR (see Appendix 3 for details).

Before conducting the econometric analysis, we tease out a few selected stylized facts pointing to possible correlations between our dummy variables and the outcome variables (fiscal balances and inflation). In that exercise, we look at country pairs with broadly similar economic structures and levels of development. Figure 1 displays the evolution of the primary balance in Sweden, which adopted both IT and FR, the former in 1993 (default starting date) and the latter in 1996, and in Austria, which enacted only FR in 1999. Figure 1 suggests that Sweden experienced on average a larger improvement in its primary balance in the years following the starting date of both regimes, compared to Austria after its FR adoption (4.1 vs. 1.3 percentage points of GDP, respectively).

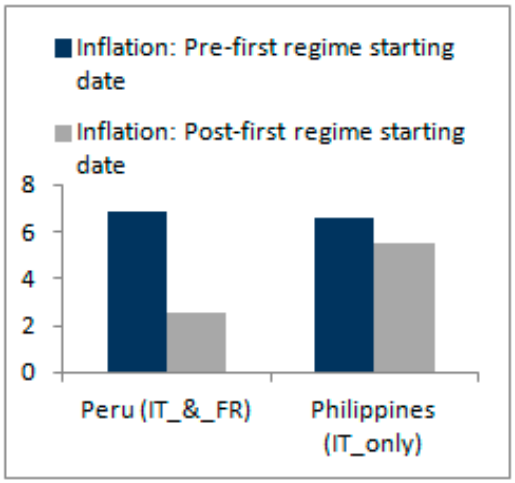
Figure 1. PFB: IT and FR vs. FR only



Source: Authors' calculations, IMF World Economic Outlook

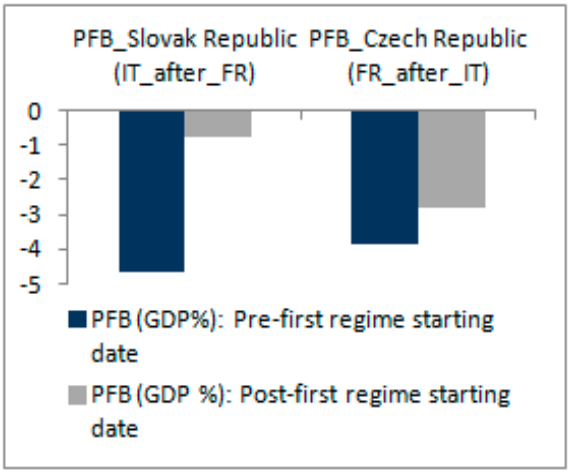
These statistics are consistent with the presumption that IT—and by extension monetary policy credibility—may magnify the fiscal discipline effect associated with FR. This is reminiscent of the possible role of monetary commitment as an "agency of restraint" on fiscal policy, but interestingly, our results suggest that the argument could operate *through* the effectiveness of the fiscal framework itself. A similar conclusion emerges from Figure 2, which displays the evolution of inflation in Peru, which adopted FR in 2000 and IT in 2002, and in Philippines, which adopted only IT in 2002. According to Figure 2, adopting both frameworks leads to better inflationary performances on average, compared to adopting only one framework (since the

Figure 2. Inflation: IT and FR vs. IT only



beginning of its first regime in 2000, the average inflation decreased by around 4.2 percentage points in Peru, against 1 after the IT adoption in Philippines). These stylized facts directly echo the theoretical proposition that constraining fiscal discretion is needed to allow the central bank to deliver low inflation.

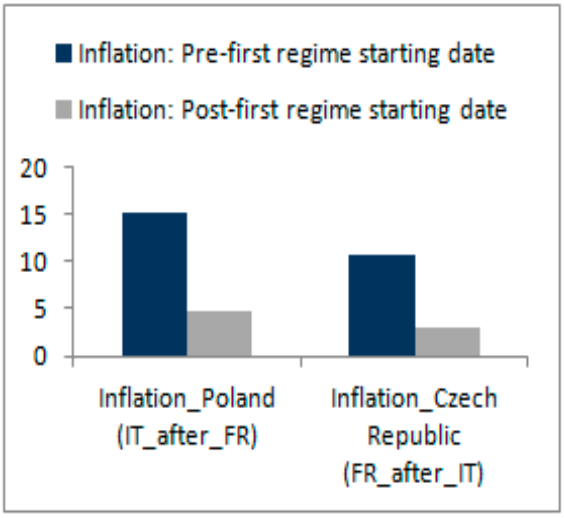
Figure 3. PFB: IT after FR vs. FR after IT



Source: Authors' calculations, IMF World Economic Outlook

We now turn our attention to the sequence of adoption. According to Figure 3, the Slovak Republic, which enacted FR in 2002 before committing to IT in 2005, ran lower primary deficits since the beginning of the first regime compared to the Czech Republic, which adopted first IT in 1998 before enacting FR in 2005. The primary balance in the years following the starting date of the first regime improved on average by 3.9 and 1.1 percentage points of GDP in these countries, respectively. While it may seem natural to deliver stronger fiscal performance under the IT_after_FR sequence than under the FR_after_IT sequence, Figure 4 suggests that Poland, which enacted FR in 1997 before adopting IT in 1998, reduced its inflation rate by more than the Czech Republic, which opted for the opposite sequence, namely IT adoption in 1998 before enacting FR in 2005 (10.5 vs. 7.7 percentage points).

Figure 4. Inflation: IT after FR vs. FR after IT



Source: Authors' calculations, IMF World Economic Outlook

In sum, simple stylized facts point to (i) a potential complementarity between IT and FR regarding their effects on fiscal balances and inflation, and (ii) the potential role of the sequence of adoption of the two frameworks. The next sections develop a more robust econometric setup to assess the generality and strength of these relationships.

IV. METHODOLOGY

A. Specification

Our empirical approach is based on a fairly general model linking policy performance to institutional dummies and control variables. As a first step, we estimate a "baseline" model, which only seeks to assess the effect of IT or FR on monetary and fiscal outcomes:

$$PFB_{it} = \alpha + \beta\, PFB_{it-1} + \lambda_1 IT_{it} (\text{or } \lambda_1 FR_{it}) + \delta_1 Debt_{it-1} + \phi X_{it} + v_i + n_t + \varepsilon_{it}, \quad \text{(1a)}$$

$$Inflation_{it} = \alpha + \beta\, Inflation_{it-1} + \lambda_1 IT_{it} (\text{or } \lambda_1 FR_{it}) + \phi X_{it} + v_i + n_t + \varepsilon_{it}, \quad \text{(1b)}$$

where PFB denotes the primary balance, IT and FR symbolize the inflation targeting and fiscal rules dummy respectively, X_{it} is a vector of control variables, v_i and n_t represent country and time fixed effects respectively, and ε_{it} is the error term. Equation (1a) captures the effect of IT (or FR) on the primary fiscal balance. The model links a country's primary fiscal balance to the past level of its government debt, the business cycle fluctuations and to a set of politico-institutional variables.[8] To account for fiscal policy persistence, we also include the lagged value of PFB. The systematic response of the primary balance to lagged government debt captures government's concerns for solvency (Bohn, 1998). The business cycle is measured by the output gap, whereas an index of government stability is used to control for the political environment. Other control variables include trade openness and the growth rate of terms of trade (to capture the budget impact of external shocks, which can be large in some countries, most notably commodity exporters), and the logarithm of real per capita GDP (to account for the level of development).[9] Equation (1b) is used to estimate the impact of IT (or FR) on inflation. It includes the same determinants as (1a), except of course for the AR(1) term, and for the absence of lagged government's debt.[10]

As outlined above, the inclusion of IT (or FR) in equations (1a) aims at capturing the ability of IT (or FR) regimes to strengthen fiscal performance by reducing or eliminating the so-called *deficit bias*, namely the tendency of governments to run excessive deficits due to myopia or to opportunistic attempts to increase chances of reelection (see, for example, Fatás and Mihov, 2003, or Debrun and others, 2008). The coefficient of interest is λ_1, which

[8] Note that relation (1a) includes IT and FR alternatively as variable of interest, each case corresponding to a test of the discipline-enhancing effect of IT and FR, respectively; the same applies to relation (1b), which models the inflationary effect of IT and FR, respectively.

