

# Coping with the Recent Financial Crisis, did Inflation Targeting Make Any Difference?

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## Abstract:

The effects of the 2008/2009 financial crisis went largely among the financial markets and hit the real economy, generating one of the greatest global economic shocks. The aim of this study is to investigate whether inflation targeting has made a difference during this crisis. We first present some arguments suggesting that inflation targeters can be expected to do better when facing a global shock. Applying difference in difference in the spirit of Ball and Sheridan (2005), we assess the difference between targeters and non-targeters and find that there is no significant difference concerning inflation rate and GDP growth. However, the rise in interest rates and inflation volatility during the crisis has been significantly less pronounced for targeters.

*JEL Classification:* E00, E4, E6

*Key words:* inflation targeting, financial crisis, macroeconomic performances, difference in difference.

## Résumé:

La crise de 2008/2009 a largement dépassé la sphère financière pour affecter l'économie réelle, générant l'un des plus importants chocs économiques internationaux. Cet article vise à répondre à la question de savoir si le ciblage d'inflation a fait la différence face à cette crise. Nous présentons d'abord les arguments sous-tendant l'hypothèse selon laquelle les cibleurs d'inflation résisteraient mieux à un tel choc. Le principe de la double différence (suivant Ball et Sheridan, 2005) utilisé pour tester cette hypothèse permet de conclure qu'il n'y a pas eu de différence entre cibleurs et non-cibleurs en termes de croissance du PIB et de taux d'inflation. Cependant, il semble que les cibleurs aient été moins affectés par les hausses de taux d'intérêt et de volatilité de l'inflation.

*Classification JEL :* E00, E4, E6

*Mots-clés :* ciblage d'inflation, crise financière, performances macroéconomiques, double différence.

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## **I- Introduction**

The global economy has recently faced a large shock due to a financial crisis originating from the US financial market and especially the US subprime market. The causes of the 2008/2009 financial crisis are subject to debate among economists. According to Stiglitz for example, the conduct of monetary policy during the economic boom preceding the crisis is responsible of the financial bubble which crashed. The five years preceding the crisis were characterized by a large increase in liquidity<sup>1</sup> coupled to relative good control of inflation, encouraging credit demand since risk premium and interest rate went down at the same time. Consumer indebtedness led to debt burden when interest rates were raised by central banks - increasing liquidity being unsustainable for sound monetary policy. Conversely, Dooley (2010) argues that the crisis has nothing to do with monetary policy. He highlights the ineffectiveness of financial regulation and the lack in financial innovations control. Rose and Spiegle (2009) point out the role of financial system regulation during the global boom. For these authors, the regulatory framework could have encouraged the risk taking by financial institutions through the implicit designation of some of them as “too big to fail”. Financial institutions bypassed the regulatory system and engaged in more risky activities, essentially by securitising loans in order to divert risks - without reducing them.

The consequences of this crisis affect primarily the financial sector - increasing uncertainties, decreasing assets prices, bankruptcies - and spread to the real economy through credit channel. On the real economy, consequences were among others, decrease in investment - mainly due to restricted access to funding and rising interest rates -, rise in unemployment and a huge drop of GDP. Despite exceptional measures taken by governments and central banks, numerous economies suffered and continue to suffer from the 2008/2009 financial crisis.

The aim of this paper is to investigate the comparative performances of inflation targeting during the recent financial crisis. It is a contribution to the relatively poor literature on the performance of inflation targeting when facing economic shocks. Neumann and Von

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<sup>1</sup> The increase in exchange reserves accumulation in emerging countries can also explain this global liquidity increase.

Hagen (2001) compare targeters to non-targeters during the 1978 and 1998 oil prices shocks, on three criteria: inflation, long term interest rate and short term interest rate on interbank market. Using the difference in difference approach, the main conclusions are follows: the rise in inflation, long term and short term interest rate were lower for targeters - even if this difference is not statistically significant for inflation rate. Mishkin and Schmidt-Hebbel (2007) also compare targeters and non-targeters facing oil price shocks. Their main hypothesis is that, if inflation targeting increases central banks credibility in anchoring price expectations, one could expect targeters to perform better in terms of inflation and the consequences of shocks through exchange rate to be less pronounced. To test this hypothesis, impulse response functions and VAR approach are implemented. The results of Mishkin and Schmidt-Hebbel (2007) are in favour of targeters. In their paper, the authors also investigated how domestic interest rate reacts to international interest rate movements. This is to evaluate the independence and the credibility of national monetary policy vis-à-vis to the world interest rate evolutions. They find that inflation targeting helps targeters' domestic interest rate to be less sensible to international interest rate. In other words, inflation targeters central banks are more independent from world interest rate shocks. de Carvalho Filho (2010, 2011) analyses the difference between inflation targeters and non-targeters during the recent financial crisis. de Carvalho Filho (2011) is, at the best of our knowledge, the only study which empirically tests whether inflation targeters outperformed the others during the recent financial crisis. He considers 51 countries, including 23 inflation targeters and find that countries which adopted the inflation targeting monetary strategy did better than their peers.

This paper provides a rigorous approach to investigate the difference between targeters and non-targeters during the 2008/2009 financial crisis. First, we start by discussing the main reasons why inflation targeters can be expected to do better during the crisis. Indeed, based on the empirical literature, inflation targeting seems to be associated to better control of inflation, better fiscal discipline, less volatile exchange rate and more exchange reserves accumulation. Inflation targeting is also associated to higher central banks credibility and more room for loosening monetary policy when necessary. As we will argue, these advantages related to inflation targeting regime can make a difference during a

crisis. Second, we use a more rigorous econometric approach in the spirit of Ball and Sheridan (2005) to empirically test our hypothesis. Targeters and non-targeters are compared in two ways: (1) on central banks performances, based on inflation and interest rate; (2) in more general terms using GDP growth. To do so, the difference in difference approach is applied, avoiding selection bias and taking into account the bias which could arise from regression to mean. We use a large sample of developed and developing countries during the 2003/2009 period. The findings suggest that it seems to have been no significant difference between the two groups in terms of GDP growth. However, inflation targeters central banks performed better since the rise in inflation volatility and real interest rate have been significantly lower.

The rest of the paper is organized as follows: section II presents supportive arguments that inflation targeting can make a difference during the crisis. Section III presents the empirical tests and results. In section IV, the robustness checks are conducted and section V concludes.

## **II- Why targeters can be expected to do better during the crisis?**

The consequences of the 2008/2009 financial crisis have been striking: for the global economy, real interest rate went up - from 6% on average in 2003/2007 to 12% in 2009 -, investment declined, unemployment raised and GDP growth dropped - from around 6% in 2007 to around 4% in 2008 and -0.08% in 2009. Facing a crisis with such effects, why inflation targeters can be expected to do better than the others? Our argumentation is based on two fields of the literature: the literature on inflation targeting and the recent literature on the financial crisis. The first one brings out some differences between targeters and non-targeters. Highlighting these differences, we refer to the second one to see how these can affect the countries' resilience during the crisis<sup>2</sup>. Going through the empirical literature on the effects of inflation targeting, there are some structural

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<sup>2</sup> We follow the literature on the recent financial crisis which argues that the initial macroeconomic conditions determine how countries faced the crisis shock. See for example Lane and Melesi-Ferretti (2010).

macroeconomic differences which can favour targeters when facing a shock. This is about fiscal policy, monetary policy and some “international economic variables”.

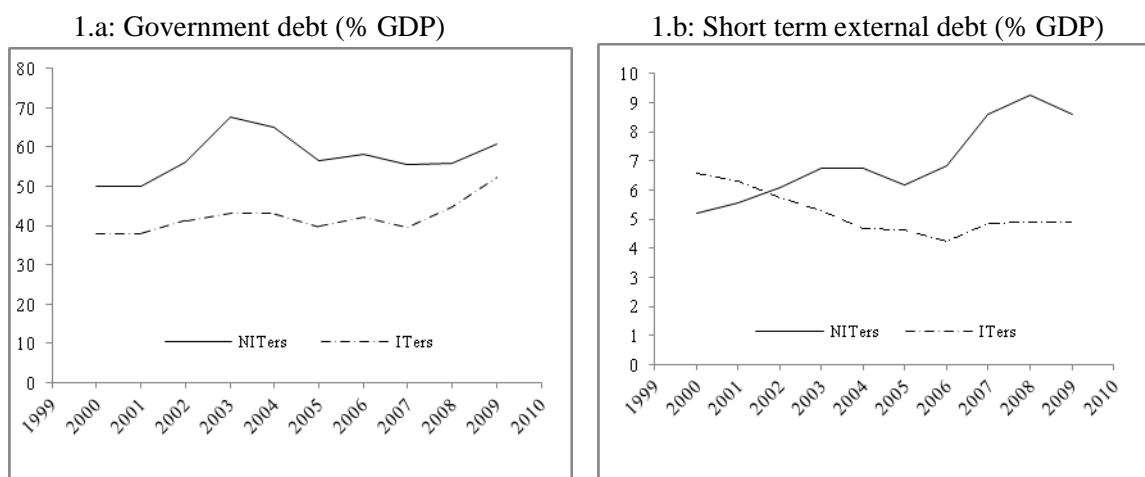
Regarding fiscal policy performances, Tapsoba (2010) highlights 3 channels through which inflation targeting can improve fiscal discipline. The first is related to the requirement of no fiscal dominance for the effectiveness of inflation targeting, the second to the Olivera-Tanzi effect<sup>3</sup> and the third to the flexible exchange rate associated to inflation targeting. In his empirical investigations on a large sample of developed and developing countries, Tapsoba (2010) finds that inflation targeting improves fiscal discipline especially when one takes into account the duration since the adoption of this monetary strategy. Lucotte (2012, forthcoming) investigates the consequences of inflation targeting adoption on fiscal discipline in developing countries, through tax collection. Using a sample of 59 countries including 19 targeters, estimations based on the propensity score matching approach reveal that on average, public revenues are higher for inflation targeters. According to Tapsoba (2010) and Lucotte (2012), inflation targeting positively affects fiscal policy management. If inflation targeting is associated to higher fiscal discipline, we can expect targeters to enter the crisis with better fiscal policy conditions and especially with lower indebtedness. This could make a difference during the crisis since the recent empirical literature shows that countries with higher government debt - especially external short term debt - in the pre-crisis period have been relatively more affected by the 2008/2009 shock - See Blanchard et al. (2010), Tsangarides (2010), de Carvalho Filho (2011). More generally, one can assume that government with higher initial debt will face more significant constraint during the crisis as it will be less able to undertake necessary fiscal stimulus, because debt service is already heavy, making it less easy to run up more debt. Buitert (2009) further notice that government credibility in its fiscal stimulus during a shock depends on the sustainability of its initial deficit. Since inflation targeting provides more fiscal discipline, targeters are expected to have sounder fiscal policy in the pre-crisis period, and then to have more scope to implement necessary adjustments during the crisis. Graph 1 shows the average

