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César Calderón Klaus Schmidt-Hebbel

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Agustinas 1180
Teléfono: (56-2) 6702475; Fax: (56-2) 6702231

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César Calderón
The World Bank

Klaus Schmidt-Hebbel
Gerencia de Investigación Económica
Banco Central de Chile

Resumen

El régimen de metas monetarias fue muy popular en las décadas de 1980 y 1990 entre los bancos centrales de países tanto industrializados como en desarrollo. Este artículo presenta una amplia exploración empírica de las posibles razones de por qué los países escogen (y abandonan) el régimen de metas monetarias. Se utiliza un amplio conjunto de datos de panel mundial para el trato y control de grupos de países, aplicando cinco técnicas de estimación de datos de panel para variables dependientes de elección discreta, y se realizan pruebas de robustez para distintos grupos de control y períodos de tiempo. La evidencia muestra que la probabilidad de tener un régimen de metas monetarias en vigor aumenta robusta y significativamente con la apertura comercial, el desarrollo financiero, una posición fiscal sólida y la inestabilidad monetaria.

Abstract

Money targeting (MT) was a highly popular monetary regime among central banks in both industrial and developing countries during the 1980s and 1990s. This paper presents a comprehensive empirical exploration of the possible explanations of why countries choose (and abandon) a MT regime. The paper uses a large world panel dataset for treatment and control country groups, applies five panel-data estimation techniques for discrete-choice dependent variables, and conducts robustness checks for different control groups and time periods. The paper's evidence shows that the likelihood of having MT in place declines significantly and robustly with trade openness, financial development, a strong fiscal position, and monetary instability.

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"We didn't abandon monetary targets, they abandoned us"
Gerald Bouey
Former Bank of Canada governor

1. Introduction

In past decades, monetary (growth) aggregates were widely used as nominal anchors by central banks in both industrial and developing countries. Under the influence of the quantity theory of money and Friedmans' constant money-growth advice, adoption of money-growth targeting (MT) grew popular in the 1970s. After the breakdown of Bretton Woods, the central banks of the largest industrial countries (including the U.S. Federal Reserve, the Bundesbank, the Bank of Japan, and the Bank of England, among others) adopted floating exchange rates and put in place monetary programs based on money-growth rules.[1] Money-growth targets became the policy objective of choice and money was used as the key operational instrument of central banks in industrial and developing countries.

Monetary policy control and effectiveness of money targets hinged on a stable demand for the monetary aggregate selected as the nominal anchor for the conduct of monetary policy. Yet technological progress, financial innovation, and international financial integration contributed to rising volatility and unpredictability of money demand in the 1970s and 1980.[2] Therefore meeting money growth targets and using money as an operational instrument became increasingly difficult for central banks in many countries, which started looking for alternative monetary policy instruments and objectives. The U.S. Federal Reserve under President Volcker was the first central bank to shift from monetary operational instruments to an interest-based monetary instrument in the early 1980s, followed subsequently by other industrial and developing-country central banks. Yet money-growth targets were not abandoned as quickly. Almost one decade later, New Zealand was the first country in the world to come-up with and adopt an alternative nominal anchor for the conduct of monetary policy: inflation targeting (in 1989-1990). Coming to the realization spelled out so eloquently in this paper's initial quote, a growing

[1] Indeed, the general acceptance of the monetarist framework starts with (West) Germany late in 1974, followed by United States, Switzerland and Canada in 1975, and United Kingdom, France and Australia in 1976 (Goodhart, 1989).
[2] Early, Goldfeld (1976) had reported the inability of money demand-based models for tracking the evolution of the quantity of money in the U.S. economy, a fact known as the *case of the missing money*.

number of countries found in inflation targeting a more effective monetary regime than MT.

However, a number of largely developing countries has continued relying on MT targeting (see Figure 1). Some developing countries have continued with MT for their domestic currency under conditions of high de-facto dollarization.

To the best of our knowledge, there is no systematic research that focuses on the determinants of choosing (and abandoning) MT – as opposed to growing empirical work on the choice of inflation targeting and of alternative exchange-rate regimes.[3] The objective of this paper is to fill this void by undertaking a comprehensive empirical exploration of the possible determinants that may explain why countries choose a MT regime.

We conduct our empirical research for a specification for the likelihood of having an MT regime in place, which depends on several structural variables that potentially affect the choice of MT against alternative monetary regimes. They include government budget balance, trade openness and GDP per-capita, besides the typical argument behind the abandonment of this kind of monetary frameworks (i.e. demand instability factors). We assemble a large dataset comprised by a treatment group of up to 29 MT countries and 34 countries that do not target inflation, with three decades (1975-2005) of annual data. This allows making use of an unbalanced panel sample of up to 1,174 country-year observations. For robustness checks, we apply different panel-data estimation techniques for discrete-choice dependent variables, comprising pooled-data estimators for logit and probit models, the conditional logit estimator for fixed effects, and logit and probit estimators for random effects – the three latter techniques allow for country heterogeneity. Finally, we check robustness of our model specification by testing its validity for different country and time sub-samples.

The paper is laid out as follows. The next section introduces the general specification for the probability of having a MT regime in place and describes the panel-data methods for discrete-choice dependent variables that are applied subsequently. Section 3 describes the data and stylized facts reflected by descriptive statistics and correlations. Estimation results are reported subsequently. Section 5 concludes.

[3] See Gerlach (1999), Mishkin and Schmidt-Hebbel (2002), Carare and Stone (2003) and Hu (2006), and Rizzo (1998), Poirson (2001), von Hagen and Zhou (2004) and Levy-Yeyati and Sturzenegger (2003), respectively, to cite a few in this latter case.

