Does Inflation Targeting Improve Fiscal Discipline? An Empirical Investigation

René Tapsoba

▶ **To cite this version:**

René Tapsoba. Does Inflation Targeting Improve Fiscal Discipline? An Empirical Investigation. 2011. halshs-00553329

HAL Id: halshs-00553329
https://shs.hal.science/halshs-00553329

Preprint submitted on 7 Jan 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

CENTRE D'ÉTUDES
ET DE RECHERCHES
SUR LE DÉVELOPPEMENT
INTERNATIONAL

Document de travail de la série

Etudes et Documents

E 2010.20

Does Inflation Targeting Improve Fiscal Discipline? An Empirical Investigation

René TAPSOBA*

Clermont Université, Université d'Auvergne, CERDI

*Clermont Université, Université d'Auvergne, Centre d'Etudes et de Recherches sur le Développement International, F-63000 CLERMONT-FERRAND. CNRS, UMR 6587, CERDI, F-63009 CLERMONT-FERRAND.
E-mail: René.Tapsoba@u-clermont1.fr
I am grateful to J-L. COMBES, A. MINEA, C. EBEKE, S. GUERINEAU, Z. BICABA, and Y. LUCOTTE for their helpful comments on an earlier draft of this paper. I would also like to thank participants at the Thematic Meeting of the French Economic Association (AFSE) in Orleans (France) 3-4 June 2010.

Abstract:

Based on panel data of 58 countries, of which 22 Inflation Targeters and 36 non Inflation Targeters, over the period 1980-2003, this paper highlights the effect of Inflation Targeting –IT- on Fiscal Discipline –FD-. We make four contributions to the literature. Firstly, by applying the 2SLS on the data, we estimate the effect of IT on central government FD as measured by Structural Primary Fiscal Balances. Secondly, we found that the effect of IT on FD takes place only on the Developing Countries sub-sample. Thirdly, the positive effect of IT on FD is stronger when the Central Bank –CB- adopts "Partial" IT rather than Full-Fledged IT –FFIT-. Fourthly, the positive effect of IT on FD is heterogeneous: it is conditional to the degree of CB independence, the level of financial deepening, the instability in the terms of trade and the length of exposure to IT -the effect is not immediate but cumulative over time-. Our results are robust to alternative specifications - using Propensity Score Matching Method, "System GMM" estimator, LAD estimator and applying 2SLS on annual data rather than triennial averages data- Our results could contribute importantly to the debate about the relevance of IT adoption by Developing Countries -due to their bad fiscal stances-.The results suggest that these countries could successfully adopt IT and improve their fiscal stances, provided that they adopt it gradually, establish flexible framework allowing them to react temporally to short-term external shocks and accompanies it with a greater independence of their CB and a deepening of their financial systems.

JEL Codes : E52, E58, E62, E63.

Keywords: Inflation Targeting, Fiscal Discipline, Central Bank, Monetary Policy, Fiscal Policy, Public Debt Monetization, Developing Countries.

« Inflation Targeting … requires the policymakers to deepen reforms, enhance transparency and improve fiscal policy. » (E. Croce a M.S. Khan, F&D, p.51, 2000 September)

1. Introduction

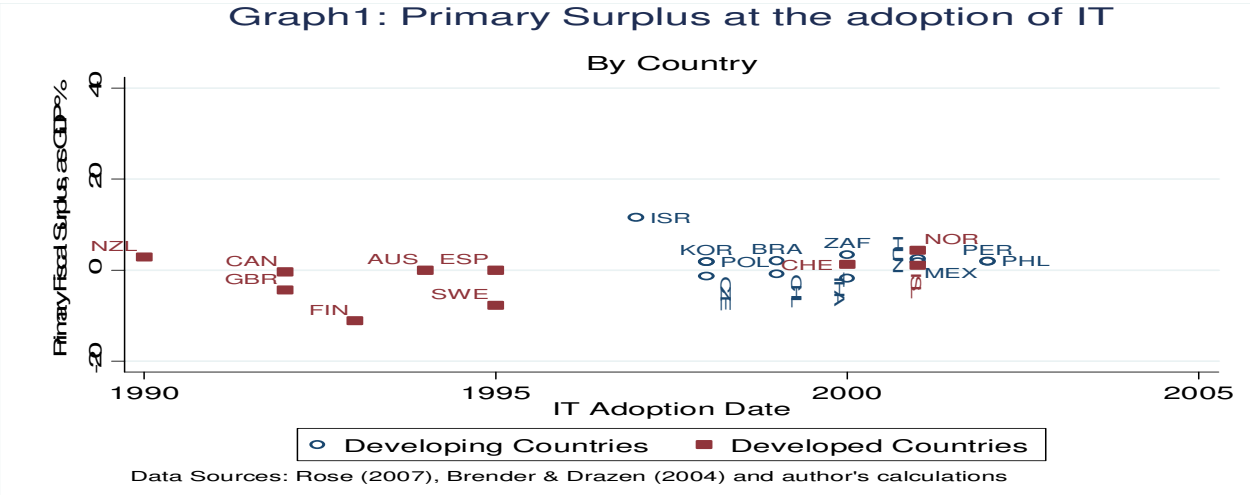
Since its adoption by New Zealand in 1990, Inflation Targeting –IT- is becoming the framework of reference for the conduct of the monetary policy –MP-. Nowadays, according to Rose (2007) classification, supplemented with a more recent one (Freedman & Laxton, IMF, April 2009), we identify 28 inflation targeters –ITers- countries, of which 18 developing countries and 10 developed countries. One of the factors explaining this movement stems from the relative inability of the other alternative MP regimes to stabilize inflation and output at short term. Historically, in order to tackle the inflation bias inherent to the so-called time inconsistency problem, central banks –CB- have used alternatively 3 MPs regimes. Certain have targeted intermediate variables such as aggregated money growth or exchange rate. In the first case, central bankers expect to anchor inflation anticipations, indirectly via the control of aggregated money growth. This MP strategy relies on the conviction of the existence of a narrow relation between money supply and inflation -quantitative theory of money-. However, because of the globalization vague of the 1980s decay and especially the financial innovations mechanisms, one assisted to an increase in the instability of the money velocity, so that money targeting has appeared as less effective in achieving inflation and output stabilization. In the second case, CB targets exchange rate, i.e. they fix their exchange rate relatively to the money of a partner country. But due to several reasons, of which the increase of the international capital flows and the difficulty to maintain the parity of change, exchange rate targeting has become less viable and less effective in achieving inflation and output stabilization[1]. Finally, since the beginning of 1990s, industrialized economies, then developing ones have decided to target directly the anticipated inflation. This MP framework, as summarized by Mishkin (2000), is mainly characterized by 5 criteria[2]: "1) the public announcement of medium-term numerical targets for inflation; 2) An institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated; 3) An information inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for deciding the setting of policy

[1] Except corner solutions like Currency Board or Monetary Union regimes which also proved relatively viable.

[2] In the literature, there are also Svensson (1997, 1999) and Truman (2003) definitions of IT.

instruments; 4) An increased transparency of the monetary policy strategy through communication with the public and the markets about the plans, objectives, and decisions of the monetary authorities-; 5) An increased accountability of the CB in achieving the inflation target". The arguments in favor of this regime hold in the flexibility of reaction it confers to central bankers to deal with shocks affecting the economy. This flexibility of reaction appears via a judicious mix of discretion and rule, synthesized in the expression "constrained discretion" regime (Bernanke & Mishkin, 1997).

In the empirical literature, IT adoption seems to have lead to several macroeconomic benefits[3]. Most of the empirical studies have found that IT has allowed an attenuation of inflation level, volatility and persistence and output volatility (Truman, 2003; Petursson, 2004; Vega & Winkelried, 2005). But surprisingly, any study has analyzed a possible effect of IT adoption on the fiscal stance. The existing literature mentions fiscal surplus only as a precondition[4] for a successful adoption of IT, stressing that large fiscal deficits lead to fiscal dominance that represents a serious threat for the viability of IT. Similar arguments have been outlined by the unpleasant monetarist arithmetic (Sargent & Wallace, 1981) and the fiscal theory of prices (Woodford, 1996, 2000). Nevertheless, the observation of the fiscal statistics (Graph1) reveals that the fiscal discipline precondition has not been met by most of the ITers at the beginning of their IT: they recorded diverse fiscal stances, ranging from negative to positive fiscal balances, with the majority revolving 0%.



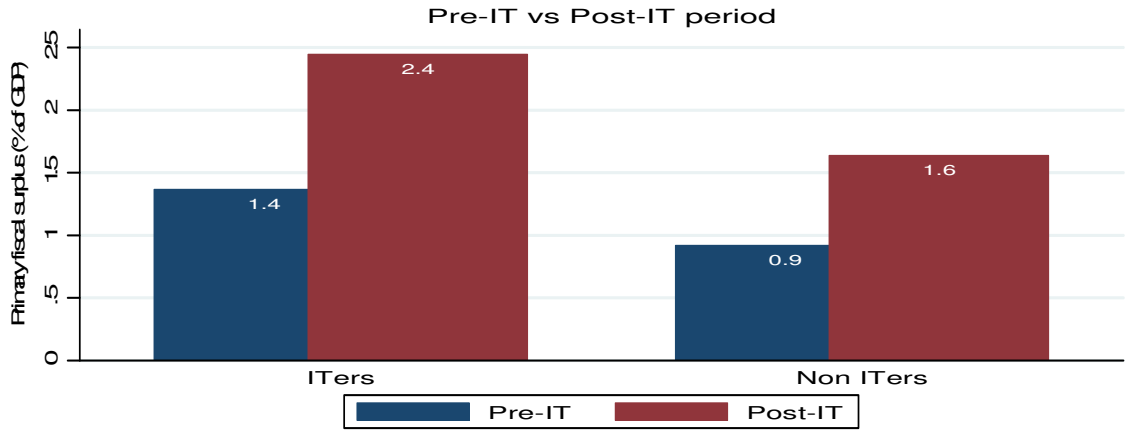
[3] Except the seminal paper by Ball & Sheridan (2005) who found any significant effect of IT on inflation and its variability on a sample of 20 industrialized economies. Amore recent one is Brito & Bystedt (2009) who found that IT has detrimental effects on the real output growth and volatility in the emerging countries.