[9] Sources, definitions and descriptive statistics of all variables are presented in Appendices 4 and 5.

[10] Controlling for government debt may not make sense because it might capture entirely the effect of FR on Inflation. Indeed, one of the main channels through which FR may affect Inflation is government debt, consistently with a *credibility-signaling* effect with regard to financial markets' expectations (see Roger, 2009; or Freedman and Ötker-Robe, 2010).

measures the effect of IT (or FR) on the outcome variable. With respect to our hypothesis that IT and FR adoption has a discipline-enhancing effect on the conduct of fiscal policy, we expect λ_1 to be positive in the fiscal policy equation (1a), and negative in the inflation equation (1b).

Starting from the general setup (1a-b), we explore the role of interactions between IT and FR, and of the sequence of adoption of IT and FR on the outcome variables. As the institutional variables are binary by nature, we use the following model:

$$PFB_{it} = \alpha + \beta\, PFB_{it-1} + \lambda_1 IT\_only_{it} + \lambda_2 FR\_only_{it} + \lambda_3 IT\_\&\_FR_{it} + \lambda_4^1 IT\_after\_FR_{it} + \lambda_4^2 FR\_after\_IT_{it} + \delta_1 Debt_{it-1} + \phi X_{it} + v_i + n_t + \varepsilon_{it}, \quad \text{(2a)}$$

$$Inflation_{it} = \alpha + \beta\, Inflation_{it-1} + \lambda_1 IT\_only_{it} + \lambda_2 FR\_only_{it} + \lambda_3 IT\_\&\_FR_{it} + \lambda_4^1 IT\_after\_FR_{it} + \lambda_4^2 FR\_after\_IT_{it} + \phi X_{it} + v_i + n_t + \varepsilon_{it}. \quad \text{(2b)}$$

Equations (2a-b) aim at identifying the overall effect of IT and FR on policy performance depending upon whether these institutions operate in isolation or simultaneously. In case IT and FR are in place at the same time, the specification allows for a differentiated effect according to which institution was adopted first. Accordingly, each equation now includes 5 dummy variables. The coefficients λ_1 and λ_2 capture the effect of IT and FR when they operate in isolation from each other. This covers policy performance among ITers when no fiscal rule is in place (coefficient λ_1) and FRers when the central bank does not operate under IT (coefficient λ_2). When IT and FR are both in place, the sum of λ_3 and either λ_4^1 *or* λ_4^2 quantifies the impact of these institutions on policy outcomes. Hence comparing λ_1 (λ_2) with $\lambda_3 + \lambda_4^1$ or $\lambda_3 + \lambda_4^2$ indicates whether *interactions* between IT and FR contribute to better policies over and above their individual impact. The coefficients λ_4^1 and λ_4^2 aim at capturing any specific effect that could result from the *sequence of adoption* by differentiating between countries having adopted IT after FR (coefficient λ_4^1) and countries having enacted FR after IT (coefficient λ_4^2).

B. Identification

Any attempt to assess the influence of institutions on policy outcomes or economic performance is vulnerable to serious identification issues, and our study is no exception. A major concern is the possibility that monetary and fiscal institutions might simply reflect unobservable preferences for price stability and fiscal discipline that ultimately shape

policies regardless of institutions themselves.[11] So the expected correlation between institutions and policy performance may not be the sign that institutional change *causes* better policies, but rather that better policies drive the adoption of institutions signaling the intent to perpetuate them. In other words, governments might well use institutions to communicate about the future policies they would adopt anyway.

The counter-argument to the irrelevance of institutions is that circumventing fiscal rules or putting pressure on an independent central bank likely involves intrinsic costs that may well exceed the reputation loss incurred when reneging on a simple promise about policy. It follows that, at least over a medium-term horizon, macroeconomic institutions could strengthen incentives to consistently stick to sound policies (e.g., Alesina and Perotti, 1995; Poterba, 1996; Jensen, 1997).

It remains that if severe enough, the possible *omitted-variable* and *reverse-causality* problems imply that standard least squares estimates exaggerate the impact of institutions on policies due to the induced correlation between residuals and institutions. The standard technical response is to use instrumental-variable methods (IV) to correct for such bias. However, good instruments—i.e. variables excluded from the main regression that would be highly correlated with institutions but uncorrelated with the error terms in (2 a-b)—are notoriously challenging to find for institutional indicators (Acemoglu, 2005).

Regarding monetary policy, Posen (1995) suggested that the apparent success of central bank independence in keeping inflation low reflected the political clout of the financial sector and its corresponding capacity to lobby policymakers in favor of conservative monetary policies. Constructing an index of financial sector influence for a small sample of OECD countries and using it as an instrument for the index of central bank independence, Posen questioned the role of independence as a specific cause of inflation. Unfortunately, our very broad country coverage does not allow replicating this approach. As regards fiscal policy rules, Debrun and others (2008) found that the lagged value of their time-varying fiscal rules index passed all the conventional diagnostic tests and qualified as a valid instrument. The resulting IV estimates supported the existence of a causal link between fiscal rules and fiscal performance.

An alternative to IV would be the *difference-in-difference* estimator (DID, see Ashenfelter and Card, 1985).[12] However, as stressed by Bertrand, Duflo and Mullainathan (2004), serial dependence in both the dependent variable and in the treatment variable (no country

[11] In principle, institutions aimed at constraining policy discretion potentially suffer from the same credibility problem as discretionary policies themselves (see McCallum, 1995; Posen, 1995; and Debrun and Kumar, 2007).

[12] Although *propensity score matching* (PSM, see Rosenbaum and Rubin, 1983) could also be considered, PSM requires a unique *treatment* variable, while the estimation of (2) involves five such variables.

abandoned IT yet due to economic duress pattern, for example) leads to misleading standard errors and are therefore inappropriate.[13]

In the absence of clear alternatives, our identification strategy relies on instrumental variables, however imperfect this might be. Since the literature does not point to strong candidate for valid instrument applicable to our entire panel, we rely on the Generalized Method of Moments (GMM) which also takes care of the bias inherent to dynamic panel models. Specifically, we use the two-step System GMM developed by Blundell and Bond (1998), with Windmeijer (2005) small sample robust correction, which combines two instrumentations. First, it instruments the first differences (which eliminates the time-invariant country-specific effects) of the equation of interest with their lagged (one period or more) values in levels, assuming that the error terms in the equation in levels are not serially correlated. Second, it uses the first difference of variables, lagged one or several periods, to instrument the variables in levels.

As far as institutions are concerned, we take comfort in the fact that our instrumentation is reminiscent of Debrun et al. (2008) who show that lagged institutional variables are valid instruments, at least for fiscal rules. Of course, other explanatory variables may be endogenous and could also be candidates for instrumentation. For instance, in the primary surplus equation, the output gap, and the lagged public debt[14] may all be correlated with the error term, leading Celasun, Debrun, and Ostry (2007) to suggest that GMM estimation is likely to be the best approach to estimate fiscal reaction functions. Finally, country and time fixed effects go a long way in addressing other possible omitted determinants across countries and over time. As Debrun and Kumar (2007), we also introduce a measure of political instability in $X_{i,t}$ to proxy the underlying political determinants of policy biases (myopia and pre-election opportunism).