2. Specification and Estimation Technique

Our general specification for the choice of MT (that is, the likelihood of having MT in place) broadens the set of potential determinants of the latter choice proposed by us. We start with a wide set of pre-conditions, which have been partly identified in the related theoretical literature. Table 1 list the full set of regressors used in this paper, identifying expected and estimated coefficient signs.

Mainly, as Mishkin and Savastano (2000) argued, the evolution of more developed and diversified financial markets made harder the task of central banks focused on the control of money. We try to capture the role of these factors by using a financial development measure and constructing an indicator that summarize the inability of the central bank for effectively monitoring and controlling money[4] growth.

We also control for some variables considered as structural, like trade openness and the fiscal position. Moreover, for capturing the phenomenon by which, nowadays, the money-based targeting regime mainly operates in the developing world we include the GDP per capita in our general specification.

Regarding the results, we expect that the basic motives that jeopardize the successful implementation of MT exert a negative influence in the relative likelihood. Thus, we expect negative signs for the estimated values associated to financial development and our measure for the inability for controlling money. Taking into account the transition and the current distribution of monetary regimes around the world, we expect a negative influence of trade openness and fiscal position in the likelihood of adopting the MT, because, for instance, more open and equilibrated economies are more associated to the inflation targeting regime.

We exploit the cross-section and time dimensions of our world sample by using panel-data estimation techniques. The general specification of our regression model for the likelihood of having MT in place is as follows:

$$Y_{i,t} = \mu_i + \delta' X_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where Y is a vector of discrete-choice country-year variables for the MT regime (a dummy that takes a value of 1 for having MT in place, 0 otherwise), X is a matrix of country-year

[4] The details of the variables regarding sources and motivation for their inclusion are shown in table 1.

explanatory variables that were introduced above, μ is a vector of individual country effects that reflect unobservable country heterogeneity, δ is a vector of slope coefficients that are common to all countries, ε is a vector of error terms, and i and t are country and time indexes, respectively.

Equation (1) is estimated using discrete-choice panel-data models, assuming either a logistic distribution (a logit model) or a normal distribution (a probit model) of the error term.

Any source of unobservable heterogeneity that may explain the decision of whether to adopt the IT regime is captured by individual country effects. The first approach to deal with this setup would be estimating individual effects jointly with the model's slope parameters. However, this practice has the problem that the joint estimation of country effects and slope parameters causes inconsistency of the latter in an asymptotic plan with large N and finite T (which is our case), a result due to Neyman and Scott (1948) and known as the incidental parameters problem. The incidental parameters are in this case the fixed effects because they compromise the large sample properties of δ [5]. In discrete-choice panel-data models the removal of the fixed effects is not as easy as in the linear panel-data model (e.g. the within estimator) and the strategy for doing so hinges on the specification of the model.[6] The basic fixed-effects discrete- choice panel-data estimator is known as the Conditional Logit Estimator (CLE) due to Andersen (1970) and extended by Chamberlain (1980).[7]

CLE evaluates the likelihood function as conditional on sufficient statistics that restrict estimation to those individuals whose choice varies over time. This means that CLE only considers individual *movers* in the likelihood function.[8] Therefore the drawback of CLE is that sample size is reduced by all individuals that are *stayers* over the sample period time.

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[5] It could be argued that this asymptotic plan does not hold in a country panel data set since we know that N is fixed and T could be very large. However, it seems to be that the large sample properties do not depend on the physical properties and that it is enough to have N larger than T. We thank Manuel Arellano for this clarification.

[6] See Honoré and Kyriazidou (2000) for an analysis of the conditions for removing fixed effects in dynamic discrete choice models.

[7] It is worth emphasizing that the extension of this method to the case of normally distributed errors is unfeasible in practice because it involves evaluation of many integrals, which is very computer-intensive.

[8] In order to clarify the notion of a sufficient statistic consider the case of a binary choice panel-data set with two periods *(T=2)*. A sufficient statistic is given by a sum of observations equal to 1, since only in this case we know that the possible pairs are (0,1) and (1,0). Therefore the conditional fixed-effects estimator only considers individuals with choices that sum unity for all (two) periods.

The panel-data literature distinguishes between fixed and random-effects estimators. In the case of discrete-choice models, selection between the two latter estimators is determined by different aspects than those found for linear models. CLE, the only feasible fixed-effects estimator for discrete-choice panel data, eliminates individual effects. The random effects estimator does not remove individual country effects; it assumes a typically normal distribution between individual effects and the variables of the model, using for the latter purpose semi non-parametric simulation techniques. Discrete-choice random effects for panel data is feasible available for both logit and normal distributions of the error term.

Hence the trade-off between the fixed-effects CLE and the random-effects estimator for discrete-choice panel-data is the benefit of robustness of the former (as it is not restricted by any assumption on the joint distribution of individual effects and explanatory variables) and the benefit of larger sample size of the latter.

Finally our estimation model is subject to potential endogeneity bias. For example, adoption of IT may strengthen the fiscal position and reduce inflation – two key potential determinants of having IT in place. Recent theoretical contributions by Arellano and Carrasco (2003) deal with this issue in the context of discrete-choice panel-data models using instrumental variables techniques, respectively. Yet the stringent assumptions on which the latter solutions rely are not very attractive. Therefore we follow an alternative approach by using first lags of most independent variables.

3. Data and Stylized Facts

Before turning to the regression results in the next section, we describe briefly our sample data, focusing on their distribution and pair-wise simple correlations.[9] Table 4 lists 65 countries that comprise our full sample by income groups. Figure 1 depicts the time tend of our dependent variable, that is, the number of countries with an MT regime during the full sample period joint with the sample of inflation targeters. MTers remain steadily at approximately 10 countries during the most part of 70s and 80s. At the beginning of the next decade, this number starts to decline as the alternative monetary policy framework (inflation targeting) becomes popular and widely accepted (compare the blue and yellow bars in this period). Note that the upward trend on the number of countries after 2000 is artificial as it is totally attributable to the change of source, namely, IMF. In figure 2 we split the countries with a MT regime in both groups of industrial and developing countries.