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<sup>3</sup> The Olivera-Tanzi effect refers to a context in which high inflation tends to reduce the volume of tax collection and the real value of tax revenue collected by a government.

government debt and the short term external debt in percentage of GDP. As expected, the two ratios are lower on average for targeters.

Graph 1:



Source : author

As regards “international economic variables”, Rose (2006) analyses the implications of inflation targeting adoption in terms of exchange rate volatility, external reserves accumulation, sudden stops of capital flows and current account balance. Using a sample of 68 countries - including 23 targeters - from 1990 to 2005 the results of its empirical tests suggest that inflation targeting tends to reduce exchange rate volatility and the exposition to sudden stops of capital inflows<sup>4</sup>. For external reserves and current account balance, it seems to be no significant difference between the two groups. Lin (2010) conducts the same investigation as that of Rose (2006). Using propensity score matching, his empirical analysis is based on 74 developed and developing countries - including 23 targeters - with data from 1985 to 2005. The results are follows: for developing countries, inflation targeting reduces the exchange rate volatility and increases external reserves accumulations. Conversely, for developed countries, inflation targeting is associated to an increase in exchange rate volatility and less external reserves accumulation.

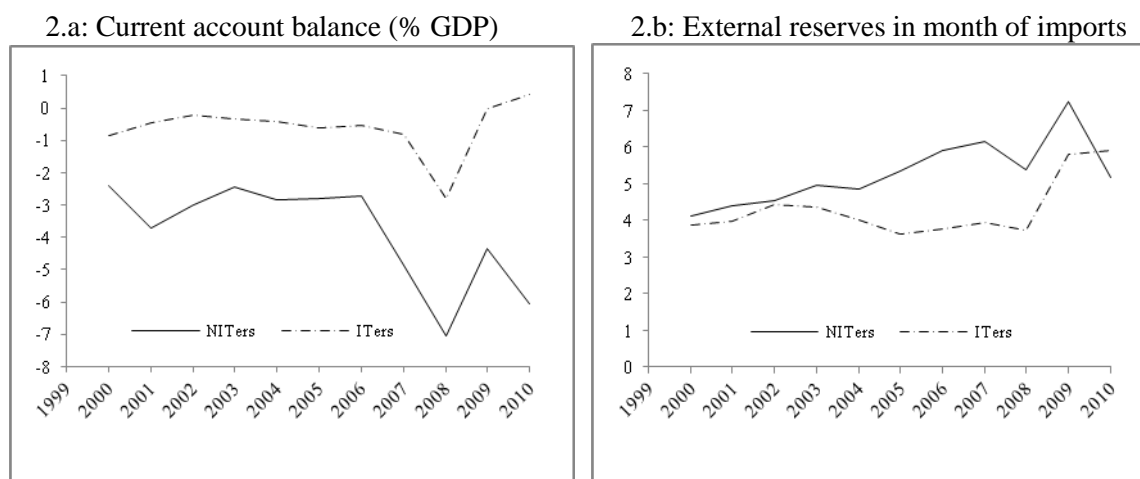
<sup>4</sup> Note that in many cases the coefficients are not statistically significant but appear with the right sign.

The conclusions of Rose (2006) and Lin (2010) that inflation targeting is associated to lower exchange rate volatility and higher external reserves accumulation - at least for developing country - can make a difference when analysing how countries face crisis shocks. As pointed by Calvo (2010), international reserves do play a role during a crisis since we do not have a global lender at last resort. In normal time - with international markets efficiency -, we do not worry about external reserves. But during a global economic downturn and a credit crisis as the one the world faced in 2008/2009, external reserves are vital since central banks have to deal with credit problems going beyond the countries boundaries. Indeed, it is less easy to get foreign currency in return for national currency in the context of crisis. Calvo (2010) further notices that, to ensure that it could have enough dollar, the European Central Bank got a currency swap arrangement with the Federal Reserve; highlighting the importance of external reserves during a global crisis. Reserves can also serve as guarantee and allow countries to access funding on international markets at a lower rate. In that case, reserves can be considered as a sign of countries' solvability. International exchange reserves can allow countries to continue to ensure its imports during a crisis - at least the most important ones - without compromising some production sectors which rely on specific imports. Exchange rate volatility could make a difference on the countries resilience during the crisis since it could be considered as an indicator of domestic currency stability on the international markets. With this in mind, if inflation targeting favours external reserves accumulation and exchange rate stability, or, but at a lesser extent, current account balance equilibrium and less exposition to sudden stop of capital flows, we can expect targeters to enter the crisis with better external position and then to be more resilient. Graph 2.a shows that on average, inflation targeters faced less current account deficit than non-targeters, while graph 2.b tends not to confirm the empirical results found in the previously cited papers.

On the monetary policy point of view, as pointed by de Carvalho Filho (2010), on average, interest rates should be higher for inflation targeters during the economic boom that preceded the crisis, since monetary policy should be more responsive to the increasing liquidity and inflation. Lee (2010) empirically shows that the target interest rates are significantly higher for inflation targeters central banks, using the Fed and ECB as counterfactual. Thanks to this higher interest rate, domestic investors are less prompted

to acquire high-yields but dubious foreign assets - since their funds are quiet well remunerated in the domestic economy; so that targeters preserve their financial system from external financial shocks<sup>5</sup>.

Graph 2:



Source : author

During the crisis there are some characteristics related to inflation targeting strategy which could be expected to help targeters to better cope with shocks. Higher interest rates for targeters before the crisis give to their central banks more scope to reduce their reference rates during the crisis, while avoiding the zero nominal interest rate boundary. Empirical studies tend to support that inflation targeting enhances central bank's credibility - Johnson (2002) shows that inflation targeting reduces inflation expectations, Levin et al. (2004) show that inflation targeting succeeds in disconnecting the current inflation expectations from the past inflation realisations. Indeed, inflation targeting monetary strategy relies mainly on central bank's independence, transparency and responsibility; three characteristics which provide more credible monetary policy. Since during the crisis one of the main concerns was increasingly uncertainties and market failures on the financial market - moral hazard and adverse selection -, it can be assumed that the more central banks are credible, the more their interventions will have the desired

<sup>5</sup> Graph 4 in our empirical investigations clearly shows that real and nominal interest rates were higher for targeters during the five year preceding the crisis.



impact on the financial markets. Also thanks to their higher credibility, as suggested by de Carvalho Filho (2010), emerging countries central banks which adopted inflation targeting have more room for monetary easing during the crisis without compromising their inflation objective. In addition, central bank's credibility can help to deal with deflation phenomenon that can arise from the global crisis<sup>6</sup>. Overall, if inflation targeters central banks are more credible, one can expect them to be more effective than their peers in dealing with different challenges they faced during the crisis.

All these arguments, mainly suggested by the literature, are in favour of inflation targeters to outperform their peers during a shock like the recent financial crisis. In the next section we empirically test this hypothesis.

### **III- Empirical analysis**

Two main ways are used to compare inflation targeters to non-targeters. First we will test the difference in monetary policy effectiveness during the crisis - in terms of inflation rate, inflation volatility, real and nominal interest rates. Second, the two groups will be compared on the basis of more general economic performances using GDP growth.

#### ***Methodological approach, period and sample***

##### *Methodology*

We are interested in the following question: did inflation targeting make a difference during the recent financial crisis? The difference in difference approach seems to be appropriated here since the crisis can be considered as an exogenous shock and treated as an event study. Particularly, we are going to estimate the effect of inflation targeting on change in our main variables. Formally, the equation can be written as:

$$\Delta Y = \alpha + \beta IT + \theta X + \varepsilon \quad (1)$$

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<sup>6</sup> This view is supported by the governor of the Canadian central bank, Mark Carney, cited in de Carvalho Filho (2010), p. 4.