V. RESULTS

We perform our estimations on the full sample for the period 1990-2009,[15] on five non-overlapping four-year periods to avoid an over-fit of the instruments due to a large number of

[13] Both fiscal balances and inflation are persistent over time, as reflected by the significant coefficients of the lagged variables in equations (1) and (2)). For a recent discussion on the uncertainties associated with the use of DID, see Donald and Lang (2007).

[14] One reason for such correlation is the possibility of time-invariant factors affecting the capacity or willingness to generate high primary surpluses in each country. Another reason is the possible persistence in the idiosyncratic shocks to primary surplus behavior. Celasun and Kang (2006) assess alternative estimators for fiscal reaction functions based on extensive Monte Carlo simulations.

[15] We explored the possibility of accounting for the likely heterogeneity between countries by carrying out the estimations on developed and developing countries subsamples. However, due to lack of sufficient variability in the experiences of IT and FR adoption, particularly regarding the sequence of IT and FR adoption, there is no alternative to using the full sample. Nevertheless, we use the status of development to control for heterogeneity.

periods relative to the number of countries.[16] Standard diagnosis statistics—namely the second-order autocorrelation test AR(2) and the Hansen's overidentification test, did not indicate any issue on the validity of the instrumentation.

A. The effects of IT and FR adoption on fiscal performances (PFB and FB)

The fiscal policy equation is generally in line with the existing literature (Table 1). The coefficient of the lagged PFB is statistically significant, confirming that the conduct of fiscal policy exhibits persistence over time. In addition, the positive and significant estimated coefficient of the lagged government debt is consistent with Bohn (1998)'s finding that governments are on average concerned by solvency. Looking at control variables, the estimated coefficient of the output gap is not statistically significant, suggesting that fiscal policy is on average acyclical for countries in our sample. In addition, the positive and significant effect of terms of trade growth rates points to the sensitivity of government revenue to external shocks, an indication that automatic stabilizers play some role. Unsurprisingly, politically more stable countries tend to exhibit better fiscal balances all else equal. Lastly, note that diagnostic tests support the absence of second-order autocorrelation for the error terms and the orthogonality between the instruments and the error term.

Let us now focus on our variables of interest. According to the first two columns of Table 1, which consider alternative specifications of equation (1a) with IT and FR as the variables of interest respectively, both IT and FR have a positive and statistically significant effect on the PFB. Our results confirm the discipline-enhancing effect of FR and IT on fiscal policy previously emphasized in the literature (see, *e.g.*, Alesina and Perotti, 1995; Alesina and others, 1999; Debrun and others, 2007; Hallerberg and others, 2009; Dabla-Norris and others, 2010; Gollwitzer, 2011; or Tapsoba, 2012 for FR; and Minea and Tapsoba for IT). Specifically, countries having adopted IT improved their PFB by more than 2.4 percentage points of GDP, while enacting FR is found to have improved the PFB by about 1.4 percentage points of GDP. The strength of the individual effect of IT on fiscal policy suggests exploring interactions between IT and FR.

Looking at column [3], estimations based on equation (2a) show that countries having adopted IT alone improved their primary balance by about 3 percentage points of GDP (the coefficient of IT_only), while countries having enacted only FR improve their PFB by 1.6 percentage points of GDP. For countries operating under both frameworks, significant gains seem to emerge from having both frameworks in place, as suggested by the theoretical

[16] Averaging data over non overlapping four-year periods is a sensible compromise between giving enough time for the sluggish responses of macro variables and separating the effects of the variables of interest from the effects of other events occurring in close proximity (see Brito and Bystedt, 2010). If a country adopts IT or FR between the first and the third year of the four-year sub-period we consider this sub-period as the starting date of the framework, while if it adopts a framework in the last year of the four-year sub-period we consider the next sub-period as the starting date of the framework.

literature. This is illustrated by the positive and significant effect of IT_&_FR which suggests that complementarities are at play in the effects of IT and FR. Tests of equality of coefficients point to an over-performance of the joint effects of IT and FR (the sum of the coefficients of IT_&_FR and of IT_after_FR or FR_after_IT, depending on the sequence of adoption) with regard to their individual effects (IT_only or FR_only), underscoring that adopting both frameworks delivers better primary balances compared to introducing only either one.[17] Interestingly, reform sequencing seems to matter, as countries that subjected fiscal policy to rules *before* the central bank operated under IT exhibit a much stronger joint effect on fiscal discipline. Specifically, countries that enacted FR prior to IT adoption improved their PFB by about 9.5 percentage points of GDP (the sum of the coefficients of variables IT_and_FR and IT_after_FR), while those that enacted FR after IT improved their PFB by roughly 3 percentage points of GDP (the sum of the coefficients of variables IT_and_FR and FR_after_IT, the latter being non significant). The test of equality of coefficients supports this dominance of the former sequence over the latter, as it rejects the null hypothesis of statistically identical estimated joints effects associated with both sequences of adoption (9.5 versus 3).[18]

Intuitively, the empirical importance of reform sequencing can be interpreted in terms of the intensity of the conflicts that could arise between monetary and fiscal authorities when reforms are partial. In principle, countries that adopt fiscal rules first could mitigate ex-ante the potentially adverse repercussions of central bank independence on fiscal discipline. In the words of Castellani and Debrun (2005), fiscal rules would prevent the "relocation" of the inflation bias into a fiscal deficit bias. The reason why a post-IT implementation of fiscal rules would have a lesser effect on fiscal discipline could be that monetary institutions created under a regime of pure fiscal discretion might be intrinsically weaker to start with,[19] resulting in smaller gains from a combination of IT and FR. In broader terms, the results could suggest that reforms of the macroeconomic framework that first target the very core of the political power—the power tax and spend—might be intrinsically more credible and hence more effective at extracting greater discipline than under the alternative sequence.

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[17] The p-value associated with the null hypothesis of statistically identical coefficients of (IT_&_FR + IT_after_FR) and FR_only stand at 0.52%, fairly below the critical threshold of 10%, confirming that the sum (2.993+6.558) is significantly larger than 1.609. The result holds for (IT_&_FR + IT_after_FR) versus IT_only, namely (2.993+6.558) versus 3.005, with a p-value of 2.64%.

[18] The p-value associated with the null hypothesis is 0.008%, well below the critical threshold of 10%, suggesting that the sum (2.993+6.558) is significantly larger than (2.993). The tests also suggest that when a country adopts IT before enacting FR, the joint effect of both frameworks is not to statistically larger than that of adopting only IT or only FR, as the p-values associated with (IT_&_FR + FR_after_IT) versus IT_only (FR_only) stand at 30.93 and 39.43% respectively, above the critical threshold of 10% .

[19] Castellani and Debrun (2005) and Debrun (2000) show that politicians not subject to fiscal rules have an incentive to appoint more "liberal" central bankers that do not completely eliminate the inflation bias à la Barro-Gordon (1983).