[4] Agénor (2002); Carare, Schaechter, & Stone (2006); Truman (2003); Calvo & Mishkin (2003)

A more acute analysis -Graph 2- shows that even though ITers did not meet the fiscal surplus precondition at the starting date of their IT, on the one hand they experienced in the post-IT period an improvement of their fiscal stances and on the other hand, their fiscal adjustments were larger than the non ITers. Therefore, it seems rational to assume that CBs having adopted IT while their governments enjoyed bad fiscal stances were urged to undertake fiscal adjustments in order to enhance the credibility of their commitment to the inflation target. It looks like as if before the adoption of IT, the fiscal precondition is not enough constraining while after the adoption of IT, the fear of breaching the inflation target makes real the necessity of disciplining the conduct of the fiscal policy. What could be the mechanisms working under these presumptions? Three potential mechanisms are postulated to explain these intuitions. Firstly, IT could help avoiding the monetary financing of the public debt; secondly, ITers could also mobilize more tax resources through an attenuation of the so-called Oliveira-Keynes-Tanzi effect. Finally, a disciplinary impact of IT on fiscal policy conduct could emerge from the fact that IT implies adopting Flexible Exchange Rate and that Flexible Exchange Rate could provide more FD than Fixed Exchange Rate (Tornell & Velasco, 1995, 2000). But do these theoretical and statistical correlations, corroborated by a more rigorous econometrical analysis? The main objective of this paper is therefore to evaluate the effect of IT adoption on the conduct of Fiscal Policy. Obviously, assessing the effect of IT raises the question of the endogeneity of IT adoption. Indeed, the estimation of the disciplinary effect of IT could be polluted by reverse causation bias since higher primary fiscal surpluses might simply reflect a "selection on observables" problem, i.e. that countries recording higher FD are those which more likely adopt IT, creating false impression that IT truly shape fiscal behavior. Furthermore, the omission of relevant variables –unobserved social preferences for FD for example-, affecting simultaneously the adoption of IT and FD would lead to a biased estimate of the treatment effect of IT on FD. In view of that, we employ the instrumental variables approach – controlling for time fixed effect and for the potential observables determinants of FD - to break any link between IT and the errors terms. For robustness purpose, we also use the propensity score matching method which allows us to evaluate consistently the average treatment effect of IT through the identification of the relevant counterfactual to the ITers group. We also run system GMM estimations which not only makes possible to control for the endogeneity of several variables but also to take into account the persistence in the FD process. Finally LAD estimates are considered to check the robustness of the evaluation regarding the presence of outliers. We make four contributions to

the literature: Firstly, to the best of our knowledge, we are the first to evaluate empirically the impact of IT on FD. Secondly, we find that the positive effect of IT upon FD is stronger on the developing countries subsample. Thirdly, we show that the effect of IT upon FD varies, depending on the form of IT adopted, strict or partial (soft). Fourthly, we investigate the existence of heterogeneities in the impact of IT on FD, i.e. the circumstances under which the effect is more or less pronounced. Our estimates put in evidence that the impact of IT on FD depends on the longevity of the IT framework, the CB degree of independence, the level of the financial development and the volatility in the terms of trade. The fulfillment of the theoretical preconditions before the adoption of IT does not affect the impact of IT on FD.

Graph 2: primary fiscal surplus (ITers vs Non ITers)



Data sources: Brender & Drazen (2004),author calculations

The remainder of the paper is structured as follows: in section 2, we discuss the relationship between IT and FD. Section 3 displays the empirical framework while section 4 discusses the dataset and shows the main results. Section 5 and 6 respectively explore the specific case of the Developing Countries and the presence of heterogeneities in the relationship between IT and FD. Section 7 briefly considers robustness checks. In section 8, we discuss policies implications and conclude.

2. Theoretical underpinnings of the Effect of Inflation targeting on Fiscal Discipline.

In this section, we review the arguments postulating the existence of a link between IT and FD.

2.1. The channel of public debt monetization

The unpleasant monetarist arithmetic (Sargent & Wallace, 1981) and the fiscal theory of prices (Woodford, 1996, 2000) have shown that in some countries, the control of inflation is

not solely a monetary phenomenon, but depends crucially on the control of fiscal deficits. There would be a kind of interaction, if not complementarity between monetary policy (MP) and fiscal policy (FP) in determining the inflationary performances. Woodford (1996, 2000), suggests that such an interaction occurs mainly in "Fiscal Dominance[5]" regimes. There are 2 types of fiscal dominance. The first, which is standard, is more frequent in the Developing Countries where the CBs still are not totally independent. In these contexts, the government fiscal requirements determine the size of the fiscal deficits to be financed. This funding gap is assigned to the CB as the level of seignoriage revenue to be generated via money creation. In such a situation, if the CB commits fully to a low single digit inflation target, then the government can no longer rely on inflation tax to finance its deficits, as low inflation would be synonymous of low inflation tax collection and therefore low seignoriage revenues through money creation. So the adoption of IT would imply for the government to find other sources of financing than inflation tax. Then, IT should encourage the government to reinforce its tax collection system and rationalize its public expenditures (Minea & Villieu, 2008). Concerning the second type of fiscal dominance, it is neither specific to Developing Countries, nor to non independent CBs. It takes the form of government pressures on the CB to use monetary policy (MP) as a tool to keep short-term interest rates at low levels and then reduce the governmental borrowing cost. In such situations, if the CB adopts IT, there would be a serious incompatibility between the government strategy and the monetary policy. In fact, IT implies using short-term interest rate as the main instrument of MP (Svensson 2001). So in the case of inflationary pressures, to contain the demand and keep inflation on track, the CB should react aggressively by increasing the short-term interest rate; so there would be a conflict between the CB –willing to raise interest rates to meet its inflation target- and the governments -willing to keep interest rates at low levels to contain the burden of its debt-.In order to ensure the private agents that the MP will not be subordinated to the fiscal policy, so the government would discipline its fiscal management by reinforcing its ability of tax collection and rationalizing its expenditures. A similar argument has also been mentioned by Calvo & Mishkin (2003) who suggest that in order to increase the confidence of the private agents about the real desire of the CB to meet its inflation target, it becomes imperative for the government to reinforce its fiscal institutions in order to avoid potential debt monetization which would inevitably lead to the collapse of the IT framework.

[5] These are regimes characterized by the subordination of the other objectives of the CB to the assistance of government budget financing.

2.2. Attenuation of the Keynes-Oliveira-Tanzi effect

IT may, by containing inflation at low levels, affect the tax mobilization, and hence the government fiscal balance. Indeed, there are for some taxes, a time lag between the date of imposition and the date of tax collection, so that the real value of tax revenue collected is eroded by inflation (Keynes-Tanzi-Oliveira effect, see Tanzi, 1992). Therefore, by committing to low single digit inflation target, the CB could help mitigating this Keynes-Tanzi-Oliveira effect. Thus, assuming that this beneficial effect of IT on the tax mobilization is not fully offset by increased government spending, then IT should be accompanied by beneficial effects on the budget balance.

2.3. Full-Fledged IT: Flexible Exchange Rate and Fiscal Discipline

Full-Fledged IT implies abandoning the intermediate targets such as Exchange Rate. In fact, IT implies the CB to have a flexible exchange rate in order to send to the private agents a clear signal about its objective, namely its entire devotion to inflation stabilization. Furthermore, Tornell & Velasco (1995, 2000) have shown that contrary to the conventional wisdom, if the Fiscal Authority is impatient, i.e. discount the future heavily, then Flexible Exchange Rate would provide more FD than Fixed Exchange Rate. In fact, with flexible exchange rate, imprudent fiscal policies would lead to immediate consequences on the foreign exchange market, because large fiscal deficits would drive up interest rates which would make the exchange rate appreciated, while with fixed exchange rate, the punishment of imprudent fiscal policies is delayed to subsequent period, namely at the politically costly collapse of the peg[6]. So, the welfare cost[7] of bad fiscal policies appears at short-term with flexible exchange rate while with fixed exchange rate it is postponed to longer term. Therefore, depending on the relative impatience of the government vis-à-vis the welfare cost of bad fiscal management, Flexible Exchange rate would provide more or less FD. Since FFIT implies adopting flexible exchange rate, then FFIT would be a source of FD in the case of an impatient fiscal authority.

[6] But in the case of a country which has sufficiently low reserves and no recourses to debt finance, then an imprudent fiscal policy would lead immediately to a collapse of the peg, so fixed exchange rate and flexible exchange rate exert the same fiscal discipline.