Where  $\Delta Y = Y_{cr} - Y_{pre}$  is the change in the output variable, with *cr* indicating the crisis period and *pre* the pre-crisis period. *IT* is a dummy variable taking the value of 1 if the country is inflation targeter and 0 otherwise. *X* is the vector of control variables and  $\varepsilon$  the error term. As pointed by Ball and Sheridan (2005), the  $\beta$  coefficient can be biased, especially if  $Y_{pre}$  is correlated to *IT*. The idea is the following: let us consider the example of interest rate; as we already discussed above, interest rate is higher for targeters in the pre-crisis period because of this monetary policy strategy. So, the change in interest rate will tend to be lower for targeters and the coefficient  $\beta$  will produce a spurious effect - especially, it will tend to overvalued the performance of *IT* in containing the rising interest rates during the crisis - since we are not taking into account these initial differences due to inflation targeting. In order to deal with this possible bias, we follow the recommendation of Ball and Sheridan (2005)<sup>7</sup> and introduce  $Y_{pre}$  as a control variable in the equation. Therefore, the final “generic” model to estimate is follow:

$$\Delta Y = \alpha + \beta IT + \theta X + \varphi Y_{pre} + \varepsilon \quad (2)$$

In equation (2) the coefficient  $\beta$  measures the effect of inflation targeting on the change in *Y*, given some initial condition on *Y*. For example, let *Y* represents GDP growth. A significant and positive  $\beta$  means that inflation targeters did better during the crisis than non-targeters with the same average GDP growth in the pre-crisis period. Now we get the real effect of inflation targeting during the crisis.

#### *Period and sample*

We use data from 2003 to 2009. The pre-crisis period consists of the five years preceding the crisis – 2003 to 2007 –, while the crisis period is the year 2009. We start by focussing on 2009 since this is the year during which the effects of the crisis have been most notable - the global GDP growth was negative as compared to about 4% in 2008 and 2010. The real interest rate reached his higher level around 12% and inflation rate shows its lower level for the last decade, see Appendix graph1. For robustness check, we will

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<sup>7</sup> For more details and technical explanations, interested reader should refer to the appendix on the methodology in Ball and Sheridan (2005).

consider 2008/2009 as crisis period, since the literature generally considers the beginning of the financial crisis in September 2008 - the failure of Lehman Brothers.

Concerning the sample, we refer to Lin (2010) and Roger (2009) for inflation targeters - 30 countries. We drop those which abandoned the strategy - Spain and Finland, in 1999 -, and those which adopted inflation targeting during our analysis period in order to avoid the selection bias - Indonesia, Romania, Slovakia<sup>8</sup> and Guatemala which adopted inflation targeting in 2005; Turkey and Serbia in 2006; Ghana in 2007.

For the control group - non-targeters -, we applied a selection criterion in the spirit of Lin and Ye (2009) based on the GDP per capita. In order to get some homogeneity, we keep in the control group only countries with the average GDP per capita at least as large as the poorest inflation targeter during the 2003/2007 period. In addition, we drop from the control group countries with GDP per capita higher than the richest inflation targeter in the same period. Keeping countries for which data on our main dependant variables - inflation rate, real interest rate and GDP growth - are available, the whole basic sample consist of 79 countries<sup>9</sup>, including 20 inflation targeters. Nevertheless, depending on data availability for control variables, the number of observations will slightly vary from one regression to another. It should be worth noting that in order to control for heterogeneity in the sample, we introduce regional dummies from the World Bank classification<sup>10</sup>.

We now turn to the empirical tests.

### ***Testing comparative performances of central banks***

Central banks' performances during the crisis are analysed through change in inflation rate, inflation volatility, real and nominal interest rate. Inflation rate is usually considered

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<sup>8</sup> Slovakia joined the European Union in 2009.

<sup>9</sup> Philippines is the targeter with the lowest average GDP per capita in 2003/2007, 1110.3 USD and Norway is the targeter with the highest GDP per capita in the same period, 40417.12 USD. So we drop from our control group countries with average GDP less than 1110 USD and countries with average GDP per capita higher than 40417 USD. See the basic countries sample list in appendix.

<sup>10</sup> Although we are in cross section, it seems necessary to account for heterogeneity since countries have not been affected by the crisis in the same way. We keep North America regional dummy as reference and introduce all the others - EAP, ECA, LAC, MENA, SA, and SSA - in the estimates.

as the outcome of monetary policy. Note that during the crisis the concern was “deflation scare” since inflation falls down for the global economy. Therefore, rather than assessing the role of inflation targeting in lowering inflation - as it is usually the case in literature -, the purpose here is to know whether inflation targeters have been less affected by the decrease in general prices level during the crisis. Another consequence of the crisis was the rise in inflation volatility due to rising uncertainties. We expect the *IT* dummy to positively affect the change in inflation rate and negatively the change in inflation volatility. As control variables, we introduce - on average in 2003/2007 - : *GDP growth*, as it is recognized that countries which grow faster tend to face higher inflation pressure; *M2 aggregate*<sup>11</sup> in percentage of GDP, as a measure of liquidity; *Imports in percentage of GDP*, in order to control for imported inflation; *Credit provided by banking system* in percentage of GDP, used as proxy of financial development; *Reserves in month of import* and the ratio *foreign liabilities/foreign assets* to control for international capital flows. The last two variables are expected to be positively correlated to the change in inflation volatility and the others negatively.

Graph 3 exhibits the performances of targeters and non-targeters in terms of inflation rate and inflation volatility in the last decade. There is a little difference in inflation rate between the two groups in 2009. Conversely, non-targeters faced higher increase in inflation volatility in 2009.

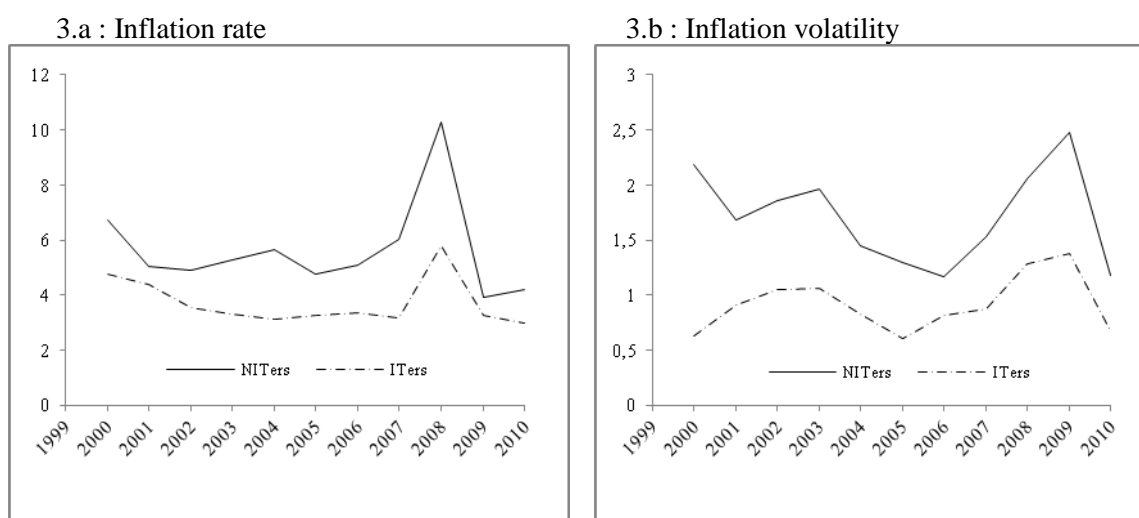
As table 1 shows, it seems be no significant difference between targeters and non-targeters in terms of inflation rate. Only one out of the six regressions exhibits a positive effect of the *IT* dummy. Conversely, the second part of the table shows that inflation volatility during the crisis has been lower for targeters - the coefficient associated to the *IT* dummy is significant and negative for all the five regressions<sup>12</sup>. Except for inflation volatility in the pre-crisis period, none of the control variables are significant.

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<sup>11</sup> M3 is certainly a more complete measure of liquidity, but this variable is much less available especially for developing countries.

<sup>12</sup> The smaller sample size of inflation volatility estimates is due the non-availability of monthly inflation data for some country.

### Graph 3



Source : author

**Table 1: Testing the impact of inflation targeting on change in inflation rate and inflation volatility during the crisis**

	Dependent variable									
	Change in inflation rate					Change in inflation volatility				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
IT	1.100 (1.396)	0.813 (0.933)	1.038 (1.372)	1.328* (1.695)	1.069 (1.522)	-0.805* (-1.907)	-0.863* (-1.911)	-0.770* (-1.769)	-0.798* (-1.818)	-0.823* (-1.762)
GDP growth		-0.165 (-1.104)			-0.156 (-0.872)					
Exchange reserves							-0.0480 (-0.957)			
Dom credit by BS			0.00281 (0.296)		0.00753 (0.433)			-0.00122 (-0.304)		
M2 (%GDP)					-0.0114 (-0.544)				-0.000739 (-0.0881)	
Imports (%GDP)				0.00788 (0.432)	0.0126 (0.575)					
Foreign liabilities/assets										0.000657 (0.0254)
Inflation	-0.255 (-0.953)	-0.230 (-0.841)	-0.244 (-0.877)	-0.247 (-0.887)	-0.237 (-0.723)					
Inflation <sub>pre</sub>						-0.900*** (-10.48)	-0.905*** (-10.27)	-0.906*** (-10.23)	-0.903*** (-8.759)	-0.901*** (-10.47)
Constant	-2.469*** (-2.797)	-1.947* (-1.892)	-3.056 (-1.286)	-2.800*** (-2.652)	-2.732 (-0.901)	3.574** (2.196)	3.776** (2.103)	3.706** (2.477)	3.634*** (3.034)	3.584** (2.159)
Regional dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	79	79	79	78	77	61	60	61	60	58
ITers	20	20	20	20	20	17	17	17	17	17
Adjusted R <sup>2</sup>	0.0964	0.0961	0.0842	0.0861	0.0639	0.504	0.500	0.495	0.494	0.492

Notes: Inflation volatility is generated each year by the standard deviation of monthly inflation rate

Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively.

