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INFLATION TARGETING: A PANEL APPROACH

By:

Juan S. Quinonez

A thesis submitted in partial fulfillment
of the requirements of the degree

of

MASTER OF SCIENCE

in

Applied Economics

Approved:

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UTAH STATE UNIVERSITY
Logan, Utah
2015



Utah State University

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Research Project
Inflation Targeting: A Panel Approach

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Logan, Utah
United States of America, December, 2015

Inflation Targeting: A Panel Approach

The Federal Reserve defines “monetary policy” as any strategy that influences money and credit, which further affects GDP. These policies are used to promote maximum employment, stable prices and moderate long-term interest rates. Generally, these policies can be differentiated by the choice of target variables. Examples of monetary policy includes exchange rate targeting, monetary targeting, among others. This paper will look at inflation targeting and investigate its effect on macroeconomic variables.

Introduction

Policy-makers have the authority to define the monetary framework, this allows them make decisions that promote economic growth and development. These frameworks are often defined by the macroeconomic variable which they decide to target. Developing countries used to use exchange rate targets in order to be able to promote competitiveness, macroeconomic stability and growth (Yagci [2001]). In this type of monetary framework, the central bank (or policy makers) is willing to buy or sell foreign exchange in order to keep the exchange rate at a certain level (pegged exchange rate) or within certain bands (pegged within bands). This framework requires a high level international reserve, so the central bank can sell foreign currency when the exchange rate is depreciating to counter this downward move, or buy back foreign currency in the opposite case. Yagci (2001) highlights the main benefits of this regime: 1) can promote stability and competitiveness, if peg is credible and 2) can keep interest rate at a lower level. The downside of this monetary policy framework is that it has limited capacity to absorb external shocks, because if the country runs down its international reserve, the policy cannot be maintained.

Developed countries were inclined to conduct a monetary policy based on monetary targets. Mishkin (2000) states that this monetary framework was characterized by: 1) reliance on information conveyed by a monetary aggregate (such as M1, M2, or other aggregate), 2) announcement of targets for monetary aggregates and 3) some accountability mechanism to preclude large and systematic deviations from the monetary aggregates. Around the decade of 1970, Germany, Switzerland, USA and UK adopted this framework due to high inflation concerns. Germany used the sum of currency and bank deposits as monetary target, Switzerland used M1, the USA used M2, whereas UK used a broader aggregate (M3). The former two countries were successful controlling inflation using monetary aggregates, attributed to the partial reliance of the monetarist K-percent rule of Milton Friedman.

On the other hand, as Mishkin (2000) continues his study, the US was not able to manage monetary aggregates to achieve interest rate, unemployment rate and inflation rate targets, three main goals of the Fed during 1970 decade. Over the course of 20 years, the Fed abandoned the aggregate monetary framework when Greenspan testified in Congress saying that the Fed will no longer use any monetary target as a guide to conduct monetary policy (Mishkin [2000]).

After failure of controlling inflation rate using aggregate monetary targets, developed countries started using inflation targeting. As of 2014, countries like Canada, New Zealand, Brazil, Chile, the USA and 44 more countries have implemented the inflation target regime and 10 more countries are in the process of implementing it. In this monetary framework an inflation target is set and publicly announced, then policy-makers will do whatever best in order to achieve said goal.