[7] With flexible exchange rate, the welfare cost inherent to the appreciation of the exchange rate is a loss of competitiveness of the economy while with fixed exchange rate, the cost of a collapse of the parity is a loss of credibility of the CB.

3. Econometric Analysis

In this section, we will present the econometric model and the estimation techniques.

3.1. Econometric Model

3.1.1. *The baseline model*

Firstly, we estimate the following equation:

$$PFB_{it} = \beta_1 IT_{it} + \beta_2 OG_{it} + \beta_3 X_{it} + f_t + \varepsilon_{it} \quad (1)$$

Where PFB_{it} is Primary Fiscal Balance of country i in period t, IT_{it} a Dummy variable equal to 1 if in period t the country i practices IT, 0 otherwise -Exchange Rate Targeting or Money Targeting-. OG_{it} is the Country's i output gap ratio in period t; we introduce OG_{it} to be able to estimate the effect of IT on Primary Fiscal Balance, adjusted for business fluctuations, i.e. the effect of IT on Structural –Discretionary- Primary Fiscal Balance[8]. X_{it} represents a vector of control variables. We have retained those mentioned in the literature as influencing the fiscal balance: the Political Stability[9], the variables determining fiscal mobilization -Agricultural Value Added, Openness, level of Economic Development proxied by Real GDP per capita, Chelliah & al. (1975)- and the Urbanization Rate (Edwards & Tabellini (1991))[10]. The time Fixed Effects are captured by f_t : these times fixed effects are included to capture all the time varying characteristics affecting uniformly all the countries[11]. ε_{it} is the Random Error.

3.1.2. *Taking into account the longevity of the regime*

Given the delays in the transmission of the MP effects, it seems plausible to assume that the effect of the adoption of IT upon FD is not immediate, but cumulative over time, the disciplining effect adding up from period to period. Furthermore, the length of time during

[8] Indeed, with such a specification, β_1 is the estimated effect of IT on the budget balance at the mid-point of the business cycle, since at this point, the output gap ratio is null. It would have been more judicious to calculate directly Cyclically-Adjusted-Budget Balances (CAB) indicators, but such an exercise is handicapped by the lack of disaggregated data –as our sample includes developing countries-.

[9] Political stability data are from ICRG

[10] Most of the variables are from IMF World Economic outlook, IFS and Word Bank WDI.

[11] Note that the inclusion of country fixed effects is inappropriate, as our variable of interest IT dummy varies little over time.

which the CB has practiced IT could enhance the credibility of its anti-inflation fight, the confidence of the public vis-à-vis the CB commitments being boosted over the years, allowing the CB to meet its inflation target, and then trigger the positive effect on the FD via the channels stemming from a low inflation as described above. Then, we adopt a more flexible form of (1) to take into account the fact that the effect of IT upon the FD depends on the longevity of the practice of IT by the CB. IT_{it} becomes $ITduration_{it}$, a variable which takes the value 1 in the year of IT adoption, 2 one year after the adoption, 3, two years later, and so on[12]. In our sample which ranges from 1980 to 2003, the maximum value for this dummy is 14 for New Zealand, which adopted IT in 1990, 0 for all the non ITers and the ITers -during their pre-IT period-. (1) becomes (1'):

$$PFB_{it} = \beta_1 ITduration_{it} + \beta_2 OG_{it} + \beta_3 X_{it} + f_t + \varepsilon_{it} \qquad (1')$$

3.2. The estimation method

3.2.1. *The endogeneity of IT*

Several reasons could lead us to suspect that the adoption of IT is endogenous and therefore the estimate of its effect on FD with OLS is biased. First, it is possible that the relationship be subject to a bias of reverse causality. Indeed, as we want to show, if IT can improve FD, it should be noted that FD could also influence the adoption of CI, because the adoption of IT is determined by country-specific variables, including the fiscal balance. By the way, observing higher fiscal surplus in the ITers group would simply reflect a "selection on observables" problem, i.e. that countries recording higher FD are those which more likely adopt IT, creating false impression that IT truly shape fiscal behavior. Secondly, the omission of relevant variables, affecting simultaneously the adoption of IT and FD, or the unobservable variables contained in the error terms –unobserved social preferences for FD for example- would lead to a biased estimate of the treatment effect of IT on FD. Thirdly, the measurement errors in explanatory variables -mainly measuring IT with a dummy variable may not well characterize IT due to the heterogeneities in the practice of IT by the different CBs- could lead to an attenuation bias in the estimation of our relationship of interest. Therefore, an identification strategy able to consistently estimate this relationship is necessary. Our

[12] We also try a logarithmic specification of the longevity of the regime and the results remain unaltered – including the fitness of the data-.

identification strategy of the IT treatment effect on FD consists in finding some variables able to break any link between the adoption of IT and the error terms, in other words, finding good instrumental variables. The only way through which they could affect FD must be indirectly, through their effect on IT adoption. Econometrically speaking, these variables should verify the following 2 conditions: the non weakness condition and the orthogonality condition. These conditions mean respectively that the instrumental variables should be jointly significant determinants of IT and should not be correlated to the error terms. We minimize the problem of omitted variables by including in the estimation equation the potential determinants of FD and we control for time fixed effects. To control for the appropriateness of the IT dummy variable to capture the heterogeneities in the IT practice, we use alternatively two IT dummies, Full-Fledged IT and Partial IT. For robustness purpose –see section 7-, we also use the propensity score matching method which allows us to evaluate consistently the average treatment effect of IT through the identification of the relevant counterfactual to the ITers group. We also run system GMM estimations which not only makes possible to control for the endogeneity of several variables but also to take into account the persistence in the FD process. Finally LAD estimates are considered to check the robustness of the evaluation regarding the presence of outliers.

3.2.2. *The instrumental variables*

We use three instruments: 1) the lagged -1 period- value of IT; 2) the lagged -1 period- value of Inflation Rate and 3) the Percentage of Neighbors ITers. The first two instruments have been used by Mishkin & Schmidt-Hebbel (2007). The underlying idea is that since its first adoption by New Zealand in 1990, any ITer has yet abandoned IT due to economic duress, so that the lagged value of IT could be a good predictor of its current value. The argument for using the lagged value of inflation as instrument for IT has been drawn from the literature, suggesting that a country should adopt IT when its inflation is reasonably at low level, preferably after a successful disinflation (Truman, 2003; Masson et al., 1997; Minella et al., 2003). Obviously, lagged values make good instruments if and only if there is no serial correlation in the errors terms. It is therefore important to note that our dependent variable, the primary fiscal balance, i.e. the overall fiscal balance excluding the interest payments allow us to avoid a possible serial correlation in the errors terms, since excluding the interest payments is synonymous of breaking any link between the past and the current fiscal policies, so

avoiding any serial correlation in the errors terms. Concerning the third instrument, we adapt it from Miao (2009). The proportion of "neighboring" countries that have adopted IT can be an effective instrument for IT because the adoption of IT by a neighbor is not correlated with the omitted variables of the foreign countries, but very likely influences the choice of monetary regime of its neighbors, due to the pairs or spillovers effects. But what do we mean by "neighboring" countries? The proximity criterion considered here is not limited to geographic proximity, but extends to the historical, linguistic, cultural, political, commercial and economic. For example, the Anglo-Saxons are treated as "neighbors" and the countries of the former USSR, today identified as European Emerging Countries are also considered as "neighbors". We classify the countries of our sample into 8 groups –see appendix 3- of neighbors: the Anglo-Saxons, the Nordic Countries, the Euro area Countries, the Other Developed Countries, the European Emerging Countries, the Countries of Latin America, the Other Emerging Countries and the Sub-Saharan countries -including the Islands-[13]. In each group, we calculate for each country in each period, the proportion of its partner countries that have adopted IT.[14] To check the validity of our instruments, standard appropriate tests are run: Stock-Yogo's test[15], Shea's partial R^2, Sargan-Hansen's over-identifying restrictions test.[16] With these 3 instruments, we apply the 2SLS estimator on our data.

4. Data and results

4.1. The sample

Our sample is composed of 58 countries over the period 1980-2003. This is an unbalanced panel because of missing data. But the econometric estimates mitigate this bias by correcting for heteroskedasticity by country. The treatment group –ITers- is composed of 22 countries and the control group of 36 countries that target either the Money Growth or the Exchange

[13] The islands have been included in the same group as the countries of sub-Saharan Africa because they share a common characteristic, namely that they are all small open economies.

[14] Note that some countries could be classified in two groups simultaneously, but when such a situation arises, we give the priority to the proximity of the structural economic characteristics criterion. For example, the United States of America and Ireland, although both Anglo-Saxons, have been classified respectively in the other Developed Countries and the Euro area.

[15] We also ensure that the instruments are jointly significant in the first step equation -see annex 4-

[16] The results of our estimates -see below- allow us to declare that our instruments are not weak because all the Cragg-Donald's statistics are above the critical threshold, 9.08. Moreover, Shea's partial R^2 is also above the conventional critical threshold, 0.20. Finally, in all our estimates, we cannot reject the null hypothesis of no correlation between the instruments and the random errors. Indeed, the probability for the null hypothesis is greater than 10%. For example, in column (1) of Table 1, the P-value of the null hypothesis is 0.6216. Therefore, we conclude that our instruments satisfy the orthogonality condition.

Rate. Of the 58 countries, 35 are Developing Countries and 23, Developed Countries.[17] we have grouped our data into three-year averages; we have finally 58 countries on 8 sub-periods of 3 years: 1980-1982, 1983-1985, 1986-1988, 1989-1991, 1992-1994, 1995-1997, 1998-2000 and 2001-2003.