What about real and nominal interest rate? By focussing on real interest rate, we are interested above all on how central banks interventions affect the cost of funding for borrowers on the real economy – i.e. the lending real interest rate. However, the estimations results for nominal and central banks reference rate are also presented - see table 2. Nominal interest rate is defined by the “money market rate” and central banks reference rate by the “central banks discount rate” - From IMF’s International Financial Statistics.

Graph 4 shows the evolution of real and nominal interest rates for the two groups. As already mentioned, targeters have had on average higher interest rate during the economic boom. In contrast, it is clear that during the crisis the real rate rose more sharply for non-targeters while the nominal rate fell by more for targeters<sup>13</sup>.

For change in real interest rate, we use as control variables - on average in 2003/2007: *Inflation rate*, *Credit provided by banking system* in percentage of GDP, a proxy of *Bank competition* - bank concentration - and a variable capturing the *Financing via international market* in 2007. The first variable is expected to be positively correlated to the dependant variable, since increase in inflation rate is associated to lower real interest rate in the pre-crisis period and higher change in real rate during the crisis. The three last variables are expected to be negatively correlated to the dependant variable, since financial development could have helped to cope with the crisis and bank competition to contain the rising interest rate in the banking sector. Financing via international market could have reduced the pressure on domestic interest rate. Finally, and maybe more importantly, we control for both *Inflation* and *Risk premium* on lending during the crisis in order to account for uncertainties on the financial market. For nominal interest rate, control variables are *Inflation rate* during the crisis, *Bank competition* and *Broad money* as a proxy of market liquidity. The first variable is expected to be positively correlated to the dependent variable and the other negatively, since bank competition and market liquidity tend to reduce the interest rate. Finally, for change in central bank reference rate, control variables are *Inflation* during the crisis, *Broad money* and *Exchange rate*. The two

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<sup>13</sup> On average, real interest rate rose from 4.6% in 2003/2008 to 11.26% in 2009 for non-targeters. During the same periods, the rate was 6.7% and 7% for targeters.

first variables are expected to be positively correlated to the central banks rate and the last one negatively.

The first part of table 2 gives the results for change in real interest rate. The negative and significant effect of the *IT* dummy suggests that increase in real interest rate during the crisis has been lower for targeters. This effect seems not significant when we control for the financial development proxy - column 2 -, suggesting that it is a transmission mechanism of monetary policy. Except for bank competition, all the control variables have the expected (significant) effect. The two other parts of the table show that change in nominal interest and central banks reference rate have been more favourable for inflation targeters during the crisis<sup>14</sup>. Especially, the negative and significant effect of the *IT* dummy on change in central banks reference rate suggest that inflation targeters central banks reduced their short term rate by more than non-targeters during the crisis. This finding is in the light of our argumentation that inflation targeters have more room for monetary policy easing when necessary. Note that the magnitude of the coefficients associated to *IT* is lower on average in the nominal rate estimates. This is not surprising since we faced deflation phenomenon during the crisis.

To sum up our findings on central banks performances, we show that even if there is no significant difference between targeters and non-targeters in terms of inflation rate, targeters have faced lower inflation volatility. More importantly, inflation targeters central banks perform better in containing the rise in interest rate during the recent fin

### ***Testing the difference in GDP growth***

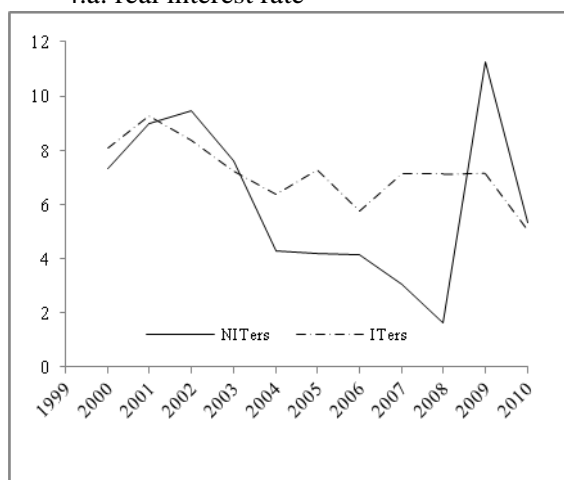
Now facing the crisis, we would like to compare inflation targeters to non-targeters in more general perspectives. Equation (2) is now considered with *Y* representing the GDP growth.  $\beta$  is expected to be positive, suggesting a lesser decline in GDP growth for inflation targeters. As control variables, we first consider the most mentioned in the recent literature on the 2008/2009 crisis - see for example Blanchard et al (2010), Lane and Milesi-Ferretti (2010), Tsangarides (2010), de Carvalho Filho (2011). ancial crisis.

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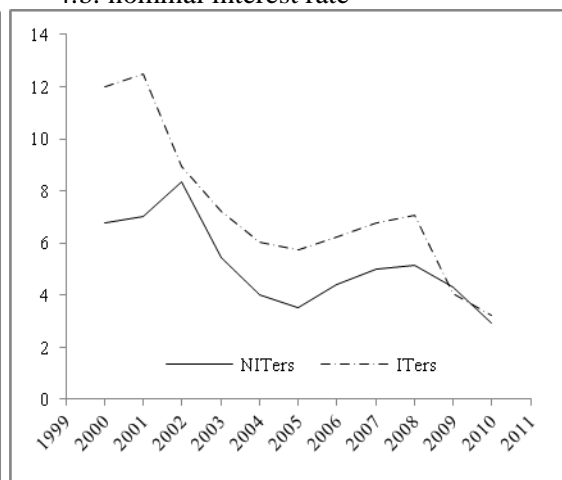
<sup>14</sup> Once again, the differences in the size of the samples between the three parts of the table are due to the availability of data on our dependent variables.

Graph 4:

4.a: real interest rate



4.b: nominal interest rate



Source : author

Table 2: Testing the impact of inflation targeting on change in interest rates during the Crisis

	Dependent variables										
	Change in real interest rate					Change in nominal interest rate			Change in central banks reference rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
it	-4.542** (-2.600)	-2.489 (-1.281)	-5.097** (-2.591)	-3.638** (-2.271)	-2.808** (-2.045)	-1.336* (-1.869)	-1.353* (-1.790)	-1.238** (-2.109)	-1.990*** (-3.150)	-2.010*** (-3.152)	-1.995*** (-3.143)
Dom credit by BS		-0.0725*** (-2.852)			-0.00358 (-0.210)						
Fcing via int markets			-0.300* (-1.706)								
Bank competition					4.532 (0.725)		0.200 (0.0773)				
Risk premium				1.873*** (4.754)	1.810*** (6.814)						
Inflation <sub>2009</sub>				-0.0820 (-0.257)				0.382*** (3.088)	-0.0496 (-0.533)		-0.0321 (-0.301)
Inflation					1.238*** (2.968)						
Broad money (%GDP)						-0.0132 (-1.684)		0.00371 (0.493)			0.00684 (0.924)
Exchange rate								0.000733*** (3.874)		-3.44e-05 (-0.0948)	-1.63e-05 (-0.0477)
Real interest rate <sub>pre</sub>	-0.699** (-2.396)	-0.676** (-2.501)	-1.085** (-2.550)	-1.742*** (-5.814)	-1.680*** (-8.231)						
Nominal interest rate <sub>pre</sub>						-0.433** (-2.485)	-0.446*** (-3.000)	-0.512*** (-4.538)			
CB reference rate <sub>pre</sub>									-0.00880 (-0.144)	-0.0331 (-0.348)	0.00303 (0.0335)
Constant	5.001* (1.678)	19.15*** (3.454)	4.386** (2.019)	2.267 (0.763)	-3.874 (-0.632)	2.803* (1.767)	1.782 (0.791)	0.324 (0.267)	-2.186** (-2.307)	-2.092** (-2.103)	-2.970** (-2.295)
Regional dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	79	79	54	46	38	41	38	41	51	51	51
ITers	20	20	15	15	15	16	16	16	19	19	19
Adjusted R <sup>2</sup>	0.289	0.393	0.372	0.682	0.699	0.355	0.326	0.551	0.162	0.156	0.133

Note: Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively



Generated in mean for the 2003/2007 period, the first set of control variables consist of: *Trade openness*, as the more an economy is opened to the rest of the world, the more it could be affected by international shocks like the 2008/2009 crisis. *Short-term external debt* in percentage of GDP, to captures the countries financial exposition as pointed by Blanchard et al (2010). The larger the short-term debt in the initial period, the larger the country could be affected by the adverse shift in capital flows during the crisis, since larger current account deficit requires more capital flows. *Exchange reserves* expressed in month of imports. As we already discussed, exchange reserve can have a crucial role when countries are facing an international shock. The *Current account balance*, as countries with large current account deficit will probably face more constraint to finance this deficit during a crisis. The two last variables are expected to be positively correlated to the dependent variable, while the others negatively.