[9] Data sources and definitions are discussed in the data appendix.

Here, it is clear that money-growth targeting was mainly a regime used by industrial countries during the 70s and 80s. Further, as we documented previously, that regime is currently restricted to the developing world.

Figure 3 (4) plots the country distributions of five independent variables for the full sample (separately for MT and non-MT sub-samples) by box plots. The boxes in each box plot account for all observations within the 25-50 and 50-75 percentile range of variable distribution. Medians are reported as thin white lines inside each box. Outliers – observations falling outside the 25-75 percentile ranges – are depicted as dots.

The following stylized facts emerge from Figure 3. The first two panels reports the annual world distribution of financial development and trade openness reflecting trend increases in medians and major increases in dispersion toward countries with exceptionally high levels of financial depth and trade integration. The government budget balance ratio to GDP shows a trend increase in its median and reduction in its dispersion, consistent with fiscal strengthening observed in industrial and developing countries alike since the 1980s. World median growth is reflected by the trend rise in the median per-capita GDP level, with little change in cross-country GDP dispersion over time. Monetary volatility exhibits declining world trends over the last two decades.

Now let's turn to a comparison of medians and dispersions observed by the five latter independent variables in the treatment and control groups of country-year observations (Figure 4). We can not say anything about the differences in medians between MT and non-MT since statistically the conclusions are not very clear. Yet the dispersion of all variables is much larger in non-MT countries.

Now we turn to the last piece of descriptive data statistics: cross-country and panel-data pair-wise correlations between our model variables reported in the upper and lower diagonal matrixes in Table 3, respectively. Three results emerge. First, there are some differences between cross-country and panel-data correlation coefficients. Indeed, cross-country correlations are more significant than those calculating for the panel data set as a whole. Second, correlations between the MT regime dummy and all independent variables are significant and exhibit expected signs only in the cross-country case. Finally any pair of correlations between regressors is highly significant and large.

4. Empirical results

We report estimation results for the choice of MT (the likelihood of having MT in place), based on equation (1). Our empirical strategy starts with reporting full-sample results for different specifications based on fixed and random-effects logit and probit models (Table 4). Then we test our model for different sub-samples comprised by country groups according to income levels (Table 5) and a shorter time period (Table 6). We discuss the results subsequently.

Table 4 reports estimation results for 3 specifications based on pooled, fixed-effects and random-effects regressions assuming a logit distribution for the error term. For the case of probit regressions we only report our preferred specification as in general the distribution assumed for the error term do not matter for results (i.e. we obtain the same significant results under both assumptions). In a first specification we test the robustness of our results by excluding the government budget balance as this variable present a restricted availability. We include the latter variable in a second specification which includes also the GDP per capita and trade openness as additional control variables. However, our preferred specification excludes only the GDP per capita because its weakness in the statistical sense.

The stiff trade-off between fixed-effect and random-effect results – robustness of the former versus larger sample size of the latter – is reflected by the large sample size difference in our results (some 500 country-year observations for fixed-effect and 1000 observations for random-effect estimations). The treatment group is the same under fixed and random effects – it is comprised by all country-year observations of MT countries since their MT starting dates. Under fixed effects, the full sample is comprised only by MT countries only – hence the control group is comprised only by MT country observations before they started MT. In contrast, under random effects, the control group is broadened to include all country-year observations of 34 non-MT countries. Hence one should exercise care in comparing results across estimations based on such large differences in control groups and overall sample size.

We find significant evidence for the influence of our two variables that jeopardize a successful MT implementation, namely, financial development and money growth volatility. Financial development and money growth volatility show the expected signs and are highly significant at conventional levels. This evidence is generally robust across fixed-effects and random-effects estimations, notwithstanding their large sample differences. Unsurprisingly, we obtain incongruent results in terms of signs and statistical significance when we neglect country heterogeneity by estimating pooled regressions. Therefore the

absence of country heterogeneity under pooled-data estimation is a severe limitation of this technique, which leads us to abandon it subsequently.

Now we turn to our additional potential determinants of the likelihood of the MT regime. Trade openness – as proxy for international best practice in macro regimes and structural reforms – is generally found to be a significant determinant behind the abandonment of a MT regime. This result could be associated to the usage of alternative monetary frameworks, generally implemented by highly institutionalized countries. Government balance also reports the expected sign with a high statistical significance. We find that countries with fiscal surplus are more prone to abandon the MT regime and to adopt alternative monetary policy schemes (e.g. inflation targeting). This finding is robust to all methods, including pooled regressions.

Keeping in mind the trade-off between fixed and random-effects estimators in sample size matters, we perform an additional regression by random-effects (see column 10 of table 4) but considering only the countries which experienced some time the adoption of the regime (i.e. the sample of *movers*, which is used in the fixed-effects setup). Our results remain robust to this exercise.

Extending our search for robustness using different control groups, we reduce our full-sample control-group comprised by all non-MT countries (results re-stated for comparison in column 1 of Table 5) by focusing sequentially on results based on non-MT countries by income levels (results reported in columns 2-4 in table 5).[10] Most results remain largely unchanged, supporting robustness to different control groups. The one exception is the trade openness, which turns out to be significant when the control group is restricted to high or middle-income countries but is not significant when control group is low-income economies.

Next we focus on a shorter time period, starting in 1990 and throughout our sample's end-year (2005). The estimation is based on the full country sample available under random effects.[11] The results, reported in columns 3-4 of Table 6, confirm significance of financial development, government balance and trade openness, but reject a significant contribution of money growth volatility. This latter finding is very intuitive because it reveals that this variable let to be a strong reason behind the abandonment of the MT regime as many countries (in particular, industrial countries) had been decided to adopt alternative strategies before 90s.