4.2. Variables calculation

✓ ***Inflation Targeting (IT_{it})***

IT_{it} is a dummy variable which takes the value 1 if in year t the country's i CB is ITer, 0 if it targets either the Money Growth or the Exchange Rate. But as noted above, all variables were grouped into three-year averages, so we recoded the variable IT_{it} , which now takes the value 1 if between the years t and t +2 the country's i CB targets inflation, 0 otherwise[18]. Appendix 7 shows ITers list along with their adoption dates. Following Rose (2007), we distinguish 2 kinds of dates: the default starting dates and the conservative starting dates. The first ones are those declared themselves by CBs while the seconds are those considered by analysts as real dates from which CBs began meeting the 5 criteria required to classify them as ITers. To be able to examine whether the impact of IT on FD differs according to the form of the IT adopted, we will characterize the period separating the default starting date from the conservative one, as Partial –or soft-[19] IT, i.e. the transitional phase during which the CB adopts "IT lite" (Carare & Stone, 2006), allowing it to undertake gradually the necessary reforms for an ultimate Full-Fledged-IT -Strict IT- adoption. We then use two IT variables, Full-Fledged IT –FFIT- and Partial IT to verify that the effect of IT on FD varies according to the degree of commitment of the CB to its inflation target. It is also important to note that Finland and Spain which adopted IT respectively in 1993 and 1995 abandoned it in 1999 to

[17] The first criterion used for the selection of the countries is the availability of data, particularly on the dependant variable (Primary Fiscal Balance). Then, to ensure that both groups are reasonably comparable, we exclude countries with a GDP per capita smaller than the poorest ITer one, Ghana (270.48 $ U.S.); we also exclude from the sample the countries whose population is less than the least populated ITer, Iceland (283,000 inhabitants).

[18] If such a recoding is relevant to analyze the effect of IT on FD on a medium-term horizon, it should be noted however that this is a drawback, as this attributes the same value to the dummy IT_{it} between t and t +2 to several CBs that have adopted IT in different years, t, t +1 or t +2. For example, Canada which has adopted IT in 1992 has the same value of IT_{it} on the sub-period 1992-1994 than Australia which has adopted it only in 1994. To ensure that these three-year averages data do not affect the validity of our results, we will therefore, in addition to our main estimates results, run regressions on annual data for robustness purpose.

[19] By Full-Fledged-Inflation-Targeting (FFIT) we mean a CB which meets all the 5 criteria mentioned above (Mishkin, 2000), while by Partial IT we mean all the CBs which lack temporarily at least one of the 5 criteria, but officially consider themselves as ITers. Concretely, when the default starting date differs from the conservative one, thus we consider that at the default date the CB adopts partial IT while at the conservative date the CB adopts FFIT. Vega & Winkelried call this form of IT, "soft" IT. One could also think of such a gradual adoption of IT as "flexible" IT.

join Euro zone[20], so we treat them as ITers respectively between 1993-1998 and 1995-1998 and as non ITers after 1999.

- ✓ ***Fiscal Discipline: Primary Fiscal Balance in % of GDP (PFB_{it})***

Primary Fiscal Balance of central government as GDP percentage, i.e. the Overall Fiscal Balance[21] excluding the payments of debt interests, is considered as measure of Fiscal Discipline [22](FD). We also consider Debt Ratio in % of GDP for robustness check.

- ✓ ***The output gap (OG_{it})***

We measure the output gap with the following formula:

$$OG_{it} = \frac{GDP_{it} - GDP_{it}^{trend}}{GDP_{it}^{trend}}$$

It is the deviation of the logarithm of real GDP relative to the trend, divided by the logarithm of the Real GDP trend. A positive difference corresponds to a phase of high business cycle –expansion- while a negative difference corresponds to a phase of low cycle –recession-.[23]

4.3. The results -on the total sample-

In columns (1) and (2) of table 1, where we consider respectively as variable of interest FFIT and Flexible IT, it appears that although positive, the effect of IT on FD at the mid-point[24] of the business cycle is not significantly different from zero. In the last two columns of table 1, where we take into account the length of time during which the CB has been under the IT framework, the positive effect of IT on the structural primary fiscal balances in % of GDP

[20] The European Central Bank (ECB) presents ITers characteristics in reality, but as it does not report officially targeting inflation, so we treat it as non ITer. In fact, the ECB publishes inflations forecasts but emphasize that these predictions are purely indicative and do not constitute any commitment regarding the conduct of the MP. Moreover, its monetary framework is hybrid, as it targets both money growth and inflation.

[21] Fiscal data are from Brender & Drazen (2004), IFS and GFS.

[22] For a detailed discussion on why Primary Fiscal Balance could be preferred to the other Fiscal Performances indicators to analyze FD, see (A. Bénassy-Quéré et J. Pisani-Ferry, 1994). Moreover, choosing primary –and not overall- fiscal balance as FD indicator will allow us to use lagged values of IT and Inflation Rate as relevant instrumental variables of IT.

[23] The output trend is obtained by smoothing the series of log real GDP with Hodrick-Prescott (HP 1997) filter.

[24] At this point, the output gap is zero, which means that we have indirectly the effect of IT on Structural (discretionary) Primary Fiscal Balance i.e. the real FD.

becomes significant at 1%. Therefore, the disciplining effect of the adoption of IT on fiscal management is not immediate, but cumulative over time. Thus, if we consider the half time elapsed - 7 years - since the initial adoption of IT by New Zealand in 1990 until the end of our period of analysis, 2003, then we can say that a country, recording the average primary fiscal balance of our sample (1.178 %), which fully commits to IT would at the end of these 7 years, increase its primary fiscal surplus by 0.198 points, which leads to a final fiscal balance of 1.376 in % of GDP.

Table 1: Effect of IT on FD: 2SLS on the total sample

Dependant Variable: Primary Balance in % of GDP	**(1)**	**(2)**	**(3)**	**(4)**
Full-Fledged IT (FFIT)	**0.323**			
	(0.508)			
Partial IT		**0.591**		
		(0.463)		
FFIT_Regime Duration			**0.198*** **	
			(0.062)	
Partial IT_Regime Duration				**0.199*** **
				(0.060)
Log of Real GDP per capita	-0.264*	-0.262*	-0.290**	-0.285*
	(0.147)	(0.147)	(0.147)	(0.147)
Output gap (HP_6,25)	20.11	19.07	21.06	19.48
	(12.88)	(12.85)	(12.86)	(12.86)
Openness	0.009	0.009	0.009	0.009
	(0.006)	(0.006)	(0.006)	(0.006)
Agricultural VA	0.014	0.015	0.003	0.003
	(0.038)	(0.038)	(0.038)	(0.038)
Urbanization rate	0.064***	0.063***	0.057***	0.056***
	(0.014)	(0.014)	(0.014)	(0.014)
Political Stability	0.070	0.072	0.072	0.074
	(0.126)	(0.126)	(0.125)	(0.125)
Time Fixed Effects	Yes	Yes	Yes	Yes
Number of observations	357	357	357	357
Partial R^2	**0.219**	**0.203**	**0.233**	**0.229**
Hansen test of over-identification (P-value)	**0.6216**	**0.5911**	**0.6784**	**0.6612**
Cragg-Donald Statistic (Stock-Yogo test)	**12.009**	**11.831**	**16.421**	**15.855**

Note: *, **, ***: significant respectively at 1, 5 and 10%. In brackets, standard deviations robust to heteroskedasticity and to error terms autocorrelation. The excluded instruments are one year lagged values of IT, one year lagged values of Inflation rate and the % of neighboring ITers. In (1) and (2), the variables of interest are respectively FFIT and Partial IT; whereas in (3) et (4) these are respectively the same variables but adjusted linearly for the duration of the regime practice. Constants are included in the estimations

5. Do the Developing Countries behave differently?

The economies of the Developing Countries show specific structural features that could make there, different, the effect of IT on FD. Indeed, these countries are characterized by low levels of economic and financial development, weak institutional quality and infrastructural capacity for inflationary forecasts. They also experience regularly great vulnerability to external shocks and sudden movement of capital -"sudden stop "- (Carare & Stone, 2006; Calvo & Mishkin, 2003). All these structural weaknesses make hardly credible any decision of IT adoption by their CBs, because the public would doubt their ability to keep inflation within its target band -or point-. This low credibility enjoyed by their CBs compared to those of the Developed Countries implies that any Developing Country which adopts IT must make more fiscal adjustments and structural reforms to win the confidence of private agents, which is crucial for any successful implementation of IT framework. Therefore, the disciplining effect of the adoption of IT on fiscal management should be different in these countries. But, is such a presumption supported by the data? To answer this question, we restrict our empirical analysis to the Developing Countries sub-sample, consisting of 35 countries, whose 12 were ITers until 2003 and 23 which have targeted either the Money growth or the Exchange Rate.