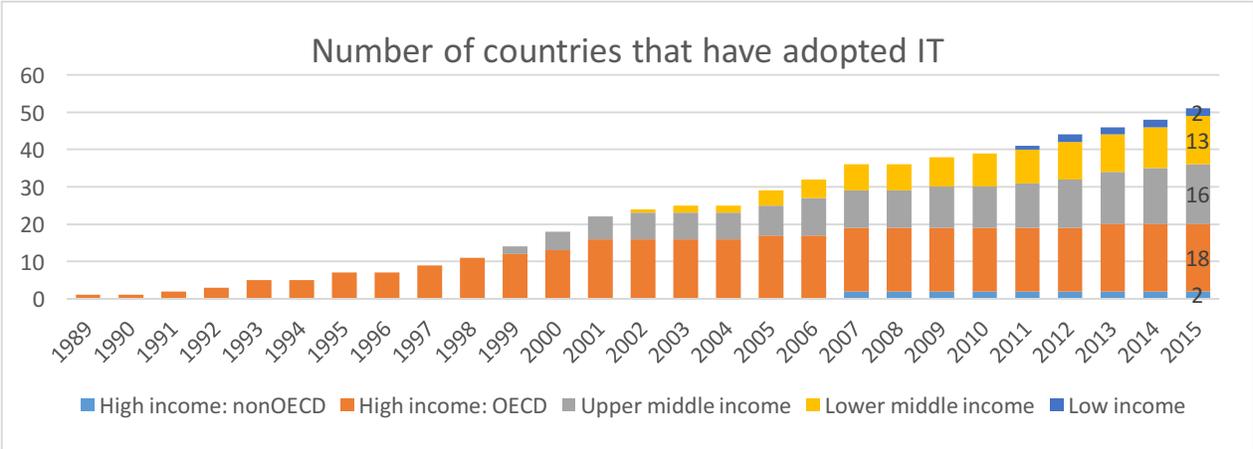


Figure 1 Number of countries that have adopted the Inflation Targeting Regimen by year. Author's elaboration

Countries that have adopted this monetary framework have experienced lower and more stable inflation rate. This two benefits help consumers and producers base their economic decisions and plan ahead their consumption and investment plans, ultimately boosting GDP and economic growth.

In this research project we will describe inflation and inflation targeting, along with more details of its benefits. Then we test if there is sufficient evidence to support this advantages, and determine how is this monetary framework related to economic development.

Inflation

As mentioned before, inflation can be defined as the general change of prices of good and services and it measures the purchasing power of money: as inflation increases, every unit of money can pay a smaller portion of goods and services. Although consumers are able to afford less goods and services, a constant low and stable increase in prices keep businesses profitable. When prices have too much volatility, produces and consumer may have a hard time making their choices of production and consumption. On this matter Okun (1971) stated that this environment of high volatility in prices jeopardize decision-makers “by exposing individuals to large risks with respect to the value of their wealth and their income”.

After exposing such adverse qualities of inflation, some people may argue that an economy is better off without inflation. The truth is that deflation (when prices in general decrease) is related to much greater dangers: such as falling profits, increase of unemployment, and other problems which can potentially yield an economic recession. So, even though high and volatile inflation is bad for the economy, deflation can be worse.

In general, if the general population expect a price increase in the future, they will increase their short-term consumption, whereas if they expect a price fall in the future, they'll postpone present consumption and wait for the prices to fall. This latter situation can be dangerous to the economy, because this reluctant consumption can decrease short-term GDP.

If prices have no variation at all (inflation rate equal to zero), producers have less incentive to continue supplying goods and services. Inflation is said to be often underestimated, hence, having an inflation rate close to zero is close to be in the deflation zone and all the concerns related to it. Generally, policy-makers try to avoid zero inflation rate.

The question policy-makers have to answer is "how much price variation is good?" There is a generally accepted concept where "low and steady" inflation improves the economic growth and development. Consumers form their own future inflation expectation, based on past inflation levels and other relevant information. If inflation is kept at a "steady" level, their inflation expectation will not be far off actual inflation, which means that they can base their economic decisions on their expected inflation. In this situation, consumers will not postpone their consumption, because they know prices will be higher on the next year, and this behavior boosts the GDP in the short run.

Skeptics of this claim often ask "how low?" or "what is steady?" The answer of those last questions varies and depends on which country we are dealing with. In general, developed countries set their inflation target between 1% and 2%, while developing countries set their targets from 2% up to 18%. Generally, policy-makers use 1% range around their targets so that inflation can fluctuate around the target, but within the boundaries.

Inflation Targeting

There are different monetary frameworks. In this study we will focus on inflation targeting (IT) regime and analyze the its effect on GDP and inflation rate. Svensson (1999) highlights the characteristics of the inflation target regime: policy-makers state a quantitative inflation target (usually 2% for developed economies), an explicit tolerance interval around the inflation target (typically $\pm 1\%$), and a compromise of achieving this target without having any other intermediate targets. Some concerns related to these will be later discussed in greater detail.