[10] We report only random-effects estimation results because fixed-effects estimation excludes all non-IT countries, as discussed above.
[11] We were not able of obtaining convergence for fixed-effects estimations.

5. Conclusions

In this paper, which is unique to the best of our knowledge, we find empirical evidence which is consistent with the theoretical arguments behind the abandonment of money-based targeting. Thus, variables associated to money demand instability play a role against the probability of adopting a money-based scheme.

Moreover, we control for variables like government balance and trade openness, getting expected signs and a significant contribution in the likelihood of abandoning the MT regime.

These results are quite robust to alternative specifications and econometric methods. Restricting the time sample (i.e. 1990-2005) we obtain the same results except for the case of money growth volatility. This may emerge as a sign that money demand instability were not longer a reason for abandon the MT regime in the aftermath of the spawn of alternative monetary policy strategies, at the beginning of 90s.

6. References

Arellano, M. and R. Carrasco (2003). "Binary choice panel data models with predetermined variables." Journal of Econometrics, No. 115, 125-157.

Arellano, Manuel (2003). "Discrete Choice with Panel Data." CEMFI. Mimeo.

Arellano, M. and B. Honoré (2001). "Panel Data Models: Some Recent Developments." Handbook of Econometrics, Vol. 5, Chapter 53.

Beck, T. R. Levine and N. Loayza (1999). "Finance and the Sources of Growth". *Policy Research Working Paper*. World Bank.

Andersen (1970). "Asymptotic properties of Conditional Maximum Likelihood Estimators." Journal of the Royal Statistical Society, Series B, 32, 283-301.

Calderón, César and Lin Liu (2002). "The direction of causality between financial development and economic growth". *Documento de trabajo* No. 184. Banco Central de Chile.

Chamberlain, Gary (1980). "Analysis of Covariance with Qualitative Data." *The Review of Economic Studies*. Vol. 47. No. 1. Econometrics Issue, 225-238.

De Gregorio José and Pablo Guidotti (1995). "Financial development and economic growth". *World Development*, vol. 23(3), pp. 433-448.

Fatás, A., I. Mihov and A. Rose (2004). "Quantitative goals for monetary policy." NBER Working Paper 10846.

Friedman, Milton (1968). "The Role of Monetary Policy." *The American Economic Review*, Vol. 58, No.1, 1-17.

Goldfeld, Stephen (1976). " The Case of Missing Money." Brookings Papers on Economic Activity, Vol. 1976, No. 3, 683-739.

Goodhart, Charles (1989). "The Conduct of Monetary Policy." *The Economic Journal*, Vol. 99, No. 196, 293-346.

Honoré, B. and E. Kyriazidou (2000). "Panel Data Discrete Choice Models with Lagged Dependent Variables." *Econometrica*, Vol. 68, No. 4, 839-874.

Kyriazidou, Ekaterini (1997). "Estimation of panel data sample selection model." *Econometrica*. Vol. 65. No. 6, 1335-1364.

Levine, Ross (1997). "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature*, Vol. 35, No. 2, 668-726.

Levine, R. N. Loayza and T. Beck (1999). "Financial Intermediation: Causility and Causes". *Policy Research Working Paper*. World Bank.

Levy-Yeyati, E., and F. Sturzenegger (2003). "To float or to fix: Evidence on the impact of exchange rate regimes and growth." *American Economic Review 93(4)*, 1173-1193.

Loayza, N. and R. Ranciere (2002). "Financial development, financial fragility, and growth". *Documento de Trabajo* No. 145. Banco Central de Chile.

Neyman, J. and E. Scott (1948). "Consistent estimates based on partially consistent observations." *Econometrica*. Vol. 16. No. 1, 1-32.

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

Mishkin, F and M. Savastano (2000). "Monetary Policy Strategies for Latin America." NBER *Working Paper*, No. 7617.

Mishkin, F. and K. Schmidt-Hebbel (2002). "A decade of inflation targeting in the world: what do we know and what do we need to know? In *Inflation Targeting: Design, Performance, Challenges*, edited by Norman Loayza and Raimundo Soto. Banco Central de Chile.

Mishkin and Schmidt-Hebbel (2001). "One decade of inflation targeting in the world: what do we know and what do we need to know." NBER *Working Paper* No. 8397.

Mishkin, F and K. Schmidt-Hebbel (2007). "Does Inflation Targeting Make a Difference? In Mishkin, F. and K. Schmidt-Hebbel (eds.) *Monetary Policy under Inflation Targeting*.

Poirson, H. (2001) "How do countries choose their exchange rate regime?" IMF Working Paper WP/01/46, April

Rizzo, J.-M. (1998). "The economic determinants of the choice of an exchange rate regime: A probit analysis." *Economics Letters 59*, 283-287

Schmidt-Hebbel, K. and M. Tapia (2002). "Monetary Policy implementation and results in twenty inflation targeting countries." Central Bank of Chile. *Working Paper* No. 166.

Schmidt-Hebbel, K and A. Werner (2002). "Inflation Targeting in Brazil, Chile, and Mexico: Performance, Credibility, and the Exchange Rate." Banco Central de Chile, *Documento de Trabajo*, No. 171.

World Development Indicators (2007). The World Bank.

von Hagen, J., and J. Zhou (2004). "The choice of exchange rate regime in developing countries: A multinomial panel analysis." CEPR Discussion Paper Series No. 4227, February

7. Data Appendix

We construct an annual panel data set comprised of 110 countries for the period 1975-2005. See the list of countries in table 3.