We also control for two variables capturing the financial and economic openness: *FDI* in percentage of GDP and the *Economic globalization index*. These variables are expected to affect negatively the change in GDP growth since the 2008/2009 financial crisis has been more detrimental for the more financially open economies. To take into account the countries' financial developments, we control for the *Growth in credit* provided to the private sector by the banking system in the pre-crisis period. This variable captures the countries financial instability and is expected to be negatively correlated to the change in GDP growth. *GDP per capita* - on average in 2003/2007 - is used as an indicator of countries economic development. Developing countries are expected to have been less affected by the recent financial crisis. Finally and importantly, we control for *Exchange rate regime*, a dummy variable taking the value of 1 if the regime is flexible and 0 otherwise. This variable is crucial for our analysis. At least in theory, adoption of inflation targeting is associated to flexible exchange rate regime. However, there are countries with flexible exchange rate, but which are not inflation targeters. Moreover, exchange rate regime could have made a difference on how countries dealt with the crisis. Taking this into account, we need to control for the exchange rate regime in all our estimates to make sure that the coefficient  $\beta$  captures the real and only the effect of inflation targeting.

Appendix graph2 shows that on average GDP growth was lower for targeters during the pre-crisis period. The crisis period does not exhibit a significant difference between the two groups.

**Table 3:** Testing the impact of inflation targeting on change in GDP growth during the crisis

	Dependent variable : change in GDP growth										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IT	2.795** (2.569)	0.656 (0.427)	0.216 (0.135)	0.681 (0.441)	1.047 (0.714)	0.646 (0.405)	0.648 (0.417)	0.522 (0.349)	1.131 (0.799)	-1.304 (-0.641)	0.634 (0.388)
Current account balance			0.101* (1.961)								0.162** (2.319)
FDI (%GDP)				-0.169** (-2.199)							
Credit growth					-0.0960* (-1.689)						-0.102 (-1.354)
Trade openness						-0.0121* (-1.782)					-0.0193** (-2.190)
Exchange reserves							-0.00221 (-0.0230)				-0.273** (-2.475)
GDP per capita								-3.66e-05 (-0.687)			-5.30e-05 (-0.774)
Economic globalization									-0.113*** (-2.880)		
Short term debt										-0.115** (-2.378)	
Exchange regime		1.541 (0.853)	1.524 (0.804)	0.935 (0.497)	1.640 (0.967)	0.941 (0.498)	1.494 (0.818)	1.985 (1.036)	1.019 (0.626)	1.693 (0.687)	0.758 (0.411)
GDP growth <sub>pre</sub>		-0.595** (-2.216)	-0.696** (-2.371)	-0.603* (-1.788)	-0.422 (-1.509)	-0.580** (-2.142)	-0.635* (-1.913)	-0.603** (-2.256)	-0.729** (-2.038)	-0.423 (-1.519)	-0.512 (-1.527)
Constant	-6.626*** (-6.174)	-5.504*** (-3.602)	-4.778*** (-2.916)	-4.506** (-2.513)	-5.657*** (-3.696)	-4.349*** (-2.774)	-5.340*** (-3.206)	-4.707*** (-2.786)	3.677 (1.211)	-6.383*** (-2.918)	-0.972 (-0.393)
Regional dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	79	77	77	76	74	76	74	77	64	49	70
ITers	20	20	20	20	20	20	20	20	20	10	20
Adjusted R <sup>2</sup>	0.169	0.348	0.368	0.373	0.389	0.352	0.326	0.341	0.440	0.324	0.415

Note: Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

Table 3 gives our estimates results. In column (1) we run the basic regression and the *IT* dummy seems to have the expected effect. We argued that for a more rigorous investigation, is it necessary to control for the difference in GDP growth in the pre-crisis period and the exchange rate regime. Doing this, there is no effect *IT*, suggesting that inflation targeting did not make a difference in terms of GDP growth during the crisis

column (2) up to (11). Except for GDP per capita<sup>15</sup>, all the control variables have the significant and expected effect on the dependent variable. The GDP growth in the pre-crisis period seems to matter while the exchange rate regime does not. The finding about exchange rate regime is in the light of the conclusion of Tsangarides (2010) who shows that exchange rate regime did not make a difference during the 2008/2009 financial crisis.

*Is there a conditional or non-linear effect of inflation targeting?*

One can argue that inflation targeting could have the expected effect depending on some characteristics peculiar to economies implementing this monetary strategy. In other words, the impact of inflation targeting can be nonlinear or conditional. We test this hypothesis by analysing different types of conditionality:

- The inflation targeting effect could depend on the degree of countries' economic globalisation. The most economically globalized countries are the most affected by the crisis and can be the ones on which the impact of inflation targeting will be more perceptible.
- The inflation targeting effect could depend on the countries indebtedness. The less indebted countries could have been less affected by the crisis. Since the literature highlights better performance of inflation targeters in fiscal policy, conditioning the effect of the *IT* dummy to indebtedness could lead to better results.
- The inflation targeting effect could depend on the relative importance of exchange reserves. We argued that exchange reserves could have helped countries to deal with the crisis. By doing so, it can favour the positive effect expected from inflation targeting.
- The inflation targeting effect could depend on the countries financial development, as the literature supports that sufficient financial development is necessary for the effectiveness of this monetary strategy.

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<sup>15</sup> The non-significant effect of GDP per capita could be due to the fact that we control for regional specificities which capture the heterogeneous effect that this variable is supposed to take into account.

To test these nonlinearities, we use the interactive variables approach. Results are presented in Appendix table 1. None of the *IT* coefficients is significant. The interaction between *IT* and exchange reserves suggests that the positive effect of exchange rate reserves is more important for targeters. The more the reserves, the more inflation targeters did better during the crisis.

Overall, the estimates results for the whole sample reject the hypothesis that inflation targeters outperformed their peers during the recent financial crisis.

### *Analysis within subsamples*

Empirical analyses on the effect of inflation targeting sometimes reach different conclusions depending on the samples of developed or emerging countries. Moreover, emerging and developed countries could have been affected in different way by the 2008/2009 financial crisis. We conducted the same investigations on these subsamples.

The Institute of International Finance countries classification is used for the emerging subsample - 38 countries in this study - and the developed subsample consists of countries classified by the World Bank as “high income countries” - 37 countries in this study. Conducting the same investigations as above with these subsamples, we find no effect of inflation targeting on change in GDP growth and change in inflation rate. Conversely, emerging and developed inflation targeters seem to have faced lower inflation volatility during the crisis, confirming our previous findings - See appendix tables 2. For interest rates, we find no significant effect of the *IT* dummy in the two subsamples. This suggests that the effects of inflation targeting on changes in interest rates are more global and there is no specificities by countries group.

To sum up, we investigated the effect of inflation targeting on the economies’ resilience during the 2008/2009 financial crisis. The results suggest that for the whole sample as well as for subsamples of emerging and developed countries, inflation targeting did not make a significant difference in terms of inflation rate and GDP growth. Interestingly, we find that inflation targeters outperformed non-targeters in regard to inflation volatility, real and nominal interest rates. These findings highlight the better inflation targeters central banks performances during the recent financial crisis.

#### **IV- Robustness check**

Two types of test are conducted to check the robustness: first, an alternative measure of the dependant variable and second, alternative control groups.

##### ***Alternative measure of dependent variable***

Considering the period 2008/2009 as the crisis period, the dependent variable is now the change in GDP growth between 2008/2009 and 2003/2007. The coefficients associated to the *IT* dummy is still not significant while for control variables, conclusions are almost the same as in our previous estimates - See Appendix table 3.

##### ***Alternative control groups***

One of the main issues in the literature on the effect of inflation targeting is to define the control group. Depending on countries selected as comparison, the findings can be very different. Then, using alternative control groups is one of the best ways to check the estimates robustness. Three cases are considered<sup>16</sup>:

*Rose (2006) control group*: Using a sample of 23 targeters and 45 non-targeters, the aim of this study is to determine the impact of inflation targeting on exchange rate volatility, current account balance and sudden stops in capital flows. The paper concludes that inflation targeters have less volatile exchange rates and are less exposed to sudden stops of capital flows.

*Lin (2010) control group*: Lin (2010) investigated the effect of inflation targeting on exchange rate volatility, exchange reserves and current account balance, using a sample of 74 countries, including 22 targeters. He finds that inflation targeting stabilizes exchange rate volatility and favours exchange reserves accumulation for developing countries. Opposite conclusions are found for developed countries.

Running the previous regressions with the control group of these two studies, we almost reach the same findings. Inflation targeting did not make a difference in terms of GDP growth during the crisis. Targeters performed better in regard to real, nominal and central

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<sup>16</sup> Since we need sufficient observations, we only choose studies which use a sample of at least 50 countries.

banks reference rate<sup>17</sup>. As regards inflation, results are somehow mixed<sup>18</sup> - See Appendix table 4.

*de Carvalho Filho (2011) control group:* de Carvalho Filho (2011) compares targeters to non-targeters facing the recent crisis. Using a sample of 51 countries including 22 targeters, he concludes that targeters did better in terms of GDP growth. Considering the same control group, we run the regressions with our specification and find that inflation targeting dummy is not significant - See Appendix table 4. Note that there are some differences between our specification and that of de Carvalho Filho (2011). First, we use 2009 as the financial crisis period while de Carvalho Filho uses the period 2008/2010. Second, we follow Ball and Sheridan (2005) and control for initial conditions. Third, we control for exchange rate regime - to disentangle its effect from that of inflation targeting - in all our regressions while de Carvalho Filho (2011) does not. Note that we find de Carvalho Filho's (2011) results when our regressions are ran without controlling for exchange rate regime and initial GDP growth<sup>19</sup>. Forth, in order to control for heterogeneity within the sample, we introduce regional dummies.

## **V- Concluding remarks**

The aim of this study was to investigate the comparative performances of inflation targeters and non-targeters facing the 2008/2009 financial crisis. The findings suggest that inflation targeters central banks performed better than the others in managing the rise in real interest rate and inflation volatility during the crisis. However, it seems to be no significant difference between the two groups in terms of GDP growth. This somehow disappointing finding can raise interrogations since, as we discuss in section II, targeters seem to have entered the crisis with some better structural economic conditions - lower

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<sup>17</sup> Although results on nominal rate seem much less robust.