This monetary framework has some requirements or "preconditions" as Batini and Laxton (2007) describe inflation targeting. After studying emerging economies that have adopted IT, these authors managed to identify four conditions: (i) institutional independence of the central bank, (ii) well-developed technical infrastructure with which the central bank is able to make inflation forecasts and other economic modeling that is deemed necessary, (iii) an economic structure where prices are deregulated and are not too sensitive to changes in commodity prices or exchange rate variations and (iv) a healthy financial system.

These are conditions for the smooth change towards the inflation targeting framework. However, not meeting them have not been a hinder for implementing it on emerging economies. Batini and Laxton (2006) concluded that, even though these preconditions are not met, developing

countries are capable of adopting this framework and that, after the implementation, the “preconditions” are met, meaning that there are improvements in institutional independence, and techniques structures.

Monetary policies are often divided in two strategies: discretionary frameworks and rule frameworks. In the former kind of monetary-policy the central bank is free to act as it considers it is suitable, given the short-term conditions. In rule frameworks, the central bank is bound to respond according to a rule set, often counter-cyclical rules, like the Friedman k-percent, which stated that the central bank should increase money supply on a fixed percentage each year regardless the state of the economy, or the Taylor-rule, which move interest rate depending on the behavior of GDP growth and the inflation rate. Bernanke and Mishkin (1997) agree to identify the inflation targeting regime as “constrained discretion”. They argue that the IT framework is not a rule in the sense that the changes in policy are not a reaction provoked by certain macroeconomic conditions, but it relies on the discretion of the central bankers to use their structural and judgmental models of the economy to determine the policy actions that will help them achieve the inflation target. So this monetary framework is ruled by the overriding goal of inflation, but relies on the discretion of the policy-makers to achieve that goal.

There are some concerns about some definitions related to this monetary framework. What does it mean that inflation rate is the only priority of the policy-makers relative to other variables (unemployment, exchange rate...)? Which inflation should be used? Which should be the inflation target?

Even though policy-makers refer to inflation as the “overriding goal” of monetary policy, they usually leave an “escape clause” for secondary objectives. Developing countries that have adopted this framework often have exchange rate secondary targets, because they are very vulnerable to international shocks, such as oil prices variations and changes in monetary policy of developed countries (like USA or the ECB).

There is a discussion on whether the inflation target should be a point (a specific target number surrounded with an upper and lower bound) or a range (minimum and maximum inflation). Hammond (2012) states that having a target point give the public a very clear signal of what the objective inflation is and using the bands around the target, the general population can estimate the mid-term inflation level. Using a target range it is very easy to check if the target was hit or missed, but they have the disadvantage that might imply that “the central bank has imprecise control over inflation objective”, as Hammond (2012) continues.

There are multiple measures of inflation within an economy, consumer inflation, producer inflation, core inflation, and such. Given this variety of price variation, which one should we use for target? Bernanke and Mishkin (1997) answer this question and respond stating that central banks should use the inflation measure that is generally considered accurate, timely and readily understood by the public. The selected inflation should also be flexible enough to capture price shocks, which the monetary policy will intend to smooth out. Every country that have adopted the IT regime has chosen one measure of inflation and has not changed ever since.

The next question that ought to be answer is “what should be the target level?” This monetary policy framework sets its target to a level of inflation that will help the economy grow to its potential GDP. This is intended to produce different benefits to the economy, such as reducing inflation and GDP volatility. Countries that have adopted this framework have, on average, lower inflation than those countries that have not adopted it.

Some critics of the inflation targeting regimen argue that the inflation is very difficult to control due to the lags under which the monetary policy operates. This problem is worse for emerging market countries, as Mishkin (2000) analyzed. These countries often face very high inflations that are meant to be brought down, but the monetary policy operates with very long lags and their forecast models often yield large errors. This combination of issues affects the central bank credibility of its ability of achieving the inflation target. However, in the sample used in this study there are 17 countries with lower middle income and low income¹ that have successfully adopted this monetary framework and have lower and steadier inflation.