For the dependent variable we construct a dummy variable which is set equal to 1 if the country is a money-based targeter, and 0 otherwise. Our classification is based on Fatás *et al.* (2004) from 1975 to 2000, and IMF (AREAER), thereafter.

For the right-hand side variables we use primarily the Word Bank data set (World Development Indicators) because it seems to be a revised version of the IFS database constructed by the IMF. This is the case for the measures of trade openness, financial development, and the GDP per capita.

The choice of the measure which better approximates a very complex and aggregate variable such as the financial development becomes an issue. The literature has converged to the use of the measure based on the domestic credit canalized to the private sector (scaled by GDP)[12]. Two reasons at least emerge for explaining this general practice. First, domestic credit is the closest definition linked to the concept of financial intermediation. Second, the nature of the agents which at last receive the funds also matters. It is probable that the financial functions, which in turn foster the presence of financial intermediaries[13], would be accomplished in a scenario in which purely private agents interact, thus abstracting from distortions coming public managed funding services.

The overall budget balance is assembled based on the Government Financial Statistics (prepared by the IMF), the Economist Intelligence Unit and figures found in official government's web pages. Finally, for accounting for the role of the volatility of nominal shocks we perform rolling calculations of the coefficient of variation for the growth of M2.

The details on the construction and the sources of all these variables we used in the estimations are shown in table 1.

[12] For instance, Beck, Levine and Loayza (1999), Levine, Loayza and Beck (1999), Calderón and Liu (2002), and Loayza and Ranciere (2002) use a similar measure. De Gregorio and Guidotti (1995) were the first at remarking the appealing of using this variable.

[13] See Levine (1997) for revising issues surrounding the concept of financial development.

Table 1: Determinants of MT Regime Likelihood in this Paper: Expected Signs and Statistically Significant Estimated Signs

Variable	Description	Source	This paper's	
			Expected signs	Estimated signs
Financial development	Domestic credit to private sector /GDP	WDI (2007)	Negative	Negative
Money growth volatility	Rolling calculation for the coefficient of variation of M2	WDI (2007). Own construction	Negative	Negative
Government budget balance	Government overall budget balance (surplus)/GDP	GFS and EIU	Negative	Negative
GDP per capita	Log of the GDP per capita	WDI (2007)	Negative	Not significant
Trade openness	(X+M)/GDP	WDI (2007)	Ambiguous	Negative

Source: Own elaboration
Notes:
WDI: Word Development Indicators
GFS: Government Financial Statistics
EIU: The Economist Intelligence Unit

Table 2: Country sample

Sample Countries

Annual data, 1975-2005

High income OECD (23)

AUS	Australia	FRA	France	KOR	Korea	ESP	Spain
AUT	Austria	DEU	Germany	LUX	Luxembourg	SWE	Sweden
BEL	Belgium	GRC	Greece	NLD	Netherlands	CHE	Switzerland
CAN	Canada	IRL	Ireland	NZL	New Zealand	GBR	United Kingdom
DNK	Denmark	ITA	Italy	NOR	Norway	USA	United States
FIN	Finland	JPN	Japan	PRT	Portugal		

High income non OECD (4)

ISR	Israel
HKG	Hong Kong
SGP	Singapore
SVN	Slovenia

Upper middle income (12)

ARG	Argentina	MYS	Malaysia
BWA	Botswana	PAN	Panama
CRI	Costa Rica	TUR	Turkey
CHL	Chile	URY	Uruguay
MEX	Mexico	VEN	Venezuela
MUS	Mauritius	ZAF	South Africa

Lower middle income (13)

BRA	Brazil	LKA	Sri Lanka
COL	Colombia	PER	Peru
CHN	China	PRY	Paraguay
EGY	Egypt, Arab Rep.	PHL	Philippines
IDN	Indonesia	THA	Thailand
IRN	Iran, Islamic Rep.	TUN	Tunisia
JAM	Jamaica		

Lower income (13)

BGD	Bangladesh	MWI	Malawi
ETH	Ethiopia	SDN	Sudan
GHA	Ghana	SLE	Sierra Leone
GIN	Guinea	UGA	Uganda
GMB	Gambia, The	ZAR	Congo, Dem. Rep.
HTI	Haiti	ZMB	Zambia
MDG	Madagascar		

Table 3: Pair-wise Cross-Country and Panel Data Correlations

pair-wise correlations	dummy regime	trade openness	financial development	GDP per capita	government budget balance (surplus)	money growth volatility
dummy regime	1	**-0.224**	**-0.093**	**-0.230**	**-0.286**	**-0.178**
trade openness	**-0.220**	1	0.032	**0.301**	**0.228**	0.033
financial development	0.003	-0.002	1	**0.077**	**-0.107**	**-0.041**
GDP per capita	0.013	**0.304**	0.029	1	**0.251**	**-0.159**
government budget balance (surplus)	**-0.149**	**0.053**	-0.004	**0.191**	1	**0.107**
money growth volatility	-0.046	0.013	-0.014	-0.030	0.036	1

Source: Own elaboration based on the WDI data set.
Numbers in bold denote correlation coefficients statistically significant at 5 percent at maximum
Numbers in the inferior triangle are the cross correlations across the time and countries (pooled correlations) while the numbers in the superior triangle are cross correlations across countries (among time demeaned variables)

Table 4

Choice of Monetary Targeting Regime: full sample estimations

Dependent variable: dummy for Money Targeting Regime (Money targeting=1; non-money targeting=0)
Estimation mthods: Discrete-choice logit panel-data models
Sample: 1975-2005 (annual data)