<sup>18</sup> The two alternative samples tend to show that inflation targeters faced lower decrease in inflation rate during the crisis. Another finding in favor of inflation targeters central banks.

<sup>19</sup> IT dummy exhibit a significant and positive coefficient in almost all the estimates.

government and short term external debt, better current account balance, lower inflation rate, higher and less volatile interest rate. So, why did targeters fail to perform better?

The first point that can be made is about the scale of the crisis. When facing a crisis with such effects, countries can be affected regardless of different strategies implemented in their economies. Tsangarides (2010) empirically studies the difference between countries with flexible and fixed exchange rate regime during the recent financial crisis. He concludes that flexible exchange rate, which was expected to do better - since the literature supports that flexibility can be a shock absorber - did not make any difference. The shock has been sizeable and indifferently affects the most developed and integrated countries.

Second, as previous works on the 2008/2009 financial crisis, our results show that the more open economies were the most affected by the crisis. Interestingly, inflation targeters economies seem to be more economically and financially opened than others. Indeed conducting a t-test on the difference in economic globalization - KOF index - and capital openness - Chinn and Ito index - between targeters and non-targeters, we find a statistically significant difference between the two groups<sup>20</sup>. These are factors that could have offset the favourable initial macroeconomic conditions of targeters.

A third issue can be highlighted: the conduct of monetary policy since the early 2000. As argued by Dai (2008) and Stiglitz among others, by focussing only - or at least mainly - on inflation, monetary policy and maybe especially inflation targeting strategy has left aside financial stability. In this context, the lack in financial regulation could have been more severe in targeters economies, making their financial system more fragile. Frappa and Mésonnier (2010) empirically support this view. They show that inflation targeting has a positive and significant effect on real house price and price-to-rent ratio. One can assume that this fragility somehow offsets the advantages related to the better structural macroeconomic conditions before the crisis. A more general empirical assessment of the link between inflation targeting and financial stability seems to be required. This is the next step of our future researches.

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<sup>20</sup> These variables have been used to test a conditional or nonlinear effect, but the interactive variables are not significant.

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## Basic sample

**Inflation targeters:** Australia, Brazil, Canada, Chile, Colombia, Czech Republic, Hungary, Iceland, Israel, Korea Rep., Mexico, New Zealand, Norway, Peru, Philippines, Poland, South Africa, Switzerland, Thailand, United Kingdom

**Non-targeters:** Albania, Algeria, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Bulgaria, Cape Verde, China, Costa Rica, Croatia, Dominica, Dominican Republic, Egypt, Arab Rep., Estonia, Fiji, Grenada, Honduras, Hong Kong SAR, China, Iran, Islamic Rep., Italy, Jamaica, Japan, Jordan, Kosovo, Latvia, Libya, Lithuania, Macao SAR, China, Macedonia FYR, Malaysia, Maldives, Malta, Mauritius, Namibia, Netherlands, Panama, Paraguay, Qatar, Russian Federation, Samoa, Seychelles, Singapore, Slovenia, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Swaziland, Syrian Arab Republic, Tonga, Trinidad and Tobago, United States, Uruguay, Vanuatu, Venezuela RB

Appendix table 1 : Non linear effect of inflation targeting

Dependent variable: Change in GDP growth (2009 – 2003/2007)					
	(1)	(2)	(3)	(4)	(5)
IT	0.382 (0.329)	-5.111 (-1.052)	1.157 (0.589)	1.372 (0.634)	-1.919 (-1.146)
IT*Economic globalization		0.105 (1.343)			
Economic globalization		-0.205*** (-3.348)			
Dom credit by BS		0.0109 (0.893)	-0.00767 (-0.517)		-0.00514 (-0.473)
IT*Dom credit by BS			-0.00836 (-0.499)		
Government gross debt (%GDP)			0.00763 (0.385)	0.00828 (0.425)	
IT*Government gross debt				-0.00610 (-0.199)	
Exchange reserves				0.197* (1.828)	0.150 (1.353)
IT*Exchange reserves					0.498** (2.342)
Exchange regime	0.737 (0.602)	-0.778 (-0.541)	1.696 (1.185)	0.633 (0.423)	1.486 (1.060)
GDP growth <sub>pre</sub>	-0.704** (-2.524)	-0.848** (-2.399)	-0.660** (-2.201)	-0.776** (-2.133)	-0.873** (-2.396)
Constant	-3.963*** (-2.761)	9.387** (2.325)	-4.402** (-2.063)	-5.471** (-2.190)	-3.705* (-1.695)
Observations	77	64	72	70	74
Adjusted R <sup>2</sup>	0.168	0.343	0.131	0.191	0.211

Note: Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

Appendix table 2: Subsamples analysis

Dependent variable: Change in GDP growth (2009 – 2003/2007)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Developed countries subsample											
IT	2.783*	0.393	0.604	0.481	1.535	0.144	1.666	0.0779	0.615	-0.0279	-1.158
	(1.861)	(0.252)	(0.408)	(0.306)	(0.662)	(0.0941)	(0.694)	(0.0411)	(0.367)	(-0.0176)	(-0.304)
Exchange regime		1.143	1.040	1.209	0.156	1.881	-0.217	1.575	1.220	1.404	5.436
		(0.782)	(0.740)	(0.812)	(0.0679)	(1.187)	(-0.0952)	(0.852)	(0.670)	(1.064)	(1.211)
m1gdpg		-1.199***	-1.210***	-1.261***	-1.114***	-1.273***	-1.563***	-1.219***	-1.330**	-1.241***	-2.057**
		(-5.067)	(-5.092)	(-4.800)	(-8.058)	(-4.586)	(-2.881)	(-5.705)	(-2.627)	(-5.432)	(-2.735)
Constant	-8.712***	-3.201***	-3.336***	-3.144***	-1.503	-4.059***	-2.878*	-2.582	-2.877	-2.511*	0.942
	(-7.445)	(-4.322)	(-3.940)	(-3.935)	(-1.011)	(-4.881)	(-2.002)	(-1.641)	(-0.463)	(-1.760)	(0.186)
Observations	35	35	35	34	23	35	33	35	32	35	21
Adjusted R <sup>2</sup>	0.0365	0.566	0.603	0.574	0.680	0.571	0.505	0.554	0.446	0.555	0.566
Emerging countries subsample											
IT	2.073	1.218	0.823	1.565	0.371	0.769	1.578	1.454	2.418	-0.0795	-1.612
	(1.353)	(0.733)	(0.508)	(0.867)	(0.240)	(0.428)	(0.851)	(0.808)	(1.328)	(-0.0371)	(-0.976)
Exchange regime		-0.337	-0.129	-0.0913	-0.209	-0.638	-0.331	0.335	-0.00620	-1.327	-0.504
		(-0.198)	(-0.0765)	(-0.0522)	(-0.135)	(-0.353)	(-0.187)	(0.179)	(-0.00331)	(-0.643)	(-0.300)
m1gdpg		-0.444	-0.126	-0.211	-0.124	-0.502**	-0.235	-0.225	-0.205	-0.227	-0.412
		(-1.603)	(-0.452)	(-0.393)	(-0.432)	(-2.188)	(-0.352)	(-0.719)	(-0.410)	(-0.417)	(-1.051)
Constant	-3.260**	-0.0605	-2.317	-1.829	1.132	1.785	-1.498	-1.542	1.596	-1.309	3.954
	(-2.440)	(-0.0270)	(-1.053)	(-0.485)	(0.531)	(0.873)	(-0.344)	(-0.640)	(0.458)	(-0.354)	(1.109)
Observations	37	37	37	35	36	37	33	37	32	27	32
Adjusted R <sup>2</sup>	0.387	0.389	0.457	0.398	0.536	0.445	0.378	0.413	0.385	0.587	0.663

Dependent variable											
	Change in inflation rate					Change in inflation volatility					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Developed countries subsample											
IT		1.271	1.469	1.399	1.331	1.226	-0.639*	-0.667*	-0.744**	-0.718*	-0.836**
		(1.279)	(1.518)	(1.478)	(1.280)	(1.522)	(-1.900)	(-2.018)	(-2.413)	(-1.841)	(-2.463)
Inflation <sub>pre</sub>		-0.182	-0.444*	-0.266	-0.173	-0.744**					
		(-0.611)	(-1.693)	(-0.722)	(-0.560)	(-2.319)					
Inflation volatility <sub>pre</sub>							0.280	0.322	0.483**	0.339	0.277
							(1.184)	(1.316)	(2.062)	(1.234)	(1.113)
Constant		-0.857	-1.614*	0.484	-1.054	1.096	0.155	0.195	-0.523	0.0403	0.159
		(-1.251)	(-2.001)	(0.253)	(-1.166)	(0.548)	(0.806)	(0.982)	(-1.407)	(0.0869)	(0.744)
Observations		37	37	37	37	35	31	31	31	29	28
Adjusted R <sup>2</sup>		0.0122	0.0642	0.0458	-0.0153	0.137	0.146	0.132	0.222	0.129	0.172
Emerging countries subsample											
IT		-1.037	-2.946*	-0.867	-1.250	-2.708*	-1.098***	-1.113***	-1.036**	-1.126***	-1.223***
		(-0.931)	(-2.000)	(-0.758)	(-1.024)	(-1.891)	(-3.129)	(-2.961)	(-2.739)	(-2.915)	(-3.051)
Inflation <sub>pre</sub>		-0.0684	0.0150	-0.0805	-0.0961	0.0342					
		(-0.262)	(0.0638)	(-0.300)	(-0.337)	(0.127)					
Inflation volatility <sub>pre</sub>							-1.162***	-1.173***	-1.170***	-1.146***	-1.159***
							(-8.543)	(-8.220)	(-8.589)	(-7.927)	(-7.796)
Constant		3.321	8.979**	4.035	3.940	10.81**	3.290***	3.280***	3.452***	3.058***	3.729***
		(1.246)	(2.256)	(1.295)	(1.282)	(2.621)	(4.151)	(3.979)	(3.760)	(3.069)	(4.107)
Observations		38	38	38	38	38	30	29	30	30	29
Adjusted R <sup>2</sup>		-0.0531	0.187	-0.0792	-0.0800	0.202	0.724	0.720	0.713	0.714	0.740