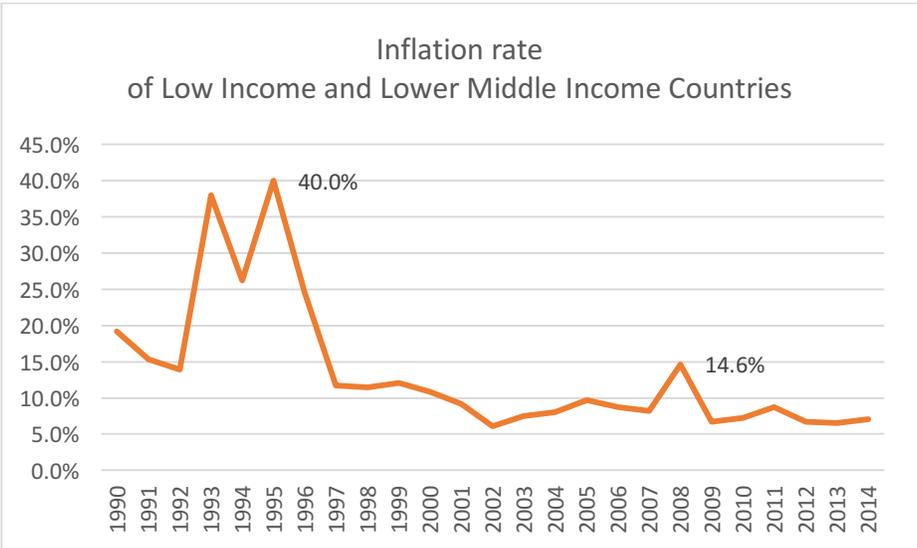


Figure 2 Average rate of inflation of 17 low income and lower middle income countries. Author's elaboration.

Approximated ten years after the “birth” of inflation targeting framework, Neumann and von Hagen (2002) tested the benefits of adopting this monetary policy. They concluded that the countries with this framework had lower inflation rates and less inflation volatility, and they said that those countries “converged closely to the stability performance of the Bundesbank”.

Not so long after Neumann and von Hagen (2002) publication, Ball and Sheridan (2003) conducted a similar study and noted that the decrease in inflation that inflation-targeting countries experienced was also present on non inflation-targeting countries. They asserted that

¹ Armenia, Bangladesh, Georgia, Ghana, Guatemala, Indonesia, Kenya, Malawi, Moldova, Mongolia, Mozambique, Niger, Pakistan, Philippines, Sri Lanka, Uganda, and Ukraine.

the decrease on inflation and its volatility was nothing but a mean regression effect, so whether a country adopted the inflation targeting regime had no effect whatsoever.

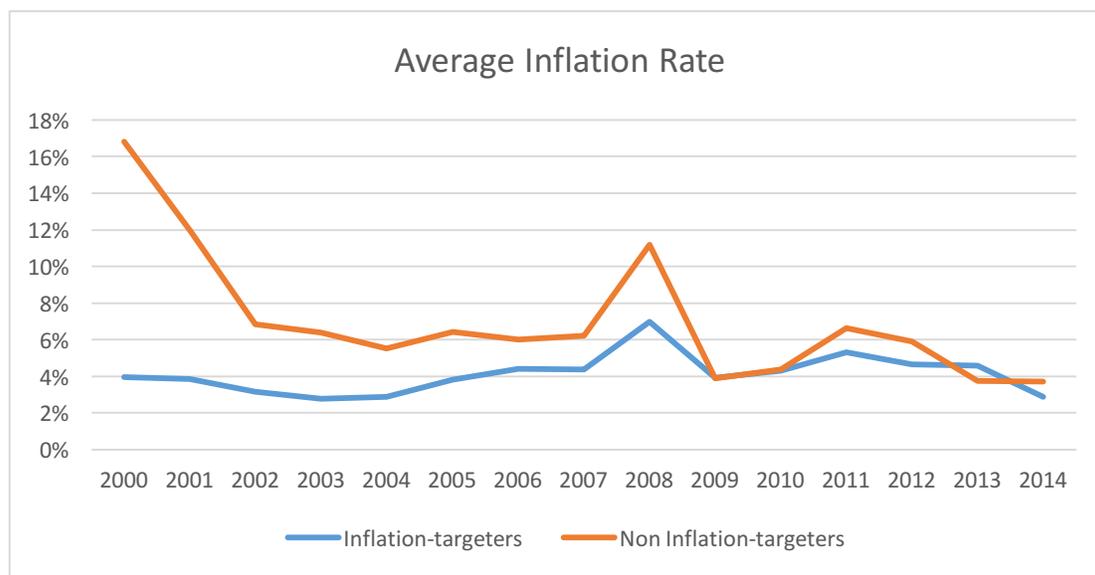


Figure 3 Average inflation rate for countries with inflation targeting framework and countries without it. Author's elaboration