	Logit panel data models									Probit panel data models		
	Pooled			Fixed effects			Random effects			Random effects	Pooled	Random effects
	1	2	3	4	5	6	7	8	9	10	11	12
Financial development	0.409 **	0.538 ***	0.471 ***	-2.645 ***	-2.666 ***	-2.832 ***	-1.534 **	-1.830 **	-2.256 ***	-0.936 **	0.285 ***	-1.542 ***
	(2.04)	(2.58)	(2.73)	(3.30)	(3.13)	(3.64)	(2.44)	(2.52)	(3.79)	(2.03)	(2.85)	(3.74)
Money instability (5 years)	-0.114	-0.091	-0.092	-0.781 **	-0.718 **	-0.723 **	-0.383 **	-0.431 **	-0.450 **	-0.64 **	-0.054	-0.282 **
	(1.58)	(1.34)	(1.35)	(2.56)	(2.27)	(2.27)	(2.26)	(2.19)	(2.25)	(2.24)	(1.39)	(2.27)
Government budget balance	-	-8.191 ***	-8.181 ***	-	-14.376 **	-14.616 ***	-	-13.873 ***	-14.220 ***	-13.932 ***	-4.987 ***	-8.699 ***
	-	(4.56)	(4.56)	-	(2.55)	(2.59)	-	(2.75)	(2.80)	(2.88)	(4.65)	(2.95)
GDP per capita	-0.001	-0.065	-	0.394	-0.374	-	0.089	-0.516	-	-	-	-
	(0.01)	(0.57)	-	(0.55)	(0.46)	-	(0.22)	(0.99)	-	-	-	-
Trade openness	-1.607 ***	-1.878 ***	-1.868 ***	-2.352	-3.143 *	-3.448 **	-2.782 ***	-3.628 ***	-3.868 ***	-2.234 **	-1.108 ***	-2.044 **
	(6.54)	(6.70)	(6.66)	(1.44)	(1.71)	(2.00)	(2.69)	(2.59)	(2.75)	(1.99)	(6.87)	(2.54)
Constant	-0.413	-0.067	-0.631 ***	-	-	-	0.030	4.900	0.556	1.675 ***	-0.400 ***	0.029
	(0.44)	(0.07)	(2.94)	-	-	-	(0.01)	(1.08)	(0.50)	(2.70)	(3.13)	(0.04)
Observations	1174	1096	1096	576	473	473	1174	1096	1096	473	1096	1096
Number of countries	63	55	55	29	22	22	63	55	55	22	55	55
Countries with the MT regime	22	22	22	29	22	22	29	22	22	22	22	22
Countries without the MT regime (control group)	41	33	33	0	0	0	34	33	33	0	33	33
LR statistic	68.76	92.34	92.01	36.60	53.11	52.89	30.44	54.01	50.81	39.53	95.59	38.32
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Absolute value of z statistics in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 5

Choice of Monetary Targeting Regime: sensitivity to alternative control groups

Dependent variable: dummy for Money Targeting Regime (Money targeting=1; non-money targeting=0)
Estimation mthods: Discrete-choice logit panel-data models
Sample: 1975-2005 (annual data)

	All countries	High-income OECD countries	Middle-income countries	Low-income countries
	Random effects	Random effects	Random effects	Random effects
	1	2	3	4
Financial development	-2.256 ***	-2.786 ***	-2.315 ***	-2.254 ***
	(3.79)	(4.32)	(3.49)	(3.19)
Money instability (5 years)	-0.450 **	-0.514 **	-0.589 **	-0.880 ***
	(2.25)	(2.35)	(2.49)	(2.71)
Government budget balance	-14.220 ***	-14.105 ***	-16.222 ***	-15.399 ***
	(2.80)	(2.69)	(3.06)	(2.92)
Trade openness	-3.868 ***	-3.280 **	-3.310 **	-1.493
	(2.75)	(2.23)	(2.36)	(1.01)
Constant	0.556	1.755	1.496	1.870 *
	(0.50)	(1.57)	(1.38)	(1.82)
Observations	1096	810	790	556
Total number of countries	55	41	40	32
Countries with the MT regime	22	22	22	22
Countries without the MT regime (control group)	33	19	18	10
LR statistic	50.81	48.97	42.97	30.98
p-value	0.00	0.00	0.00	0.00

Note: Absolute value of z statistics in parentheses
When we allow for different country control groups we consider both the countries that have the regime in place (movers) and those countries that have not experienced a regime change (stayers)
** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 6

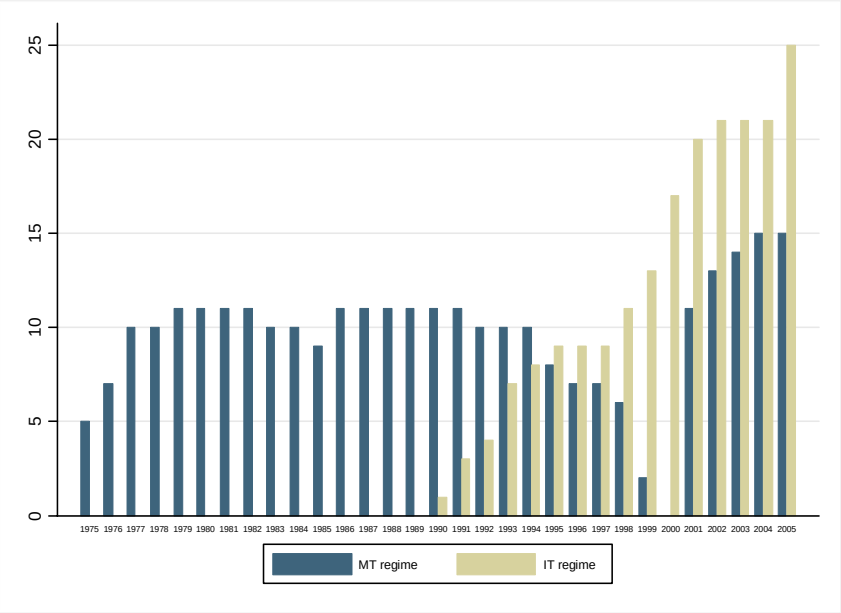
Choice of Monetary Targeting Regime: sensitivity to alternative time samples