We perform three robustness checks on the results. First, we explore the sensitivity to the IT starting date. Compared to column [3], based on default IT starting dates, column [4] collects estimations based on conservative IT starting dates. We see that not only IT and FR adoption still exert a positive and significant effect on PFB, but also that the interaction and the timing of IT and FR adoption continue to significantly affect PFB. In particular, the PFB improvement lies between 4.3 percentage points of GDP for countries having enacted FR after IT and 7.7 percentage points for countries having adopted IT after FR. This is well above the PFB improvement associated with the adoption of IT or FR only. The test of equality of these two estimated joints effects (7.7 versus 4.3) confirms the superiority of the former sequence of adoption over the latter.[20]

The second robustness check looks at whether the results hold when using the overall fiscal balance (FB) as the preferred measure of fiscal performance. The rationale for including interest payments is that the latter reflect the current budgetary footprint of past policies. Estimations based on the FB are shown in Appendix 6, and confirm the results obtained for PFB.[21] IT and FR adoption significantly improve the overall balance (Columns [1]-[2]), while countries that adopted both IT and FR tend to have stronger balances compared to countries that adopted only one of the two frameworks. The joint effect of IT and FR is associated with an improvement in FB of about 3.2 percentage points of GDP when FR are enacted after IT and of more than 6.5 percentage points of GDP when IT is adopted after FR. By contrast, this positive impact on the fiscal balance only amounts to about 2.8 percentage points for countries having adopted only IT and to 1.2 for countries with FR only. So IT must come after FR to be associated with a significant improvement in the fiscal balance—by about 3.4 percentage points. These results carry through when considering conservative starting dates (column [4] of Appendix 6).

Third and finally, given the strength of the sequencing results, we control for the time elapsed between the adoptions of each regime. The underlying idea is that the joint effect of IT and FR may differ depending upon whether the second regime was announced—and hence anticipated by the private agents—at the outset of the first regime or came as a surprise. The extent to which expectations incorporate the forthcoming implementation of the second regime depends on the time between the adoptions of the two regimes. Our main results (displayed in Column [5] of Table 1) are qualitatively identical. In particular, the time elapsed between the adoptions of IT and FR does not appear to matter.

[20] The p-value associated with the null hypothesis is 0.015%, fairly below the critical threshold of 10%, confirming that 7.7 is larger than 4.3, namely that enacting FR before adopting IT delivers better overall fiscal balances than the reverse sequence.

[21] Diagnostic tests remain good and qualitative results for the control variables hold.

Table 1: Effects of IT, FR, and Their Interactions, on the Primary Fiscal Balance (PFB)

Dependent Variable: Primary Fiscal Balance	**[1]**	**[2]**	**[3]**	**[4][a]**	**[5]**
Lagged Primary fiscal balance	0.246***	0.293***	0.371***	0.389***	0.347***
	(0.079)	(0.056)	(0.074)	(0.059)	(0.060)
Lagged Debt/GDP	0.013*	0.015*	0.026***	0.020**	0.020**
	(0.007)	(0.009)	(0.010)	(0.008)	(0.009)
Inflation Targeting (IT) Dummy	**2.420*** **				
	(0.856)				
Fiscal Rule (FR) Dummy		**1.349****			
		(0.682)			
IT_only			**3.005*** **	**1.996*** **	**2.025****
			(1.086)	**(0.744)**	**(1.044)**
FR_only			**1.609*** **	**1.569*** **	**1.179***
			(0.569)	**(0.436)**	**(0.633)**
IT_and_FR			**2.993***	**4.260****	**1.999***
			(1.623)	**(1.891)**	**(1.052)**
IT_after_FR			**6.558****	**3.444***	**4.824***
			(3.106)	**(1.812)**	**(2.696)**
FR_after_IT			**-1.417**	**-2.553**	**-0.160**
			(1.836)	**(2.145)**	**(2.461)**
Time length between IT (FR) and FR (IT)					-0.213
					(0.137)
Output Gap	16.758	8.699	-9.791	-8.847	-7.578
	(14.864)	(7.807)	(8.485)	(7.600)	(8.705)
Trade Openness	-0.014	-0.010	-0.006	-0.006	-0.012*
	(0.014)	(0.008)	(0.008)	(0.006)	(0.007)
Growth Rate of Terms of Trade	9.721**	7.487**	5.949	2.571	6.596*
	(4.972)	(3.624)	(3.884)	(3.687)	(3.611)
Government Stability	0.480	0.468**	1.109***	1.044***	1.054***
	(0.400)	(0.239)	(0.218)	(0.227)	(0.268)
Logarithm of real per capita GDP	0.179	0.170	0.879	0.623	0.921
	(0.701)	(0.630)	(0.763)	(0.522)	(0.748)
Time Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	341	341	341	341	341
Arellano-Bond test for AR(2): p-value	0.147	0.299	0.427	0.459	0.550
Hansen test for over-identification: p-value	0.581	0.179	0.443	0.358	0.126

Note: The estimation method is two-step system GMM with Windmeijer (2005) small sample robust correction. Data are averaged over five non-overlapping four-year periods between 1990 and 2009. Standard errors are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Output gap, logarithm of real per capita GDP, IT dummy, FR dummy, IT_only, FR_only, IT_and_FR, IT_after_FR, and FR_after_IT are treated as endogenous. Lagged primary fiscal balance, lagged debt/GDP, trade openness, government stability and the time length are treated as predetermined, while time effects and the growth rate of terms of trade are considered as exogenous. Constant included (but not reported). [a]: estimations carried out using *conservative*, instead of default, IT starting dates.

Overall, our results confirm the theoretical literature's insights that a well designed macroeconomic policy framework should constrain policy discretion for both monetary and fiscal instruments. Moreover, it appears that a country set on adopting both IT and FR could maximize the impact on fiscal discipline by reforming the fiscal policy framework before monetary institutions. As shown in the next section, the same sequence also appears to deliver lower inflation on average.

B. The Effects of IT and FR Adoption on Inflation

We now turn to the impact of institutional reforms on *inflation*. To mitigate the influence of outliers due to hyperinflation episodes, we normalize the inflation rate as *Inflation*/(1+*Inflation*).[22] Table 2 reports the estimation results using normalized inflation as the dependent variable. Columns [6] and [7] indicate that IT and FR are on average associated with lower (normalized) inflation to the tune of 4.2 and 3.1 percentage points respectively.

As for fiscal discipline, interactions and sequencing matter. The adoption of an IT monetary regime alone significantly reduces the inflation rate by 2.2 percentage points. However, enacting FR alone does not seem to significantly affect inflation performances (the coefficient of FR_only has the expected negative sign but is not significant). Hence, greater fiscal discipline per se does not reduce inflation in our sample. As for fiscal policy, countries operating under both IT and FR experienced a larger decrease in their inflation rates, compared to countries having adopted only IT or only FR. Compared to countries that adopted only IT, the decrease in inflation is stronger for adopters of both frameworks. The average drop amounts to 3.9 (2.6+1.3) percentage points for those that introduced FR before adopting IT and 2.6 (2.6-1.3, the latter coefficient being non significant) percentage points for those that embarked on the reverse sequence. The test of equality of these two estimated joints effects (3.9 versus 2.6) confirms the superiority of the former sequence of adoption over the latter.[23] These results are in line with those obtained for fiscal discipline. A comprehensive reform of macroeconomic institutions is more effective than a partial reform. Among comprehensive reforms, those that seek to limit discretion at the core of the political power—fiscal policy—deliver stronger improvements in macroeconomic performance.

In all cases, diagnostic tests do not challenge the validity of our identification strategy (see Table 2). The coefficients estimated for control variables are reasonable and intuitive. Specifically, the AR(1) coefficient confirms persistence in inflation and by the same token the validity of dynamic panel specification. As expected, inflation tends to rise during periods of economic expansion, while all else equal, politically more stable countries exhibit lower inflation.

[22] See, for example, Mishkin and Schmidt-Hebbel (2002).

[23] The p-value associated with the null hypothesis is 0.006%, fairly below the critical threshold of 10%, confirming that 3.9 is larger than 2.6, namely that enacting FR before adopting IT reduces inflation better than the reverse sequence.