On this Developing Countries sub-sample -Table 3-, the disciplining effect -without the interactive variables- of IT on FD is no more solely cumulative over time, but immediate. In fact, in (1) and (2), i.e. when we do not take into account the influence of the length of exposure to IT, the effect of IT on Primary Fiscal Balances is significantly positive -whereas it was not significant on the total sample- Another interesting result is that the effect of IT is more accentuated with the adoption of Partial IT (2) than with the adoption of FFIT (1). Indeed, the degree of significance is higher in (2) that in (1); better, when we take into account the longevity of the regime, only the gradual adoption of IT improves the FD. In summary, we found that in the Developing Countries, the adoption of IT increases immediately the primary structural budget balance in % of GDP. Moreover, the disciplining effect of IT on Fiscal Management is more pronounced for the countries which adopt gradually IT, because, they must undertake more reforms and fiscal adjustments during a transitional phase to win public confidence before any credible transition to FFIT. Since the positive effect of IT on FD appears significantly different from zero solely on the developing countries sub-sample, then we will focus on these countries in the remainder of the analysis.

Table 2: Effect of IT on FD -2SLS on the Developing Countries Sub-Sample-

Dependant Variable: Primary Balance in % of GDP	**(1)**	**(2)**	**(3)**	**(4)**
Full-Fledged IT (FFIT)	**1.417***			
	(0.832)			
Partial IT		**1.599****		
		(0.623)		
FFIT_Regime Duration			**0.529**	
			(0.331)	
Partial IT_Regime Duration				**0.156***
				(0.092)
Log of Real GDP per capita	-0.198	-0.252	-0.164	-0.093
	(0.247)	(0.249)	(0.247)	(0.233)
Output Gap (HP_6.25)	12.11	11.11	9.224	10.44
	(14.93)	(14.87)	(14.72)	(14.66)
Openness	-0.003	-0.005	-0.003	0.0005
	(0.010)	(0.011)	(0.011)	(0.010)
Agricultural VA	-0.006	-0.005	-0.012	-0.014
	(0.044)	(0.043)	(0.044)	(0.045)
Urbanization Rate	0.055***	0.054***	0.054***	0.051***
	(0.017)	(0.017)	(0.017)	(0.018)
Political Stability	0.199	0.160	0.196	0.197
	(0.173)	(0.171)	(0.174)	(0.172)
Time Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	205	205	205	205
Partial R^2	**0.2215**	**0.2095**	**0.3123**	**0.3204**
Hansen Test of Over-identification (P-value)	**0.5658**	**0.6624**	**0.2117**	**0.2341**
Cragg-Donald Statistic (Stock-Yogo Test)	**15.627**	**16.421**	**18.111**	**18.147**

Note: *, **, ***: significant respectively at 1, 5 and 10%. In brackets, standard deviations robust to heteroskedasticity and to error terms autocorrelation. The excluded instruments are one year lagged values of IT, one year lagged values of Inflation rate and the % of neighboring ITers. In (1) and (2), the variables of interest are respectively FFIT and Partial IT; whereas in (3) et (4) these are respectively the same variables but adjusted linearly for the duration of the regime practice. Constants are included in the estimations.

6. Heterogeneities in the effect of IT on FD : the conditional effects

6.1. The specification

Due to the idiosyncrasies, the effect of IT on FD could be different within the developing countries. These idiosyncrasies would come from the differences in the structural characteristics of these economies (Carare & Stone, 2006; Fraga & al., 2003; Mishkin, 2004). In this context, it is necessary to introduce the interaction of IT with these characteristics (T_{it}). We regress now (2) on the Developing Countries sub-sample:

$$PFB_{it} = \beta_1 IT_{it} + \beta_2 OG_{it} + \beta_3 X_{it} + \beta_4 T_{it} + \beta_5 IT_{it} * T_{it} + f_t + \varepsilon_{it} \quad (2')$$

We explore 4 potential heterogeneities: 1) the degree of the CB Independence; 2) the Financial Deepening and 3) the instability in the Terms of Trade and 4) the meeting of the Theoretical Pre-conditions for a successful IT adoption.

1) Much of the influence of IT on FD comes from a mitigation of the monetary financing of the budget deficit. But IT adoption is not the only way in achieving such a disciplining effect on fiscal management. Making the CB independent vis-à-vis the fiscal authorities may also lead to a positive effect on FD since CB independence[25] means for the government to renounce to any resort to "printing money" or any privileged access to credit to finance a deficit of public accounts (Bénassy-Quéré & Pisani-Ferry (1994) and Woodford (2000)). Therefore, the independence of the CB should interact complementarily with IT to improve the FD. So, we expect a positive effect of the interaction between IT and the CB independence[26] on the FD.

2) Some papers (Carare & Stone (2006); Miao (2009)) have emphasized the role of financial deepening[27] in the success of IT, because these are important factors conditioning the mechanisms of transmission of the MP rule. Therefore, the ability of ITers CBs to hit their inflation targets, and in turn their ability to discipline the fiscal policy, is conditioned by the level of financial development. Furthermore, in presence of developed banking system, the receipts of seignoriage become insignificant because of their flight to commercial banks. This would encourage the governments in such contexts to improve their collection of tax revenues and to clean up their public finances management (Minea & Villieu, 2008). So, the financial development should interact positively with IT to improve FD.

3) Volatility in the terms of Trade implies the instability in government revenues, particularly in the countries where most of the public revenues come from the exports of commodities (Cashin & Pattillo, 2000). Moreover, fluctuations in the terms of trade are a source of *voracity* effect, i.e. pressure from all sides for increased public spending, and therefore deterioration of

[25] Note that only operational independence of the CB is required as a precondition for a successful IT adoption (Calvo & Mishkin, 2003), so adopting IT do not necessarily imply that the CB is independent.

[26] We use CB governor's turnover rate (Ghosh & al., 2003) as an inverse proxy for the CB independence.

[27] Measured by the credits to private sector as % of GDP (Beck, Kunt & Levine, 2007)

public finances (Tornell & Lane 1999). Thus, the positive effect of IT on FD should be higher for ITers experiencing less volatility in their terms of trade. Furthermore, the need to cope with external shocks has led ITers to introduce forms of flexibility in their IT implementation-escape clauses, target bands, longer horizons of the MP, "core" inflation targeting-. But as stressed by Bernanke & Mishkin (1997), even though this flexibility allows the CB to cope with shocks, it is nevertheless a factor reducing its accountability and transparency, which could damage the credibility of its actions and lead to the breaching of its target. This would cancel any positive effect of IT on FD stemming from low inflation. Therefore, we expect a negative effect of the interaction between IT and the volatility in the terms of trade[28] on FD.

4) As noted above, the literature advocates a minimum of theoretical preconditions to be met before a successful adoption of IT. By fulfilling these prerequisites, the CB therefore increases the credibility of its actions, crucial determinant of the success of IT. So, it seems plausible to assume that the interaction between IT and the meeting of the preconditions lead to a positive effect on FD, via the positive effect on FD stemming from a low inflation. To test for this, we draw a specification from Lin & Ye (2008) and approximate the fulfillment of the preconditions by the estimated propensity scores -see table 5- recorded by each country. Then we interact IT with the gap between the propensity score of each country and the sample mean propensity score: $Pscore_{it} - \overline{Pscore_{it}}$. With such a specification– see Wooldridge (2002)-, the coefficient β_1 gives an estimate of the effect of IT on FD for the average level of propensity scores while the conditional effect is captured by β_5.

6.2. The results

When we introduce the interactive variables -Table 3-, first we find that IT has no significant effect -in level- on FD, except in column (2). However, some conditional effects proved significant[29]. The effect of IT conditional to the instability in the terms of trade is not significantly different from zero when we consider FFIT -column 1- whereas this effect is significant when we consider partial IT -column 2-. This is understandable, since the developing countries –which are the most exposed to the voracity effect due to the weakness of their institutions- adopt gradually IT most of time -rather than FFIT-. So within the

[28] We measure the volatility in the terms of trade by the standard deviation of the terms of trade growth rate.

[29] The coefficients of IT and that of the interactive variables are jointly different from zero. Therefore IT influences significantly FD only in country having structural economic characteristics different from zero -or different from the mean propensity score-

developing ITers countries, the positive effect of IT on FD would be lower for those experiencing larger instability in their terms of trade.

Table 3: Conditional Effects of IT on FD (Developing Countries Sub-Sample)

Dependant Variable: Primary Balance (% of GDP)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Full-Fledged IT (FFIT)	**1.729**		**0.507**		**-0.176**		**0.366**		**-0.218**	
	(1.059)		(0.392)		(0.382)		(0.398)		(0.434)	
Partial IT		**0.502****		**0.042**		**-0.120**		**0.117**		**0.092**
		(0.247)		(0.112)		(0.191)		(0.139)		(0.269)
ToT Volatility	0.087***	0.088***							0.079***	0.075***
	(0.025)	(0.026)							(0.027)	(0.027)
FFIT*ToT Volatility	**-0.041**								**0.091**	
	(0.096)								(0.059)	
Partial IT*ToT Volatility		**-0.037***								**-0.037**
		(0.022)								(0.027)
Turnover Rate (CB)			-0.006	-0.011					-0.003	-0.010
			(0.001)	(0.010)					(0.010)	(0.010)
FFIT*Turnover			**-0.013***						**-0.011**	
			(0.007)						(0.007)	
Partial IT*Turnover				**-0.019*****						**-0.018****
				(0.007)						(0.007)
Credit to Private					-0.013	-0.012			-0.008	-0.015
					(0.010)	(0.010)			(0.010)	(0.009)
FFIT*Credit to Private					**0.010****				**0.005**	
					(0.004)				(0.004)	
Partial IT*Credit to Private						**0.006***				**0.007****
						(0.003)				(0.003)
Pscore							-0.569	-0.611	-0.525	-0.591
							(1.807)	(1.901)	(1.802)	(1.833)
FFIT*($Pscore - \overline{Pscore}$)							**1.294**		**1.187**	
							(1.143)		(1.174)	
Partial IT*($Pscore - \overline{Pscore}$)								**0.360**		**0.358**
								(0.630)		(0.615)
The other covariates	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	205	205	188	188	204	204	143	143	187	187
Partial R^2	**0.2105**	**0.2208**	**0.2317**	**0.2301**	**0.2498**	**0.2411**	**0.2213**	**0.2270**	**0.2107**	**0.2098**
Hansen Test of Over-identification (P-value)	**0.1933**	**0.2071**	**0.4924**	**0.4916**	**0.6534**	**0.6518**	**0.4803**	**0.4719**	**0.1904**	**0.1921**
Cragg-Donald (Stock-Yogo Test)	**12.196**	**11.922**	**13.127**	**13.107**	**14.273**	**14.627**	**12.417**	**12.792**	**12.168**	**12.339**

Note: *, **, ***: significant respectively at 1, 5 and 10%. In brackets, standard deviations robust to heteroskedasticity and to error terms autocorrelation. The excluded instruments are one year lagged values of IT, one year lagged values of Inflation rate, the % of neighboring ITers and the products of each of the interactive variables with the one year lagged IT (for the interactive variables). In the odd columns the variable of interest is FFIT whereas in the pair columns it is Partial IT.