Dependent variable: dummy for Money Targeting Regime (Money targeting=1; non-money targeting=0)
Estimation mthods: Discrete-choice logit panel-data models

	1975-2005 (full sample)		1990-2005	
	Fixed effects	**Random effects**	**Fixed effects**	**Random effects**
	1	*2*	*3*	*4*
Financial development	-2.832 ***	-2.256 ***	-5.287 **	-2.769 ***
	(3.64)	(3.79)	(2.50)	(3.13)
Money instability (5 years)	-0.723 **	-0.450 **	-0.473	-0.320
	(2.27)	(2.25)	(1.41)	(1.48)
Government budget balance	-14.616 ***	-14.220 ***	-16.644 **	-19.674 ***
	(2.59)	(2.80)	(2.22)	(2.94)
Trade openness	-3.448 **	-3.868 ***	-10.639 ***	-8.145 ***
	(2.00)	(2.75)	(3.29)	(3.69)
Constant	-	0.556	-	3.295 **
	-	(0.50)	-	(2.11)
Observations	473	1096	214	601
Total number of countries	22	55	19	55
Countries with the MT regime	22	22	19	19
Countries without the MT regime (control group)	0	33	0	36
LR statistic	52.89	50.81	46.94	49.47
p-value	0.00	0.00	0.00	0.00

Note: Absolute value of z statistics in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*

Figure 1: Adoption of Money-based Targeting (number of countries)



Source: Own elaboration based on Fatás *et al.* (2004) and IMF (several issues).
Blue bars denote the number of countries which operate under a MT regime, while yellow bars denote the same for the IT regime case.
The data on monetary targeting dates and counties corresponds to Fatás et al. (2004) from 1975 to 2000, and IMF thereafter.

Figure 2: Adoption of Money-based Targeting (number of countries)

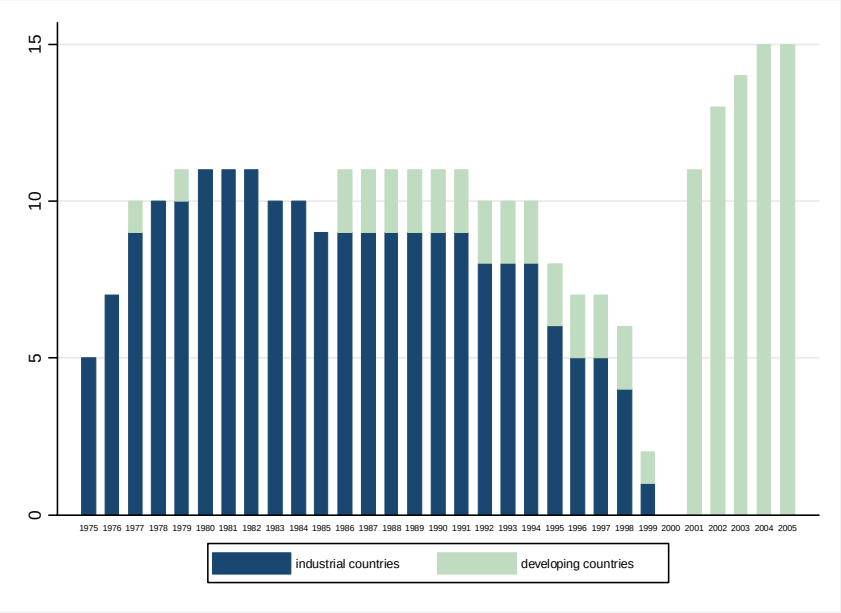
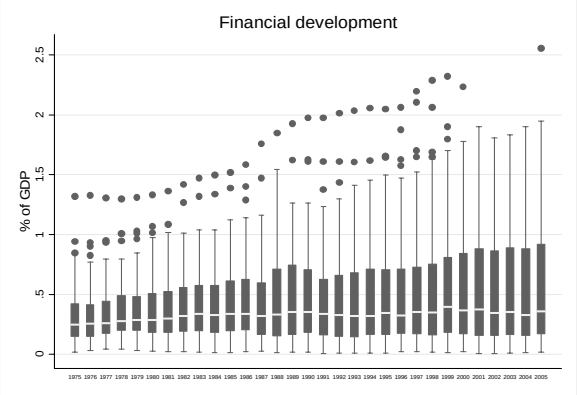
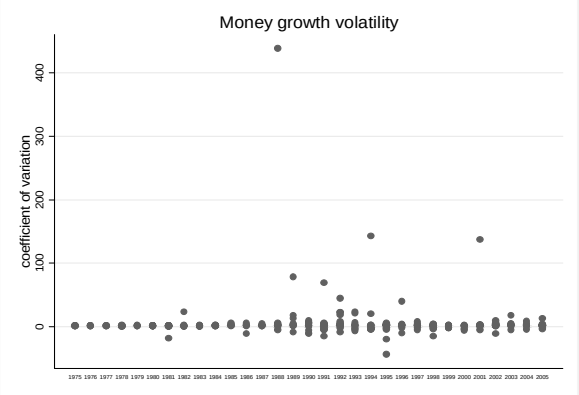
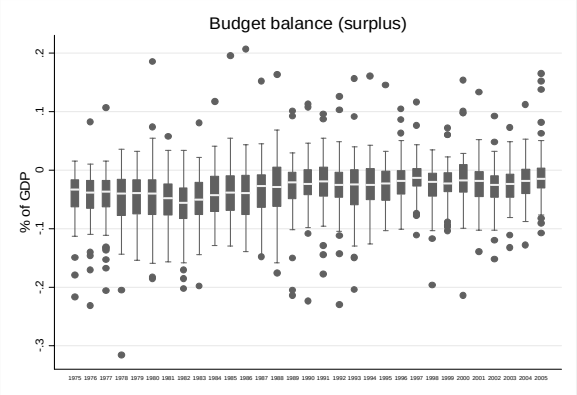
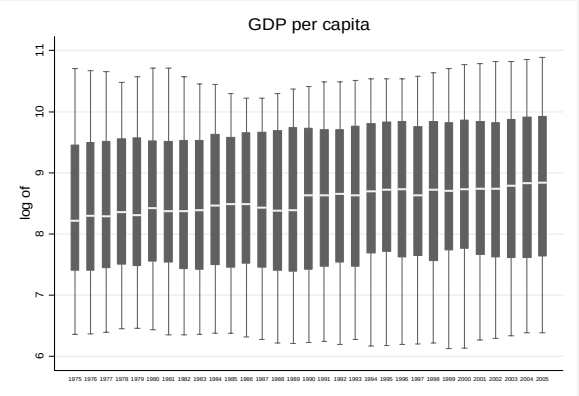