Table 2: Effects of IT, FR, and Their Interactions, on Inflation

Dependent Variable: Inflation Rate	**[6]**	**[7]**	**[8]**	**[9][a]**	**[10]**
Lagged Inflation Rate	0.450***	0.456***	0.465***	0.361***	0.512***
	(0.149)	(0.145)	(0.057)	(0.049)	(0.065)
Inflation Targeting (IT) Dummy	**-0.042****				
	(0.019)				
Fiscal Rule (FR) Dummy		**-0.031***			
		(0.016)			
IT_only			**-0.022****	**-0.032***	**-0.017***
			(0.009)	**(0.020)**	**(0.010)**
FR_only			**-0.012**	**-0.018**	**-0.012**
			(0.008)	**(0.013)**	**(0.011)**
IT_and_FR			**-0.026****	**-0.040***	**-0.029***
			(0.013)	**(0.023)**	**(0.016)**
IT_after_FR			**-0.013***	**-0.029***	**-0.021***
			(0.008)	**(0.017)**	**(0.012)**
FR_after_IT			**0.013**	**0.036**	**0.026**
			(0.011)	**(0.024)**	**(0.018)**
Time length between IT (FR) and FR (IT)					0.0003
					(0.0014)
Output Gap	0.602*	0.751**	0.214*	0.016	0.125
	(0.359)	(0.354)	(0.117)	(0.120)	(0.141)
Trade Openness	-0.00003	-0.00008	-0.00004	0.0002	0.00008
	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Terms of Trade Growth Rate	-0.042	-0.030	-0.101	-0.084	-0.063
	(0.108)	(0.108)	(0.070)	(0.067)	(0.086)
Government Stability	-0.018**	-0.018**	-0.011***	-0.016***	-0.013**
	(0.008)	(0.008)	(0.003)	(0.004)	(0.005)
Logarithm of Real per capita GDP	-0.004	-0.008	-0.008*	-0.010	-0.007
	(0.011)	(0.012)	(0.005)	(0.007)	(0.007)
Time Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	500	500	500	500	500
Arellano-Bond test for AR(2): P-value	0.981	0.828	0.969	0.823	0.976
Hansen test for over-identification: P-value	0.136	0.105	0.227	0.186	0.233

Note: The estimation method is two-step system GMM with Windmeijer (2005) small sample robust correction. Data are averaged over five non-overlapping four-year periods between 1990 and 2009. Standard errors are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Output gap, logarithm of real per capita GDP, IT dummy, FR dummy, IT_only, FR_only, IT_and_FR, IT_after_FR, and FR_after_IT are treated as endogenous. Lagged inflation rate, trade openness, government stability and the time length are treated as predetermined, while time effects and the growth rate of terms of trade are considered as exogenous. Constant included (but not reported). [a]: estimations carried out using *conservative*, instead of default, IT starting dates.

We subject our results to the same battery of robustness tests as for the fiscal equation, and the results discussed above generally carry through. First, Column [9] displays estimations based on the conservative starting dates for IT (instead of default starting dates in [8]). The inflation reduction is stronger compared to the case of default IT starting dates. The reason is that conservative starting dates offer a stricter measure for the beginning of an IT regime. Second, Column [10] confirms that controlling for the time elapsed between the adoption of IT and FR does not qualitatively change the estimated influence of the interactions and sequence of adoption of IT and FR on inflation.

VI. CONCLUSION

This paper is the first full-fledged empirical analysis of the joint effect of monetary and fiscal institutions on inflation and fiscal performance. Specifically, we explored the impact of Inflation Targeting (IT) and national-level fiscal rules (FR) on the fiscal balance and the rate of inflation. We performed the analysis on a broad panel of 152 developed and developing countries over the period 1990-2009, using a System GMM estimator to account for the persistence in inflation dynamics and in fiscal policy. We also argued that this approach is a good identification strategy to measure the impact of institutions on policy outcomes.

The main results are as follows. First, the interaction between IT and FR matter a great deal for their effects on fiscal balances and on inflation, suggesting that some complementarity between these two rule-based policy frameworks is at work, in line with conventional theories of the policy mix, including the vast literature on policy credibility, the unpleasant monetarist arithmetic argument (Sargent and Wallace, 1981), and the fiscal theory of the price level (Woodford, 1994). Second, the timing of adoption of IT and FR is not neutral for their effects on fiscal and monetary policies.

Our result about the sequencing of macroeconomic reforms has both a theoretical and a practical appeal. From a theoretical angle, reforms that first target the core of the political power (the power to tax and spend) may send a stronger signal about the determination of politicians to limit macroeconomic policy discretion in a meaningful way, and as such carry greater credibility gains. By contrast, initiating reforms of the macroeconomic framework by delegating a rather technical instrument to an unelected technician may come across as rather timid. At the same time, a partial reform focused on monetary policy increases the risk of political pressures on the independent central to mitigate the costs stemming from a non-coordinated policy mix. In that, our findings shed new light on the literature inspired by the classical Barro and Gordon (1983) game between the government and the central bank. Our results suggest that both players may find it mutually beneficial to actively coordinate on the basic features of their respective policy frameworks. Concretely, letting central banks have a say on the design and implementation of fiscal rules and government engage on the basic features of the monetary policy framework could lead to a very productive interaction.

From a practical perspective, our results strongly suggest to prioritize fiscal reforms, or at least not to consider formal restraints on fiscal discretion as an afterthought of monetary policy reforms. That said, imposing simultaneous constraints on both monetary and fiscal discretion may raise concerns in a highly uncertain environment, where the capacity to respond quickly and decisively to shocks carries high value. The impact of the reforms of the macroeconomic framework on macroeconomic volatility should certainly be carefully addressed in future research.

Appendix 1. Comparative Description of IT and FR Institutional Parameters

	Inflation Targeting (IT)	Fiscal Rules (FR)
Starting dates	Early 1990s, namely in 1990 in New Zealand.	The new wave of FR started in the early 1990s, namely in 1994 in New Zealand.
Nature	Numerical targets on inflation.	Numerical targets on fiscal aggregates.
Targets Horizon	Annual, Medium term, or Over the business cycle, etc.	Annual, Medium term, or Over the business cycle, etc.
Statutory basis (or legal origin)	Institutional commitment to price stability as the primary objective of monetary policy (Enshrined in the Constitution in some countries; regular explanations by central bankers) in the National Parliament).	FR adoption needs to be accompanied by a strong institutional infrastructure, either enshrined in the Constitution, or in a Fiscal Responsibility Law, or resulting from a political commitment.
Transparency	Regular communications with the public regarding policy objective, orientation, decisions and results (publication of inflation reports, inflation projections, minutes of monetary policy meetings, etc.).	Mandatory publication of regular reports that must contain multiyear fiscal projections and other pre-determined disclosures; Transparency Law.
Accountability	Greater accountability of central bankers in achieving the inflation target; Public explanation of target breach and measures taken to bring inflation within the target; In New Zealand for example, the Governor can be dismissed by Minister of Finance if he is proved to be accountable for missing the target.	Monitoring mechanisms, including the establishment of independent fiscal agencies (or councils); Fiscal responsibility Laws; Internal and external audit systems.
Escape clauses	Revision of target path under "Exceptional circumstances" (major oil price shocks, natural disasters, unusual events provided they do not cause general inflationary pressures); Use of core inflation targets.	"Exceptional circumstances clause" that allows a temporary deviation from the rule in the face of a rare shock, or even to deal with the fiscal impact of major structural reforms (e.g., civil service reform); Use of cyclically-adjusted balances rules.
Sanctions	Formal sanctions (dismissal of the central bank governor); Reputation cost: loss of credibility.	Formal sanction (credit restrictions, and personal fines, dismissal, and penal prosecution); Reputation cost (loss of credibility).

Sources: Mishkin and Schmidt-Hebbel (2002), Roger and Stone (2005), Roger (2009) for IT, and Debrun and others (2008) and IMF (2009) for FR.