Concerning the independence of the CB– proxied by the turnover rate of the governors of CBs-, its interaction with IT has a significant[30] negative effect on FD. But as the turnover rate is the reverse proxy of the CB independence, then this corresponds to a favorable effect on FD -Columns 3, 4 and 10-. For given developing countries ITers, the effect of IT on FD resorts stronger for those enjoying greater independence of their CB. The effect of IT on FD, conditional to the level of financial deepening is positive and significant -columns 5, 6 and 10-. This is due to the fact that the loss

of seignoriage revenues -resulting from low single digit inflation target and partial flight to commercial banks in countries with well developed banking system- forces the governments to increase their ability to mobilize tax revenues and to reduce budget wasting. The effect of IT on FD conditional to the fulfillment of the preconditions is not significantly different from zero. Therefore the positive effect of IT on FD is not observed solely in the developing ITers countries recording higher propensity scores.

7. Robustness Analysis

In this section, we adopt alternative specifications to check the robustness of our results.

7.1. Robustness to the estimation method

- ✓ ***The propensity Score Matching Method***

This method -Appendix 1- aims at identifying, on the basis of observable economic characteristics, the relevant counterfactual to the treatment group –ITers-, in order to evaluate consistently the Average Treatment Effect of IT on FD.

- **Propensity Scores Estimation**

To estimate the propensity scores –table 4-, i.e. the probability for each country i in period t, to adopt IT, conditionally to the observable covariates, we consider two types of covariates:

[30] But when we introduce simultaneously all the interactive variables, in the case of FFIT, the effect of IT conditional to the CB independence becomes insignificant -column 9-

- *The theoretical preconditions variables*

We retain the Past Inflation Rate -1 lag-, Money growth, the 5 years Turnover Rate of the CBs governors -reverse proxy for the independence of the CB-, Real GDP per capita and the degree of Capital Market Development. We expect for the effects of the first 3 variables, negative signs on the probability of IT adoption. For the last two variables, we expect a positive effect.

- *Exchange Rate Targeting Determinants*

We consider the following variables to control for the likelihood that some countries choose to target the Exchange rate as an alternative framework for the conduct of their MP: Fixed Exchange Rate Dummy[31] and Openness. The expected effect of these variables on the probability of adopting the IT is negative.

- **Matching Results**

The results –table 5- confirm those found with the 2SLS: the adoption of IT affects positively the FD, especially on the Developing Countries sub-sample.

Table 4: Probit Estimations of Propensity Scores

	(1)	(2)
Dependent Variable : IT Pscore	**Total Sample**	**Developing Countries Sub-Sample**
Log of Real GDP per capita	0.001	0.479***
	(0.073)	(0.141)
Inflation Rate (1 year lagged)	0.045*	0.056**
	(0.023)	(0.025)
Turnover Rate (CB)	-0.010*	-0.012*
	(0.005)	(0.007)
Openness	-0.004*	0.050
	(0.002)	(0.004)
Money Growth	-0.013	-.0198**
	(0.008)	(0.010)
Fixed Exchange Rate	-0.249**	-0.382***
	(0.010)	(0.141)
Stock Market Capitalization	0.008***	0.001
	(0.002)	(0.004)
Number of Observations	254	166
Pseudo R^2	0.1865	0.2674

[31] Data on Exchange Rate Regimes are from Reinhart & Rogoff (2004)

Table 5: Effect of IT on FD: Propensity Score Matching Method

Dependant Variable: Primary Balance	**Nearest-neighbor-matching**	**3-Nearest-neighbor-matching**	**Radius matching r=0.01**	**Radius matching r=0.03**	**Kernel matching (biweight)**
Total Sample					
Average Treatment on Treated (ATT)	**2.0967****	**1.2965***	**0.8537**	**1.3304***	**1.0242**
	(0.7943)	(0.6988)	(0.851)	(0.7411)	(0.7275)
Number of Observations (Treated Group)	54	54	54	54	54
Number of Observations (Control Group)	200	200	200	200	200
Number of Observations (Total Sample)	254	254	254	254	254
Developing Countries Sub-Sample					
Average Treatment on Treated (ATT)	**1.7968**	**1.912***	**2.452***	**2.602***	**41***
	(1.402)	(1.051)	(1.056)	(1.184)	126)
Number of Observations (Treated Group)	28	28	24	28	
Number of Observations (Control Group)	138	138	138	138	3
Number of Observations (Total Sample)	166	166	162	166	5

Note: *, **, ***: significant respectively at 1, 5 and 10%.In brackets, the standard deviations (bootstrapped with 500 replications). The IT variable considered here is Partial IT.

✓ ***System GMM estimator***

In the literature it is acknowledged that fiscal balances have certain inertia due to delays in establishing a new fiscal policy (Gali & Perotti, 2003). Therefore, we test the robustness of our results to the inclusion of the lagged fiscal balance among the covariates, by using the estimator of the Generalized Method of Moments -System GMM- (Blundell & Bond, 1998). The results –Appendix- remain robust to this new specification. Since the effect of IT on FD is more pronounced on the Developing Countries sub-sample, we then focus on it for the interpretations. In the short-term, the positive effect of IT on FD is more significant[32] when the CB adopts gradually IT than when it adopts FFIT. The long term effect of partial IT on the structural primary fiscal balances (1.241 / (1 - 0.542) = 2.71) is higher than the short term one, which confirms the result found with the 2SLS, that the effect of IT on FD is cumulative over time.

✓ ***Robustness to outliers -LAD estimator-***

It is important for us to ensure that our results are not led by some outliers -especially on the fiscal variables-. Then, we rerun (1) with the Least Absolute Deviation –LAD- estimator[33]

[32] The precision of the estimates gets better with Partial IT (significant at 1%) than with FFIT (significant at 5%)

[33] See Wooldridge (2002)

which has the property of being robust to outliers, as it estimates a smooth conditional median function. The results -Appendix 6- remain robust.

7.2. Robustness to time dimension nature

Finally, to test the robustness of our results to the time dimension nature -see discussion earlier in the presentation of the sample- we re-estimate equations (1) and (2) on annual data -as opposed to triennial average data-.The results[34] remain robust to this new specification.

8. Conclusion and Economic Policy implications

We have highlighted in this paper, the effects of Inflation Targeting -IT- adoption on Fiscal Discipline –FD-, on a sample of 58 countries -Developing and Developed Countries-, composed of 22 ITers and 36 targeting either Money Growth or Exchange Rate, over the period 1980-2003.These results, obtained by applying the 2SLS estimator, suggest that the adoption of IT, relatively to Money Targeting or Exchange Rate Targeting, does not improve central government FD on the total sample. The positive effect of IT on FD takes place only in the Developing Countries sub-sample-where seignoriage still represents a substantial source of government finance-. The adoption of IT in these countries may increase the structural primary fiscal balance -as GDP %- by 1.6 points. Indeed, to demonstrate to private agents that their CBs will not succumb to government pressure for monetization of public debt and in turn violate its inflation target, therefore their governments are prompted to clean up their fiscal management through an increase of their efforts to mobilize tax revenues and to reduce budget wasting. Moreover, in these Developing Countries -and to a lesser extent on the total sample-, the positive effect of IT on FD is stronger when the CB adopts Partial IT rather than Full-Fledged IT –FFIT-. So IT encourages countries that have adopted it while they have adverse economic structural characteristics to that, to improve their fiscal management during a transitional phase –Partial or soft IT-, allowing them to adopt credibly FFIT subsequently. Last but not least, we have shown that the positive effect of IT on FD is heterogeneous: it is conditional to the degree of CB independence, the level of the financial deepening, the instability in the terms of trade and the length of time during which the CB has been under the IT framework -the effect is not immediate but cumulative over time-.

[34] Available upon request to the author.

Our results are robust to alternative specifications -using Debt Ratio as an alternative indicator of FD, using Propensity Score Matching Method, System GMM estimator, LAD estimator and applying 2SLS on annual data rather than triennial averages data-. However, these results should be interpreted with caution. Indeed, some CBs reports practicing IT but in reality keep on pursuing other MP objectives such as the limitations of their exchange rate fluctuations. Conversely, other CBs did not report formally targeting inflation, but often present ITers characteristics in reality -ECB, Fed-. As the border between the different MP regimes is not clearly determined, so our results should be taken with caution.