Note: Control variables (not reported here) are the same as in table 1 and table 3

Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

**Appendix table 3: Robustness with alternative measure of dependent variable**

	Dependent variable: Change in GDP growth (2008/2009 – 2003/2007)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IT	1.822** (2.224)	0.409 (0.313)	0.0644 (0.0477)	0.411 (0.315)	0.723 (0.593)	0.364 (0.269)	0.375 (0.277)	0.326 (0.249)	0.859 (0.708)	-0.726 (-0.451)	-0.521 (-0.433)
Current account balance			0.0793* (1.796)								0.130** (2.597)
FDI (% GDP)				-0.158*** (-2.728)							
Credit growth					-0.0800* (-1.730)						-0.0863 (-1.418)
Trade openness						-0.0120** (-2.554)					-0.0174*** (-2.871)
Exchange reserves							0.00370 (0.0476)				-0.222*** (-2.894)
GDP per capita								-2.25e-05 (-0.405)			-6.56e-05 (-1.287)
Economic globalization									-0.0985*** (-2.733)		
Short term debt										-0.0923*** (-2.843)	
Exchange regime		0.911 (0.611)	0.897 (0.577)	0.229 (0.150)	0.962 (0.696)	0.310 (0.200)	0.717 (0.472)	1.183 (0.729)	0.436 (0.337)	0.861 (0.482)	0.699 (0.469)
GDP growth <sub>pre</sub>		-0.448** (-2.618)	-0.528*** (-3.049)	-0.544*** (-2.737)	-0.316* (-1.736)	-0.442** (-2.574)	-0.577*** (-3.009)	-0.454** (-2.497)	-0.635*** (-3.200)	-0.464*** (-3.168)	-0.587*** (-2.785)
Constant	-4.737*** (-7.352)	-3.739*** (-3.309)	-3.171*** (-2.770)	-2.446** (-2.033)	-3.799*** (-3.221)	-2.550** (-2.149)	-3.186*** (-2.816)	-3.249* (-1.843)	4.442 (1.641)	-1.644 (-1.387)	1.265 (0.702)
Regional dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	79	77	77	76	74	76	74	77	64	49	70
Adjusted R <sup>2</sup>	0.119	0.272	0.294	0.354	0.323	0.290	0.298	0.264	0.429	0.326	0.439

Note: Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

**Appendix table 4: Robustness with alternative control groups**

	Rose (2006) control groups										
	Dependent variable: Change in GDP growth (2009 – 2003/2007)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IT	3.008** (2.467)	1.719 (1.345)	1.724 (1.333)	1.825 (1.391)	1.659 (1.347)	1.756 (1.164)	1.990 (1.394)	1.381 (0.973)	2.125 (1.392)	2.259 (1.532)	1.957 (1.051)
Exchange rate regime		-1.518 (-1.032)	-1.529 (-1.027)	-1.674 (-1.134)	-0.920 (-0.646)	-2.161 (-1.294)	-1.749 (-1.121)	-1.033 (-0.605)	-1.236 (-0.729)	-1.716 (-1.065)	-2.216 (-1.159)
GDP growth <sub>pre</sub>		-1.074*** (-2.842)	-1.073*** (-2.829)	-1.060** (-2.651)	-0.694* (-1.867)	-1.075** (-2.657)	-1.110*** (-2.901)	-1.145*** (-3.051)	-1.143*** (-3.179)	-0.949** (-2.607)	-0.576 (-1.207)
Constant	-5.870*** (-4.353)	0.152 (0.0677)	0.190 (0.0810)	0.293 (0.138)	-0.805 (-0.360)	1.408 (0.617)	-0.143 (-0.0636)	0.780 (0.341)	6.191 (1.631)	-1.691 (-0.690)	0.559 (0.141)
Observations	58	57	57	57	53	56	55	57	55	57	50
Adjusted R <sup>2</sup>	0.327	0.468	0.457	0.458	0.496	0.471	0.454	0.460	0.470	0.466	0.455

	Dependent variable									
	Change in inflation rate					Change in inflation volatility				
IT	1.476*	1.808**	1.482**	1.402*	1.909**	-0.517	-0.537	-0.466	-0.491	-0.473
	(1.820)	(2.229)	(2.070)	(1.705)	(2.404)	(-1.593)	(-1.604)	(-1.502)	(-1.495)	(-1.361)
Inflation <sub>pre</sub>	-0.0781	-0.106	-0.0793	-0.0864	-0.131					
	(-0.280)	(-0.366)	(-0.264)	(-0.301)	(-0.380)					
Inflation volatility <sub>pre</sub>						-0.978***	-0.979***	-0.987***	-0.997***	-0.952***
						(-26.44)	(-23.54)	(-25.56)	(-27.42)	(-22.33)
Constant	-3.107***	-3.692***	-3.033	-2.901***	-3.418	1.792***	1.812***	2.195***	2.422***	1.656***
	(-3.340)	(-4.228)	(-1.039)	(-2.777)	(-0.964)	(5.454)	(4.683)	(3.285)	(4.901)	(4.599)
Observations	57	57	57	56	55	51	50	51	50	49
Adjusted R <sup>2</sup>	0.0362	0.0399	0.0578	0.0568	0.0590	0.870	0.869	0.870	0.873	0.876

	Dependent variable										
	Change in real interest rate			Change in nominal interest rate			Change in central bank reference rate				
IT	-5.244***	-4.218**	-5.719**	-4.387**	-3.483**	-1.534	-1.561*	-0.961	-1.930***	-2.011***	-1.937**
	(-3.106)	(-2.478)	(-2.641)	(-2.568)	(-2.411)	(-1.571)	(-1.895)	(-1.590)	(-2.743)	(-2.819)	(-2.715)
Real interest rate <sub>pre</sub>	-0.471***	-0.445***	-0.677*	-1.615***	-1.590***						
	(-2.947)	(-2.892)	(-1.985)	(-7.043)	(-7.022)						
Nominal interest rate <sub>pre</sub>						-0.456**	-0.458***	-0.557***			
						(-2.479)	(-2.876)	(-7.829)			
CB reference rate <sub>pre</sub>									-0.0913	-0.0207	-0.0859
									(-1.055)	(-0.195)	(-0.881)
Constant	4.797	11.56***	2.951	3.071	-9.810	3.768	3.662	0.286	-1.931**	-2.134**	-1.947
	(1.461)	(3.206)	(1.359)	(0.955)	(-1.497)	(1.591)	(1.481)	(0.198)	(-2.073)	(-2.040)	(-1.211)
Observations	50	50	37	28	26	35	37	35	41	41	41
Adjusted R <sup>2</sup>	0.294	0.340	0.211	0.797	0.793	0.336	0.319	0.737	0.124	0.0876	0.0664

Note: Control variables (not reported here) are the same as in table 1, 2 and 3

Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

### Lin (2010) control group

	Dependent variable: Change in GDP growth (2009 – 2003/2007)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IT	2.323**	1.546	1.546	1.657	1.709	1.572	1.717	1.131	1.802	2.133	1.966
	(2.144)	(1.116)	(1.099)	(1.192)	(1.295)	(1.017)	(1.157)	(0.752)	(1.111)	(1.341)	(1.060)
Exchange rate regime		-1.867	-1.867	-2.001	-0.907	-2.492	-2.067	-1.273	-1.765	-2.002	-2.275
		(-1.217)	(-1.203)	(-1.298)	(-0.605)	(-1.457)	(-1.278)	(-0.726)	(-0.992)	(-1.164)	(-1.190)
GDP growth <sub>pre</sub>		-1.211***	-1.211***	-1.191***	-0.731*	-1.187***	-1.252***	-1.293***	-1.306***	-1.077***	-0.579
		(-3.656)	(-3.647)	(-3.318)	(-1.997)	(-3.347)	(-3.662)	(-4.073)	(-4.091)	(-3.379)	(-1.229)
Constant	-5.596***	1.015	1.014	1.111	-0.734	2.184	0.904	1.757	6.504*	-0.926	0.701
	(-4.667)	(0.513)	(0.494)	(0.581)	(-0.327)	(1.112)	(0.458)	(0.918)	(1.898)	(-0.409)	(0.181)
Observations	67	66	66	66	55	65	64	66	64	66	52
Adjusted R <sup>2</sup>	0.253	0.495	0.486	0.487	0.514	0.504	0.483	0.490	0.494	0.496	0.484