Appendix 2. Country List

Albania, Algeria, Angola, Argentina, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Rep., Chad, Chile, China, Columbia, Congo Democratic Rep., Congo Rep., Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Czech Rep., Denmark, Dominica, Dominican Rep., Ecuador, Egypt, El Salvador, Equatorial Guinea, Estonia, Ethiopia, Fiji, Finland, France, Germany, Gabon, Gambia, Georgia, Ghana, Greece, Grenada, Guatemala, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italia, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea Rep., Kuwait, Kyrgyz Rep., Lao PDR, Latvia, Lesotho, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Seychelles, Singapore, Slovak Rep., Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syrian Arab Rep., Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Yemen Rep., Zambia.

Appendix 3. Countries Having Adopted *IT* and *FR* Along with Their Starting Dates (Default starting dates/Conservative starting dates)

ITer	FRer	IT_only	FR_only	IT_and_FR	IT_after_FR	FR_after_IT
Australia (1993/1994)	Angola (2005)		Angola (2005)	Australia (1993/1994)		
Brazil (1999/1999)	Argentina (2000)		Argentina (2000)	Brazil (1999)		
Canada (1991/1992)	Australia (1998)			Canada (1991/1992)		Australia (1998/1998)
Chile (1991/1999)	Austria (1999)		Austria (1999)	Chile (1991/1999)		Chile (2000/2000)
Columbia (1999/1999)	Belgium (1992)	Columbia (1999/1999)	Belgium (1992)			
Czech Republic (1998/1998)	Botswana (2003)		Botswana (2003)	Czech Republic (1998/1998)		
Finland* (1993/1994)	Brazil (2000)			Finland* (1993/1994)		Brazil (2000/2000)
Ghana (2007/2007)	Bulgaria (2003)	Ghana (2007/2007)	Bulgaria (2003)			
Guatemala (2005/2005)	Canada (1998)	Guatemala (2005/2005)				Canada (1998/1998)
Hungary (2001/2001)	Cape Verde(1998)		Cape Verde(1998)	Hungary (2001/2001)		
Iceland (2001/2001)	Chile (2000)			Iceland (2001/2001)		
Indonesia (2005/2005)	Costa Rica (2001)		Costa Rica (2001)	Indonesia (1967/1967)	Indonesia (2005/2005)	
Israel (1992/1997)	Czech Republic (2005)			Israel (1992/1992)	Israel (1992/1997)	Czech Republic (2005/2005)
Korea, Rep (1998/1998)	Denmark (1992)	Korea, Rep (1998/1998)	Denmark (1992)			
Mexico (1999/2001)	Ecuador (2003)		Ecuador (2003)	Mexico (1999/2001)		
New Zealand (1990/1990)	Equatorial Guinea (2007)		Equatorial Guinea (2007)	New Zealand (1990/1990)		
Norway (2001/2001)	Estonia (1993)		Estonia (1993)	Norway (2001/2001)	Norway (2001/2001)	Norway (2001/2001)
Peru (2002/2002)	Finland (1995)			Peru (2000/2000)	Peru (2002/2002)	Finland (1995/1995)
Philippines (2002/2002)	France (1998)	Philippines (2002/2002)	France (1998)			
Poland (1998/1998)	Germany (1972)		Germany (1972)	Poland (1997/1997)	Poland (1998/1998)	
Romania (2005/2005)	Hungary (2007)	Romania (2005/2005)				Hungary (2007/2007)
Slovak Republic* (2005/2005)	Iceland (2004)			Slovak Republic* (2002/2002)	Slovak Republic * (2005/2005)	Iceland (2004/2004)
South Africa (2000/2000)	India (2004)	South Africa (2000/2000)	India (2004)			
Spain* (1995/1995)	Indonesia (1967)			Spain* (1995/1995)		
Sweden (1993/1995)	Israel (1992)			Sweden (1993/1995)		
Switzerland (2000/2000)	Ireland (2000)		Ireland (2000)	Switzerland (2000/2000)		
Thailand (2000/2000)	Japan (1947)	Thailand (2000/2000)	Japan (1947)			
Turkey (2006/2006)	Kenya (1997)	Turkey (2006/2006)	Kenya (1997)			
United Kingdom (1992/1992)	Lithuania (1997)		Lithuania (1997)	United Kingdom (1992/1992)		

Appendix 3. Countries Having Adopted IT and FR along with Their Starting Dates (Default starting dates / Conservative starting dates) (continued)

ITer	FRer	IT_only	FR_only	IT_and_FR	IT_after_FR	FR_after_IT
	Luxembourg (1990)		Luxembourg (1990)			
	Madagascar (2006)		Madagascar (2006)			
	Mauritius (2008)		Mauritius (2008)			
	Mexico (2006)		Namibia (2001)			Mexico (2006/2006)
	Namibia (2001)		Nigeria (2004)			
	Netherlands (1994)		Netherlands (1994)			
	New Zealand (1994)					New Zealand (1994/1994)
	Nigeria (2004)					
	Norway (2001)					
	Pakistan (2005)		Pakistan (2005)			
	Panama (2002)		Panama (2002)			
	Peru (2000)					
	Poland (1997)					
	Portugal (2002)		Portugal (2002)			
	Slovak Republic (2002)					
	Slovenia (2000)		Slovenia (2000)			
	Spain (2002)					Spain (2002/2002)
	Sri Lanka (2003)		Sri Lanka (2003)			
	Sweden (1996)					Sweden (1996/1996)
	Switzerland (2003)					Switzerland (2003/2003)
	United Kingdom (1997)					United Kingdom (1992/1992)
	United States of America[+] (1990)		United States of America[+] (1990)			

Data Sources: Rose (2007) and Roger (2009) for IT starting dates, and IMF (2009) for FR starting dates.

* Finland, Spain and Slovak Republic abandoned their IT to join the Euro Area respectively in 1999 (Finland and Spain) and 2009. [+]: The United States of America enacted FR in 1990 but abandoned it in 2002, so as Belgium in 1992 and 1999 respectively. Norway adopted IT and FR in the same year, 2001, so we set variables IT_and_FR, IT_after_FR and FR_after_IT simultaneously equal to 1 after both IT and FR adoption (in 2001). Armenia, Comoros, Hong Kong, Liberia, and Timor-Leste also adopted FR but due to lack of available fiscal and/or inflation data (which constitute one of our dependent variables), they are not included in our sample. Serbia adopted IT in 2006, but due to lack of data on fiscal balance, this country is dropped from the sample.

Appendix 4. Sources and Definitions of Data

Inflation rate	Annual growth rate of average CPI	World Economic Outlook (2010)
Overall fiscal balance (FB)	Difference between general government revenue (including grants) and expenditure, as GDP percentage.	
Primary fiscal balance (PFB)	Difference between general government revenue (including grants) and expenditure (excluding interest payments), as GDP percentage.	
Full-Fledged or Formal IT (conservative starting dates)	Dummy variable taking the value 1 if in a given year a country operates formally under IT, and zero otherwise. When we use conservative starting dates of IT we refer to full-fledged IT.	Rose (2007) and Roger (2009)
Soft or Informal IT (default starting dates)	Dummy variable taking the value 1 if in a given year a country operates informally under IT, and zero otherwise. When we use default starting dates of IT we refer to soft IT.	
Fiscal rule dummy (FR)	Dummy variable taking the value 1 if a country placed, at the national level, a numerical limit on fiscal aggregates (fiscal balance, expenditure, revenue or debt)	Fiscal Rules Database of the IMF's Fiscal Affairs Department, Fiscal Policy and Surveillance Division (2009)
Trade openness	Sum of imports and exports divided by GDP	Penn World Table (PWT.6.3)
Real per capita GDP	Real per capita GDP at constant prices. Proxy for a country's stage of development.	
Public Debt (percent of GDP)	Gross General government debt, in percentage of GDP	Ali Abbas and others (2010)
Government stability	Index ranging from 0 to 12 and measuring the ability of government to stay in office and to carry out its declared program(s). The higher the index, the more stable the government is.	International Country Risk Guide (ICRG, 2009)
Output gap	Difference between the logarithm of real GDP and the logarithm of a Hodrick-Prescott filtered trend of real GDP (with 100 as smoothing parameter, given the annual frequency).	Authors' calculations, based on data from WDI (2010)
Growth Rate of Terms of Trade	Annual relative change in the terms of trade	