The results of this paper have economic policy implications that could contribute importantly to the debate about the relevance of IT adoption by the developing countries. Because of the importance of seignoriage revenue in their public revenue, one could argue that it would not be credible for these countries to adopt IT, as public debt monetization would create inflationary pressures that would ultimately result in the inflation target breaching. But our results suggest rather that they could successfully adopt IT and improve their fiscal stances, provided that they adopt it gradually and establish flexible framework allowing them to react temporally to short-term external shocks. By the way, they could stabilize both inflation and fiscal policy -therefore macroeconomic stability, which is a key prerequisite for a strong and balanced long term growth (Fischer, 1993)-.

References

Agénor, P. R, 2002, «Monetary Policy Under Flexible Exchange Rates: An Introduction to Inflation Targeting», *Central Bank of Chile.*
Alesina, A. and R. Perotti, 1994, «The Political Economy of Budget Deficits» *IMF Working Paper*, No. 94/85.

Ball, L., and N. Sheridan, 2005, «Does Inflation Targeting Matter? », *University of Chicago Press*, Chicago.

Bénassy-Quéré, A. and J. Pisani-Ferry, 1994, «Indépendance de la Banque Centrale et Politique Budgétaire», *CEPII, Document de travail* n° 94-02

Bernanke, B. S., Laubach, T., Mishkin, F.S. and A.S. Posen, 1999. «Inflation Targeting: Lessons from the International Experience», *Princeton University Press*: Princeton.

Bernanke, B. S. and F.S. Mishkin, 1997, «Inflation Targeting: a New Framework for Monetary Policy», *Journal of Economic Perspectives* 11, 2: 97-116.

Blundell, R. and S. Bond, 1998, «Initial Conditions and Moment Restrictions in Dynamic Panel Data Models », *Journal of Econometrics*, 87 (1), pp. 115-143.

Brender, A. and A. Drazen, 2004, «Political Budget Cycles in New Versus Established Democracies», *NBER Working Papers* 10539.

Brito, R. D. and B. Bystedt, 2010, "Inflation Targeting in Emerging Countries, Panel Evidence", *Journal of Development Economics 91 (2010) 198–210*

Calvo, G. and F. S. Mishkin, 2003, «The Mirage of Exchange Rate Regimes for Emerging Market Countries, » *Journal of Economic Perspectives*, Vol. 17, No. 4.

Carare, A. and M. R. Stone, 2006, «Inflation targeting regimes», *European Economic Review*, Elsevier, vol. 50(5), pages 1297–73, July.

Cashin, P. and C. Pattillot, 2000, «Term of Trade Shocks in Africa: Are They Short-lived or Long-lived? » *IMF Working Paper*, No. 00/72.

Chelliah, R., H. Baas, and M. Kelly, 1975, «Tax Ratios and Tax Effort in Developing Countries 1969–71 » *Staff Papers*, International Monetary Fund, March, Vol. 22, pp. 187–205.

Croce, E. and M. S. Khan, 2000, « Régimes monétaires et ciblage de l'inflation », *Finance et Développement*, volume 37 - No.3.

Dehejia, R.H., and S. Wahba, 2002, «Propensity score-matching methods for non experimental causal studies. », *Review of Economics and Statistics* 84 (1), 151–161.

Edwards, S. and G. Tabellini, 1991, «Explaining Fiscal Policies and Inflation in Developing Countries», *Journal of International Money and Finance*, vol. 10, special issue, p. S16-S48.

Fischer, S. 1993, « the Role of Macroeconomic Factors in Growth», *Journal of Monetary Economics*, 32 (3): 485-512.
Fraga, A., Goldfajn I. and M. A. Minella, 2003, «Inflation Targeting in Emerging Market Economies», *NBER Macro Annual*

Freedman, C. and D. Laxton, 2009, « Why Inflation Targeting? », *IMF working paper* No.09/86

Gali, J. and R. Perotti, 2003, «Fiscal Policy and Monetary Integration in Europe », *Economic Policy*, 18(37), pp. 533-572.

Ghosh, A., Gulde, A. and H. Wolf, 2003, «Exchange Rate Regimes: Choice and Consequences. », *MIT Press*, Cambridge, MA.

Heckman, J., Ichimura, H. and E. Todd, 1998, «Matching as an econometric evaluation estimator. », *Review of Economic Studies* 65, 261–294.

Jaimovich, D. and U. Panizza, 2006, «Public debt around the world: a new dataset of central government debt», *Research Department Working Paper* 561, Inter-American Development Bank.

Lin, S. and H. Ye, 2007, «Does Inflation Targeting Really Make a Difference? Evaluating the Treatment Effect of Inflation Targeting in Seven Industrial Countries», *Journal of Monetary Economics* 54, 2521–2533.

Lin, S. and H. Ye, 2008, «Does Inflation Targeting Make a Difference in Developing Countries? » Journal of Development Economics, doi:10.1016/j.jdeveco.2008.04.006

Masson, P., Savastano, M. and S. Sharma, 1997, «The Scope for Inflation Targeting in Developing Countries», *IMF Working Paper* No. 97/130

Miao, Y., 2009, «In Search of Successful Inflation Targeting: Evidence From an Inflation Targeting Index», *IMF Working Paper* No. 09/148

Minea, A. et P. Villieu, 2008, «Financial Development, Institutional Quality and Inflation Targeting», *Unpublished Paper.*

Mishkin, F. S., 2000, «Inflation Targeting in Emerging-Market Countries. », *American Economic Review. American Economic Association*, vol. 90(2). Pages 105–109

Mishkin, F. S., 2004, «Can Inflation Targeting Work in Emerging Market Countries? » *NBER Working Paper* 10646.

Mishkin, F. S. and K. Schmidt-Hebbel, 2007, «Does Inflation Targeting Make a Difference? », *NBER Working* 12876.

Persson, T., and G. Tabellini, 1993, «Designing Institutions for Monetary Stability», *Carnegie-Rochester Conference Series on Public Policy* 39, 53-84.

Petursson, T. G., 2004, «The effects of inflation targeting on macroeconomic performance. », *Working Paper* 23, Central Bank of Iceland.

Reinhart, C. M. and K. S. Rogoff, 2004, «The Modern History of Exchange Rate Arrangements: A Reinterpretation », *The Quarterly Journal of Economics* 119(1), 1-48.

Roger, S., and M. Stone, 2005, «On Target? The International Experience with Achieving Inflation Targets. », *IMF Working paper* No. 05-163.

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

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

Sargent, T and N. Wallace, 1981, "Some unpleasant monetarist arithmetic", *Federal Reserve of MinneapolisQuaterly Review, 5, 1-17.*

Svensson, L.E.O., 2001 «Inflation Targeting: Should It Be Modeled as an Instrument Rule or a Targeting Rule? », *European Economic Review* 46 (2002) 771–780.

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

Tornell, A., and A. Velasco, 1995, «Fixed or Flexible Exchange Rates: Which Provides More Fiscal Discipline? », *NBER Working Paper* No. 5108.

Tornell, A., and A. Velasco, 2000, «Fixed or Flexible Exchange Rates: Which Provides More Fiscal Discipline? » *Journal of Monetary Economics*, Vol. 45, pp. 399–436.

Tornell, A., and P. R. Lane, 1999, «The Voracity Effect », *American Economic Review,* vol. 89, pp. 22-46

Truman, E. M., 2003, «Inflation Targeting in the World Economy », *Washington, DC: Institute for International Economics.*

Vega, M. and D. Winkelried, 2005, «Inflation Targeting and Inflation Behavior: A Successful Story? » *Macroeconomics working paper* 0502026.

Woodford, M., 1996, «Control of the Public Debt: A Requirement for Price Stability*?* » *NBER working paper* No. 5684.

Woodford, M., 2000, «Fiscal Requirements for Price Stability», *Journal of Money, Credit and Banking*

Wooldridge, J., 2002, «Econometric Analysis of Cross Section and Panel Data. », *MIT Press*, Cambridge, MA.

Appendices

Appendix 1: Methodological Note on the Propensity Score Matching[35]

The objective of this method is to evaluate the treatment effect of IT on FD in the country having adopted it. To estimate the Average Treatment Effect on Treated (ATT), we consider the following equation:

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

D, is the IT dummy; $Y_{i0}|D_i = 1$ is the is the value of the outcome –FD- that would have been observed if a targeting country had not adopted IT and $Y_{i1}|D_i = 1$, the outcome value actually observed in the same country. The fundamental difficulty in estimating the ATT is that the second term on the right-hand side of (1), ($E[Y_{i0}|D_i = 1]$) is not observable. We cannot observe the FD of an ITer if it had not adopted IT. If a country's targeting choice is random, one can easily obtain the ATT by comparing the sample mean of the treatment group (targeters) with that of the control group (non-targeters). However, this method would generate biased estimates if the targeting decision is not random. In particular, if the targeting choice is systematically correlated with a set of observable variables that also affect the outcomes, then we will have the ''selection on observables'' problem[36], which makes traditional linear regression an unreliable method.