	Dependent variable									
	Change in inflation rate					Change in inflation volatility				
IT	1.724**	1.940**	1.736**	1.634**	1.763**	-0.376	-0.379	-0.344	-0.424	-0.335
	(2.270)	(2.519)	(2.335)	(2.130)	(2.446)	(-1.234)	(-1.216)	(-1.136)	(-1.321)	(-1.024)
Inflation rate <sub>pre</sub>	-0.0430	-0.0789	-0.0517	-0.0514	-0.130					
	(-0.164)	(-0.283)	(-0.180)	(-0.191)	(-0.394)					
Inflation volatility <sub>pre</sub>						-0.955***	-0.952***	-0.971***	-0.983***	-0.929***
						(-23.39)	(-22.80)	(-23.37)	(-27.21)	(-20.95)
Constant	-3.320***	-3.779***	-2.883	-3.082***	-2.735	1.692***	1.627***	2.216***	2.327***	1.549***
	(-3.920)	(-4.795)	(-1.014)	(-3.327)	(-0.840)	(5.159)	(4.609)	(3.465)	(4.936)	(4.378)
Observations	66	66	66	65	64	58	57	58	57	56
Adjusted R <sup>2</sup>	0.0120	0.0138	0.0289	0.0271	0.0178	0.864	0.863	0.866	0.869	0.871

	Dependant variable										
	Change in real interest rate					Change in nominal interest rate			Change in central bank reference rate		
IT	-4.737***	-3.821**	-5.570**	-3.604**	-3.106**	-1.522	-1.247	-0.940	-1.902***	-1.982***	-1.905**
	(-3.017)	(-2.452)	(-2.632)	(-2.128)	(-2.261)	(-1.582)	(-1.666)	(-1.583)	(-2.773)	(-2.860)	(-2.721)
Real interest rate <sub>pre</sub>	-0.478***	-0.448***	-0.699**	-1.650***	-1.591***						
	(-2.963)	(-2.904)	(-2.108)	(-6.730)	(-7.012)						
Nominal interest rate <sub>pre</sub>						-0.456**	-0.448***	-0.556***			
						(-2.479)	(-2.876)	(-7.829)			
CB reference rate <sub>pre</sub>									-0.0869	-0.0175	-0.0792
									(-1.007)	(-0.172)	(-0.805)
Constant	4.561	12.41***	3.281*	2.659	-10.19*	3.779	3.064	0.309	-1.960**	-2.159**	-1.894
	(1.492)	(3.509)	(1.967)	(0.923)	(-1.885)	(1.603)	(1.332)	(0.216)	(-2.139)	(-2.119)	(-1.215)
Observations	54	54	39	31	29	36	41	36	43	43	43
Adjusted R <sup>2</sup>	0.269	0.339	0.207	0.756	0.764	0.344	0.261	0.740	0.132	0.0985	0.0788

Note: Control variables (not reported here) are the same as in table 1, 2 and 3

Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

### de Carvalho Filho (2011) control group

	Controlling neither for initial GDP growth nor for exchange rate regime										
	Dependent variable: Change in GDP growth (2009 – 2003/2007)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IT	1.979**	1.979**	1.772	1.976*	3.498***	1.497	1.868*	2.072*	1.717*	2.431**	2.945**
	(2.027)	(2.027)	(1.657)	(1.960)	(3.145)	(1.534)	(1.933)	(2.014)	(1.718)	(2.213)	(2.288)
Constant	-5.218***	-5.218***	-5.302***	-5.216***	-7.480***	-4.302**	-4.872**	-6.115**	-7.332	-7.198***	-8.223***
	(-2.794)	(-2.794)	(-2.844)	(-2.753)	(-4.597)	(-2.383)	(-2.607)	(-2.350)	(-1.283)	(-3.153)	(-2.882)
Observations	47	47	47	47	33	47	47	47	46	47	33
Adjusted R <sup>2</sup>	0.104	0.104	0.102	0.0818	0.271	0.156	0.0857	0.112	0.0966	0.135	0.306

	When controlling for initial DGP growth and exchange rate regime										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IT	1.979**	1.656	1.516	1.658	2.470*	1.741	1.888	1.766	1.604	2.107	4.337**
	(2.027)	(1.267)	(1.088)	(1.248)	(2.043)	(1.248)	(1.310)	(1.151)	(1.160)	(1.325)	(2.189)
Exchange rate regime		-0.754	-0.687	-0.751	1.494	-1.352	-0.998	-0.840	-0.887	-0.872	-0.846
		(-0.495)	(-0.439)	(-0.488)	(0.960)	(-0.848)	(-0.605)	(-0.494)	(-0.560)	(-0.520)	(-0.475)
GDP growth <sub>pre</sub>		-0.565	-0.538	-0.565	-0.0659	-0.512	-0.643	-0.544	-0.595*	-0.481	0.671
		(-1.446)	(-1.332)	(-1.421)	(-0.132)	(-1.318)	(-1.627)	(-1.535)	(-1.864)	(-1.213)	(1.375)
Constant	-5.218***	-1.786	-2.020	-1.789	-8.200**	-1.035	-1.802	-2.016	-0.888	-3.246	-11.80**
	(-2.794)	(-0.584)	(-0.651)	(-0.578)	(-2.629)	(-0.366)	(-0.601)	(-0.654)	(-0.177)	(-1.114)	(-2.384)
Observations	47	47	47	47	33	47	47	47	46	47	33
Adjusted R <sup>2</sup>	0.104	0.164	0.151	0.142	0.238	0.198	0.150	0.142	0.146	0.154	0.308

Note: Control variables (not reported here) are the same as in table 3

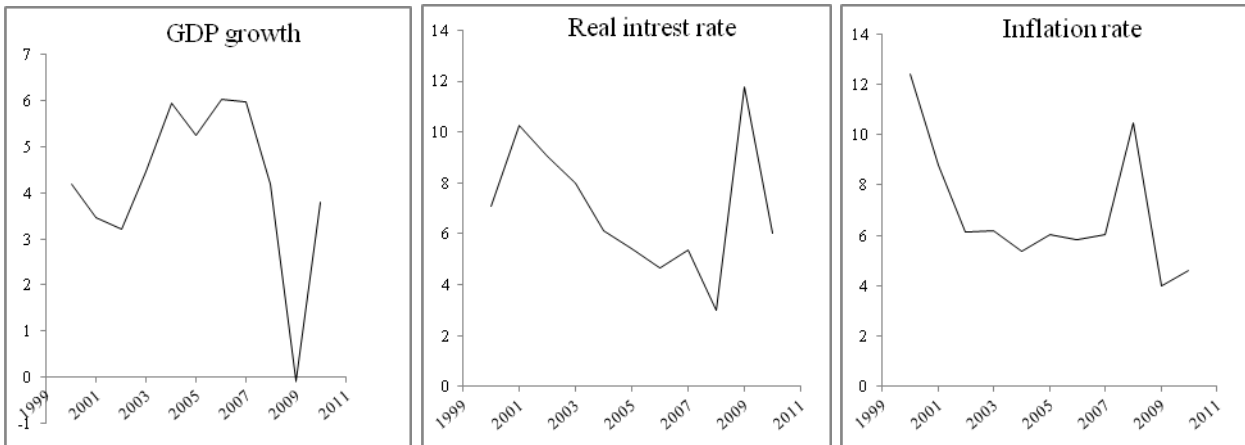
Robust t-statistics in parentheses

\*, \*\*, \*\*\* indicate the statistical significance at 10%, 5% and 1% respectively

## Appendix 6: data and sources

Variables	Definition	Source
Inflation rate	Annual change in consumer price (%)	World Bank (2012)
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency	World Bank (2012)
Exchange reserves	Total reserves expressed in months of imports	World Bank (2012)
Dom credit by BS	Domestic credit provided by banking sector (in % of GDP)	World Bank (2012)
M2 (% GDP)	Money and quasi money (M2, in % of GDP)	World Bank (2012)
Imports (% GDP)	Imports of goods and services (in % GDP)	World Bank (2012)
Fcng via int markets	Financing via international capital markets (gross inflows, % of GDP)	World Bank (2012)
Risk premium	Interest rate charged by banks on loans to prime private sector customers minus the "risk free" treasury bill interest rate	World Bank (2012)
Real interest rate	Lending interest rate adjusted for inflation as measured by the GDP deflator	World Bank (2012)
FDI (% GDP)	Foreign direct investments	World Bank (2012)
Trade openness	Sum of exports and imports of goods and services measured as a share of gross domestic product	World Bank (2012)
Short term debt	Debt that has an original maturity of one year or less (in % of GDP)	World Bank (2012)
Current account balance	Measure the current account in percentage of GDP	World Economic Outlook (September 2011)
Foreign liabilities/assets	Ratio of foreign liabilities to foreign assets	International Financial Statistics (November 2011)
Inflation volatility	Standard deviation of monthly inflation rate	International Financial Statistics (November 2011)
Broad money (% GDP)	Broad money expressed in percentage of GDP	International Financial Statistics (November 2011)
Exchange rate	Nominal exchange rate (US dollar per national currency)	International Financial Statistics (November 2011)
Nominal interest rate	Money market rate	International Financial Statistics (November 2011)
CB reference rate	Central bank discount rate	International Financial Statistics (November 2011)
Credit growth	Growth in claims of banking system on private sector	International Financial Statistics (November 2011)
Exchange regime	Dummy variable, = 1 if the exchange rate regime is flexible	de facto classification in Gosh et al (2010)
Bank competition	Bank concentration	Beck et al (2009)
Economic globalization	Measure of countries economic globalization	KOF index - Dreher (2011)

Appendix graph 1: Global evolution of GDP growth, real interest rate and inflation



Appendix graph 2: GDP growth for the whole sample, developed and emerging subsamples (targeters / non-targeters)