Appendix 5. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation Targeting Dummy (IT)	4,925	0.063	0.244	0	1
Fiscal Rule Dummy (FR)	4,725	0.118	0.323	0	1
IT_only	4,925	0.015	0.120	0	1
FR_only	4,925	0.073	0.261	0	1
IT_and_FR	4,925	0.053	0.224	0	1
IT_after_FR	4,925	0.011	0.106	0	1
FR_after_IT	4,925	0.033	0.178	0	1
Inflation rate	3,641	50.728	645.854	-17.640	24,411.03
Normalized inflation: Inflation/(1+Inflation)	3,641	0.100	0.152	-0.214	0.996
Overall fiscal balance (GDP percent)	2,997	-2.143	7.522	-151.309	121.838
Primary fiscal balance (GDP percent)	2,783	0.742	7.304	-147.492	123.181
Debt (GDP percent)	3,719	69.524	65.306	0.318	2,092.922
Trade openness	3,969	82.788	48.722	1.086	456.562
Terms of Trade Growth Rate	3,883	0.017	0.382	-0.942	17.921
Output Gap	2,789	-0.004	0.054	-0.620	0.238
Real per capita GDP	3,969	9,946.41	11,187.57	153.16	88,292.58

Appendix 6. The Effects of IT, FR, and Their Interactions, on the FB

Dependent Variable: Overall Fiscal Balance	**[1]**	**[2]**	**[3]**	**[4][a]**
Lagged Overall fiscal balance	0.334***	0.307***	0.317***	0.374***
	(0.060)	(0.090)	(0.078)	(0.052)
Lagged Debt/GDP	0.015*	0.015*	0.009*	0.022***
	(0.009)	(0.009)	(0.006)	(0.008)
Inflation Targeting (IT) Dummy	**2.170*** **			
	(0.644)			
Fiscal Rule (FR) Dummy		**1.266****		
		(0.646)		
IT_only			**2.816*** **	**2.144****
			(0.862)	**(0.838)**
FR_only			**1.260****	**0.646***
			(0.573)	**(0.340)**
IT_and_FR			**3.163***	**1.577***
			(1.836)	**(0.830)**
IT_after_FR			**3.398***	**4.043***
			(1.788)	**(2.128)**
FR_after_IT			**-1.367**	**-0.449**
			(1.774)	**(1.942)**
Output Gap	17.254**	21.691*	13.034	-2.650
	(8.022)	(11.416)	(8.594)	(13.038)
Trade Openness	-0.004	-0.001	0.001	-0.001
	(0.009)	(0.011)	(0.009)	(0.008)
Growth Rate of Terms of Trade	13.589***	13.450**	7.991*	10.157**
	(3.942)	(5.361)	(4.396)	(4.027)
Government Stability	0.882***	0.908***	1.324***	1.158***
	(0.264)	(0.320)	(0.291)	(0.236)
Logarithm of real per capita GDP	-0.009	-0.211	0.295	0.611
	(0.514)	(0.592)	(0.669)	(0.577)
Time Effects	Yes	Yes	Yes	Yes
Number of Observations	351	351	351	351
Arellano-Bond test for AR(2): P-value	0.186	0.169	0.351	0.259
Hansen test for over-identification: P-value	0.172	0.193	0.306	0.103

Note: The estimation method is two-step system GMM with Windmeijer (2005) small sample robust correction. Data are averaged over five non-overlapping four-year periods between 1990 and 2009. Standard errors are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Output gap, logarithm of real per capita GDP, IT dummy, FR dummy, IT_only, FR_only, IT_and_FR, IT_after_FR, and FR_after_IT are treated as endogenous. Lagged overall fiscal balance, lagged debt/GDP, trade openness and government stability are treated as predetermined, while time effects and the growth rate of terms of trade are considered as exogenous. Constant included (but not reported). [a]: estimations carried out using *conservative*, instead of default, IT starting dates.

References

Acemoglu, D. Johnson, S. and Robinson, J., 2005, "The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth", *American Economic Review*, 95, pp. 546-579.

Aiyagari, S. and Gertler, M., 1985, "The backing of government debt and monetarism," *Journal of Monetary Economics*, 16, pp. 19-44.

Alesina, A. and Perotti, R., 1995, "The Political Economy of Budget Deficits," *IMF Staff Papers*, 42, pp. 1-31.

Alesina, A., Hausmann, R., Hommes, R. and Stein, E., 1999, "Budget Institutions and Fiscal Performance in Latin America," *Journal of Development Economics*, 59, pp. 253–273.

Ashenfelter, O. and Card, D., 1985, "Using the Longitudinal Structure of Earnings to Estimate the Effects of Training Programs," *Review of Economics and Statistics*, 67, pp. 648-660.

Barro, R. and Gordon, D., 1983, Rules, "Discretion and reputation in a Model of Monetary Policy", *Journal of Monetary Economics*, 12, pp. 101-121.

Batini, N. and Laxton, D., 2007, "Under What Conditions Can Inflation Targeting Be Adopted? The Experience of Emerging Markets," in Schmidt-Hebbel, K. and Mishkin, F. (eds.) *Monetary Policy Under Inflation Targeting*, Central Bank of Chile, Santiago.

Beetsma, R.M.W.J. and Bovenberg, A. L., 1997a, "Designing fiscal and monetary institutions in a second-best world", *European Journal of Political Economy*, 13, pp. 53–79.

Beetsma, R.M.W.J. and Bovenberg, A. L., 1997b, "Central bank independence and public debt policy", *Journal of Economic Dynamics and Control*, 21, pp.873-894.

Beetsma, R.M.W.J. and Bovenberg, A.L., 1998, "Monetary Union without Fiscal Coordination May Discipline Policymakers", *Journal of International Economics* 45, pp. 239–258.

Beetsma, R.M.W.J., Debrun, X. and F. Klaassen, 2001, "Is Fiscal Policy Coordination in EMU Desirable?" CEPR Discussion Papers # 3035.

Benhabib, J., Schmitt-Grohé, S. and Uribe M., 2001, "Monetary policy and multiple equilibria," *American Economic Review*, 91, pp. 167–186.

Bernanke, B. and Woodford, M., 2004, "Introduction to the Inflation Targeting Debate," in Bernanke B. and Woodford, M. (eds.), *The inflation targeting debate,* The University of Chicago Press, pp. 1-10.

Bertrand, M., Duflo, E. and Mullainathan, S., 2004, "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, 119, pp. 249–275.

Blundell, R. and Bond, S., 1998, "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics*, 87, pp. 115-143.

Bohn, H., 1998, "The behavior of US public debt and deficit," *Quarterly Journal of Economics*, 113, pp. 949–963.

Brito, R. and Bystedt, B., 2010, "Inflation targeting in emerging economies: Panel evidence," *Journal of Development Economics*, 91, pp. 198-210.

Castellani, F., and Debrun, X., 2005, "Designing macroeconomic frameworks: a positive analysis of monetary and fiscal delegation," *International Finance* 8: pp. 87–117.