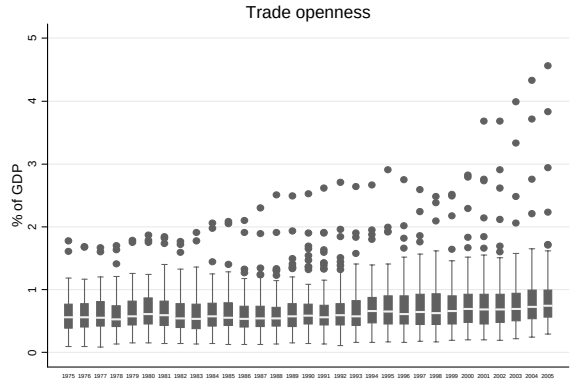
Figure 3: Full-Sample Country Distributions of 5 Explanatory Variables, 1975-2005





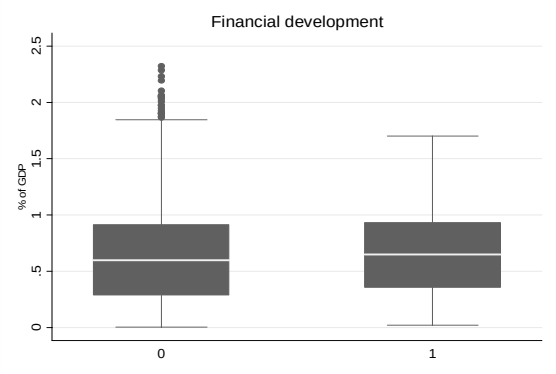


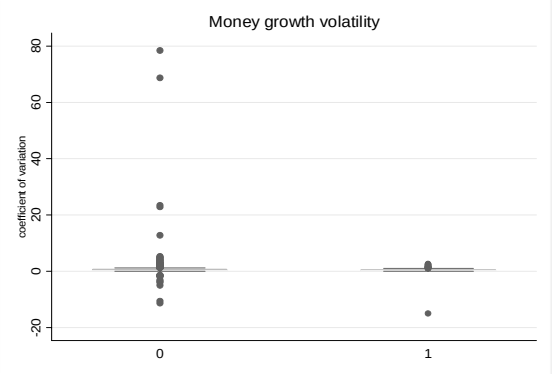


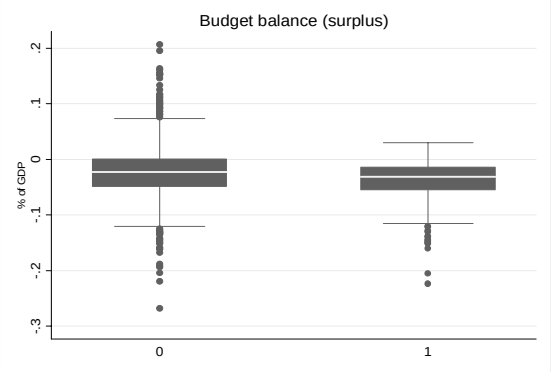


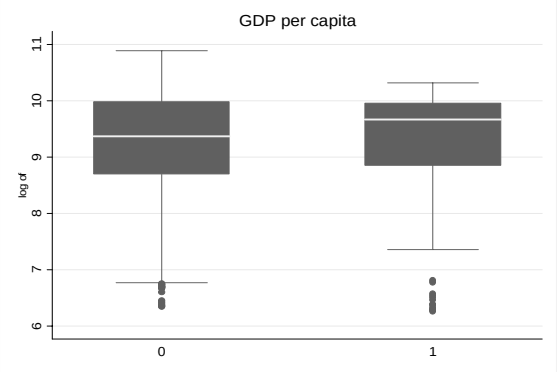
Source: Own elaboration based on the WDI data

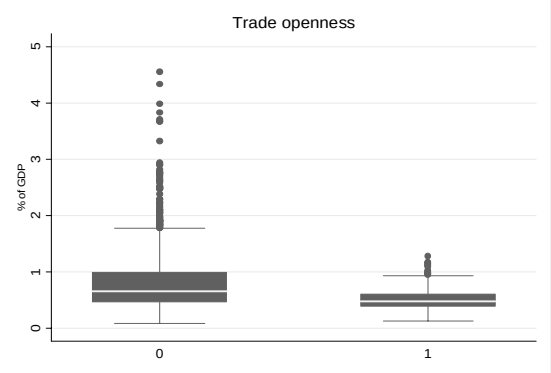
Figure 4: MT and non-MT Country-year Distributions 5 Explanatory Variables, 1975-2005











Source: Own elaboration based on the WDI data

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