To address the ''selection on observables'' problem, we make use of a variety of propensity score matching methods recently developed in the treatment effect literature. The central idea of matching is to use a control group to mimic a randomized experiment. The key assumption needed to apply the matching method is the conditional independence assumption ($Y_0, Y_1 \perp D|X$), which requires that, conditional on X, the outcomes (FD) be independent of the targeting dummy. Under this assumption, (1) can be rewritten as :

$$ATT = E[Y_{i1}|D_i = 1, X_i] - E[Y_{i0}|D_i = 0, X_i] \quad (2)$$

where we have replaced ($E[Y_{i0}|D_i = 1]$)with ($E[Y_{i0}|D_i = 0, X_i]$), which is observable.

To identify the good counterfactual to the treatment group, Rosenbaum-Rubin (1983) suggest matching the treated units and control units on their propensity scores, which are the probabilities of policy adoption conditional on X and can be estimated using simple probit or logit models. A further assumption needed to apply propensity score matching is the common support assumption ($p(X_i) < 1$),

which requires the existence of some comparable control units for each treated unit. Using propensity score matching, the ATT now can be estimated as:

$$ATT = E[Y_{i1}|D_i = 1, p(X_i)] - E[Y_{i0}|D_i = 0, p(X_i)] \quad (3)$$

We consider 3 commonly used propensity score matching methods. The first method is nearest-neighbor matching with replacement, which matches each treated unit to the n control units that have the closest propensity scores. We use n=1 and n=3. The second method is radius matching, which matches a treated unit to the control units with estimated propensity scores falling within radius r. We use a wide radius (r = 0.03) and medium radius (r = 0.01). The third method is kernel matching, which matches a treated unit to all control units weighted in proportion to the closeness between the treated unit and the control unit.

Appendix 2: List of the countries

Developing Countries : Argentina, Bolivia, Brazil, Bulgaria, Cameroon, Canada, Chile, Costa Rica, Cyprus, Czech Republic, Ecuador, El Salvador, Ghana, Guatemala, Honduras, Hungary, India, Israel, Malaysia, Morocco, Mauritius, Mexico, Nigeria, Pakistan, panama, Peru, Philippines, Poland, South Africa, South Korea, Sri Lanka, Thailand, Tunisia, Turkey, Uruguay, Venezuela.

Developed Countries: Australia, Belgium, Canada, Denmark, Deutschland, Finland, France, Greece, Iceland, Ireland, Italia, Japan, Luxembourg, New Zealand, Norway,, Netherlands, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United Sates of America

Control group: Argentina, Belgium, Bolivia, Bulgaria, Cameroun, Costa Rica, Cyprus, Denmark, Deutschland, Ecuador, El Salvador, France, Ghana, Guatemala, Greece, Honduras, India, Ireland, Italia, Japan, Luxembourg, Malaysia, Morocco, Mauritius, Netherlands, Nigeria, Pakistan, panama, Portugal, Singapore, Sri Lanka, Tunisia, Turkey, United Sates of America, Uruguay, Venezuela.

[35] This note has been entirely adapted from Lin & ye (2007)

[36] See Dehejia & Wahba (2002) et Heckman & al. (1998)

Treatment group: Australia, Brazil, Canada, Chile, Czech Republic, Finland, Iceland, Israel, Mexico, New Zealand, Norway, Peru, Philippines, Poland, South Africa, South Korea, Spain, Sweden, Switzerland, United Kingdom, United Sates of America, Thailand.

Appendix 3: Countries Classification according to the neighborhood criterion

Developed Anglo-Saxons	Nordic Countries	Euro Area	Other developed Countries	European Emerging Countries	Latin America	Other Emerging Countries	Sub-Saharan Africa and Islands
Australia,	Finland*	Belgium	USA	Bulgaria	Argentina	South Africa	Cameroon
Canada,	Iceland	Cyprus	Japan	Czech Republic	Bolivia,	South Korea	Ghana
N. Zealand	Norway	Finland*	Switzerland	Hungary	Brazil,	India	Madagascar
Ireland*, UK	Sweden	Deutchland	Singapor	Israel	Chile	Malaisia	Nigeria
	Denmark	France		Poland	Costa Rica	Morocco	Mauritius
		Greece			Ecuador	Pakistan	
		Ireland*			El Salvador	Philippines	
		Italia			Guatemala	Sri Lanka	
		Luxembourg			Honduras	Thailand	
		Netherlands			Mexico	Turkey	
		Portugal			Panama	Tunisia	
		Spain			Peru		
					Uruguay		
					Venezuela		

Source: Miao (2009) and author. *: Ireland and Finland are classified respectively among the Anglo-Saxons and Nordic before 1999, but as Euro Area Members after 1999, because in 1999 they have integrated the Euro Area.

Appendix 4: Effect of IT on FD: System GMM Estimator

	Total Sample		Developing Countries Sub-Sample	
Dependant Variable: Primary Balance in % of GDP	**(1)**	**(2)**	**(3)**	**(4)**
Budget Balance (1 Year lagged)	**0.533*** **	**0.532*** **	**0.540*** **	**0.542*** **
	(0.087)	(0.088)	(0.160)	(0.158)
Full-Fledged IT (FFIT)	**0.223*** **		**1.229** **	
	(0.051)		(0.480)	
Partial IT		**0.188*** **		**1.241*** **
		(0.120)		(0.443)
Log of Real GDP per capita	-0.219	-0.578	-0.268	-0.276
	(0.132)	(1.997)	(0.195)	(0.192)
Output Gap (HP_6.25)	3.879**	3.842**	16.94	16.88
	(1.643)	(1.640)	(19.15)	(18.87)
Openness	-0.021	-0.018	-0.012*	-0.011*
	(0.041)	(0.041)	(0.006)	(0.006)
Agricultural VA	-0.021	-0.008	-0.027	-0.027
	(0.161)	(0.163)	(0.036)	(0.036)
Urbanization Rate	-0.142	-0.149	0.015	0.012
	(0.135)	(0.136)	(0.021)	(0.021)
Political Stability	0.120	0.118	-0.022	-0.045
	(0.095)	(0.095)	(0.114)	(0.115)
Number of Obsevations	347	347	198	198
Hansen Test (P-value)	**0.312**	**0.302**	**0.123**	**0.247**
AR(2) (P-value)	**0.244**	**0.239**	**0.825**	**0.822**

Note: *, **, ***: significant respectively at 1, 5 and 10%. In brackets, standard deviations robust to heteroskedasticity and to error terms autocorrelation. AR(2) : Probability of 2nd order autocorrelation test of Arellano & Bond. The IT, the output gap and Openness are assumed to be endogenous; log of Real GDP per capita, agricultural VA, Urbanization rate and political Stability are assumed to be predetermined.

Dependant Variable: Full-Fledged IT (FFIT)	
1 Year Lagged IT value	**0.628*** **
	(0.0894)
1 Year Lagged Inflation rate value	**-0.165*** **
	(0.0580)
% of Neighboring ITers	**0.034*** **
	(0.011)
Constant	0.408*
	(0.235)
Time Fixed Effects	Yes
The Other Covariates	Yes
Number of Observations	369
Adjusted R^2	0.543
F-statistic of joint Significance of the 3 instruments	**F (3, 172) = 35.13 Prob > F = 0.0000**

Appendix 5: First Step Equation

Dependant Variable: Primary balance (as GDP %)	**(1)**	**(2)**
Full-Fledged IT (FFIT)	**0.209*** **	
	(0.076)	
Partial IT		**0.212*** **
		(0.074)
	(0.183)	(0.178)
Output Gap (HP_6.25)	36.07**	37.50**
	(17.59)	(16.23)
The Other Covariates	Yes	Yes
Time Fixed Effects	Yes	Yes
Number of Observations	345	345

Appendix 6: LAD Estimator on the total sample

Note: *, **, ***: significant respectively at 1, 5 and 10%. In brackets, standard Deviations boostraped with 500 replications

Appendix 7: Inflation Targeters list

Countries	**Partial IT: default starting date**	**Full-Fledged IT: conservative starting date**
Australia	**March 1993**	**September 1994**
Brazil	**June 1999**	**June 1999**
Canada	**February 1991**	**January 1992**
Chile	**January 1991**	**August 1999**
Colombia+	**September 1999**	**October 1999**
Czech Republic	**January 1998**	**January 1998**
Finland	**February 1993**	**January 1994**
Hungary	**June 2001**	**August 2001**
Iceland	**March 2001**	**March 2001**
Israel	**January 1992**	**June 1997**
Mexico	**January 1999**	**January 2001**
New Zealand	**March 1990**	**March 1990**
Norway	**March 2001**	**March 2001**
Peru	**January 2002**	**January 2002**
Philippines	**January 2002**	**January 2002**
Poland	**September 1998**	**September 1998**
South Africa	**February 2000**	**February 2000**
South Korea	**April 1998**	**April 1998**
Spain	**January 1995**	**January 1995**
United Kingdom	**October 1992**	**October 1992**
Sweden	**January 1993**	**January 1995**
Switzerland	**January 2000**	**January 2000**
Thailand	**May 2000**	**May 2000**
Beyond the end date of our sample		
Indonesia	**July 2005**	**July 2005**
Romania	**August 2005**	**August 2005**
Slovakia	**January 2005**	**January 2005**
Turkey	**January 2006**	**January 2006**
Ghana	**January 2007**	**January 2007**

Sources: Rose (2007) ; Freedman & Laxton (2009). Note. +: due to lack of sufficient data on fiscal balances, Colombia does not appear in the sample used for our econometric section.