Celasun, O. and Kang, J.S., 2006, "On the Properties of Various Estimators for Fiscal Reaction Functions", IMF WP # 06–182.

Celasun, O., Debrun, X. and Ostry, J.D., 2007, "Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A Fan-Chart Approach", IMF Staff Paper, 53 (3).

Dabla-Norris, E., Allen, R., Zanna, L., Prakash, T., Kvitradze, E., Lledo, V., Yackovlev, I. and Gollwitzer, S., 2010, "Budget Institutions and Fiscal Performance in Low-Income Countries," IMF Working Paper # 10–80.

Debrun, X., 2000, "Fiscal rules in a monetary union: a short run analysis," *Open Economies Review* 11: pp. 323–358.

Debrun, X., Hauner, D. and Kumar, M., 2007, "Discretion, institutions, and fiscal discipline", in: Kumar, M., Ter-Minassian, T. (Eds.), Promoting Fiscal Discipline. IMF, chapter 2.

Debrun, X., Moulin, L., Turrini, A., Ayuso-i-Casals, J., and Kumar, M., 2008, "Tied to the mast? The role of national fiscal rules in the European Union," *Economic Policy* 54: April.

de Macedo, J. and Martins, J., 2008, "Growth, reform indicators and policy complementarities," *Economics of Transition*, 16, pp. 141–164.

de Mendonça, H. and de Guimarães e Souza, G., 2011, "Is Inflation Targeting a good remedy to control inflation?" *Journal of Development Economics*, 98, pp. 178–191.

Dewatripont, M. and Roland, G., 1995, "The Design of Reform Packages under Uncertainty," *American Economic Review*, 85, pp. 1207–23.

Dixit, A., and Lambertini, L., 2003, "Interaction of commitment and discretion in monetary and fiscal Policies," *American Economic Review* 93: pp. 1522–42.

Donald, S. and Lang, K., 2007, "Inference with Difference-in-Differences and Other Panel Data," *Review of Economics and Statistics*, 89, pp. 221–233.

Fatás, A. and Mihov, I., 2003, "The case for restricting fiscal policy discretion," *Quarterly Journal of Economics*, 118, pp. 1419-47.

Freedman, C. and Ötker-Robe, I., 2010, "Important Elements Inflation Targeting for Emerging Economies," IMF WP #10–113.

Giavazzi, A. and Tabellini, G., 2005, "Economic and Political liberalizations," *Journal of Monetary Economics*, 52, pp. 1297–1330.

Gollwitzer, S., 2011, "Budget Institutions and Fiscal Performance in Africa," *Journal of African Economies*, 20, pp. 111–152.

Gonçalves, C. and Salles, J., 2008, "Inflation targeting in emerging economies: What do the data say?" *Journal of Development Economics*, 85, pp. 312–318.

Hallerberg, M., Scartascini, C. and Stein, E., 2009, "The budget process as a political arena," in Hallerberg, M., Scartascini, C. and Stein, E. (eds.), *Who Decides The Budget: A Political Economy Analysis of the Budget Process in Latin America*, David Rockefeller Center for Latin American Studies, Inter American Development Bank, Washington, 295–321.

International Monetary Fund, 2009, "Fiscal Rules Anchoring Expectations for Sustainable Public Finances," IMF, Washington.

Jensen, H., 1997, "Credibility of Optimal Monetary Delegation.'', *American Economic Review,* 87, pp. 911–920.

Kopits, G., 2001, "Fiscal rules: Useful policy framework or unnecessary ornament?" IMF WP #01–145.

Kopits, G. and Symansky, S., 1998, "Fiscal policy rules," IMF Occasional paper #162.

Leeper, E., 1991, Equilibria under "'Active' and 'Passive' Monetary and Fiscal Policies," *Journal of Monetary Economics*, 27, pp. 129–147.

Lin, S. and Ye, H., 2009, "Does Inflation Targeting Make a Difference in Developing Countries?" *Journal of Development Economics*, 89, pp. 118–123.

Masson, P., Savastano, M. and Sharma, S., 1997, "The Scope for Inflation Targeting in Developing Countries," IMF WP #97–130.

Masson, P. and Pattillo, C., 2002, "Monetary Union in West Africa: An Agency of Restraint for Fiscal Policies?", *Journal of African Economies*, 11, pp. 387-412.

Minea, A. and Tapsoba, R., 2014, "Does inflation targeting improve fiscal discipline?", *Journal of International Money and Finance*, 40, pp.185-203.

Mishkin, F., 2000, "Inflation Targeting in Emerging-Market Countries," *American Economic Review*, 90, pp. 105–109.

Mishkin, F., 2004, "Can Inflation Targeting Work In Emerging Market Countries?" NBER WP No. 10646.

Mishkin, F. and Schmidt-Hebbel, K., 2002, "One Decade of Inflation Targeting in the World: What Do We Know and What Do We Need to Know?" in Loayza, N. and Soto, R. (eds.), *Inflation Targeting: Design, Performance, Challenges*, Central Bank of Chile, Santiago, pp. 171–219.

Posen, A.S., 1995, "Declarations Are Not Enough: Financial Sector Sources of Central Bank Independence," NBER Chapters, in: NBER Macroeconomics Annual 1995, 10, pp. 253-274.

Poterba, J., 1996, "Do budget rules work?", NBER Working Paper Series, # 5550.

Roger, S., 2009, "Inflation targeting at 20: achievements and challenges," IMF WP #09–236.

Roger, S. and Stone, M., 2005, "On Target: The International Experience with Achieving Inflation Targets," IMF Working Paper #05–163.

Rose, A., 2007, "A stable International Monetary System Emerges: Inflation Targeting is Bretton Woods, Reversed," *Journal of International Money and Finance*, 26, pp. 663–681.

Rosenbaum, R. and Rubin, B., 1983, "The central role of the propensity score in observational studies for causal effects," *Biometrika*, 70, pp. 41–55.

Sargent, T and Wallace, N., 1981, "Some unpleasant monetarist arithmetic," *Federal Reserve of Minneapolis Quarterly Review*, 5, pp. 1–17.

Sims, C., 1988, "Identifying policy effects," in Bryant R. and others (eds.), *Empirical macroeconomics for interdependent economies*, The Brookings Institution, Washington DC, pp. 305–321.

Sims, C., 2004, "Limits to inflation targeting," in Bernanke B. and Woodford, M. (eds.), *The inflation targeting debate*, The University of Chicago Press, pp. 283–308.

Sims, C. A., 2011, "Stepping on a rake: The role of fiscal policy in the inflation of the 1970s," *European Economic Review*, 55, pp. 48–56.

Svensson, L., 1997, "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets," *European Economic Review*, 41, pp. 1111–46.

Tanzi, V., 1992, "Structural Factors and Tax Revenue in Developing Countries: A Decade of Evidence," Cambridge University Press, pp. 267–81.

Tapsoba, R., 2012, "Do National Numerical Fiscal Rules really shape fiscal behaviours in developing countries? A treatment effect evaluation", *Economic Modelling*, 29, pp.1356-1369.

Uribe, M., 2006, "A fiscal theory of sovereign risk," *Journal of Monetary Economics*, 53, pp. 1857–75.

Vega, M. and Winkelried, D., 2005, "Inflation Targeting and Inflation Behavior: A Successful Story?" *International Journal of Central Banking*, 1, pp. 153–175.

Windmeijer, F., 2005, "A finite sample correction for the variance of linear efficient two-step GMM estimators," *Journal of Econometrics*, 126, pp. 25–51.

Woodford, M., 1994, "Monetary Policy and Price-level Determinacy in a Cash in-advance economy," *Economic Theory*, 4, pp. 345–348.