Miller *et al* (2012) compiled different studies regarding inflation targeting and its impact on economic performance. After comparing all the research, he concluded that the inflation targeting regime does not affect economic performance in developed countries, but it has positive effects on developing countries. Similarly, Walsh (2009) investigated the benefits of the IT regime and concluded that the decrease in inflation (and inflation volatility) was more evident in developing countries rather than developed countries. He argues that developed countries adopted this monetary policy framework in periods where their inflation was already low or stable. For this reason, there is no clear evidence, for developed countries, of the benefits of the IT scheme. However, developing countries that adopted the IT have lowered their inflation level, volatility as well as reduction in GDP growth volatility (Gonçalves and Salles [2006]).

Non-macroeconomics benefits include an increase in transparency. Policy-makers try to be transparent and trustworthy so that the general public may trust them and start making their economic decisions based on the promised inflation target, this is called “anchoring” inflation expectations. For this reason, in this regimen, the expected inflation is a very important variable for the policy-makers. Bordo and Siklos (2014) defined central bank credibility as a “commitment to follow well-articulated and transparent rules and policy goals”. They conclude that the central bank credibility level of inflation targeting countries is similar to credibility levels during the gold standard period.

Another of these benefits is the increase of accountability. Alongside the declaration of the inflation target, there are penalties for the policy-makers if they do not meet their goals in the right time. Every time this target is not met, people in general may start losing their “anchor” to the inflation, and the policy-makers may lose their credibility. In order to boost the trustworthiness and transparency, those in charge of the monetary policy improve their

communication towards the general public, usually this is done using monthly announcements. One of the most important benefits is the independence of the policy-makers. By not being influenced by the government, monetary policy can be performed so that it can achieve the inflation target and not having any other intermediate goal.

Even though many benefits have been attributed to the inflation targeting regimen, Epstein (2003) argued that none are a consequence of this regime, but to other policy measures that are used in this monetary framework. Epstein (2003) claims that countries with IT regime has accomplished to lower inflation rate has done so at the same “output-price” as countries without IT regime. Further more, he says that all the countries use the same instrument to lower inflation rate: increase interest rate.

This research project will investigate the benefits of the IT framework stated above. Particularly we will study the effect of this regime on GDP and inflation, using information of 47 inflation targeting countries and 82 non-inflation targeting countries from 1990 to 2014. Table 1 show the distribution of the countries, by the World Bank classification, used in the sample and Table 2 shows the detailed list of countries. The selection criterion was based on information availability: we choose those countries that had at least 50% of the observation for GDP, Inflation, Capital formation, Labor, and Government deficit. For those cases where the time observations were not consecutive, a linear approximation was used to fill in the missing observation.

Table 1: Country distribution

| | World Bank Classification | IT Countries | Non-IT Countries | Total |
|--------------------|---------------------------|--------------|------------------|-------|
| High Income | High income: OECD | 15 | 12 | 27 |
| | High income: nonOECD | 1 | 16 | 17 |
| | Upper middle income | 16 | 17 | 33 |
| Low Income | Lower middle income | 12 | 22 | 34 |
| | Low income | 3 | 15 | 18 |
| | Total | 47 | 82 | 129 |

Table 1: County distribution by classification. Source: World Bank database

In general, high income countries have experienced a GDP growth of 0.76% from 2000 to 2013. For most of this period, IT countries had higher GDP than non-IT countries. From 2009 the average GDP for IT countries has fallen, and this is partly explained by the fact that since that year, the lower end of high income countries has adopted this monetary framework which has lowered the average GDP of the IT countries, while the upper end of high income countries (mainly non-OECD countries) has not implemented this regime.

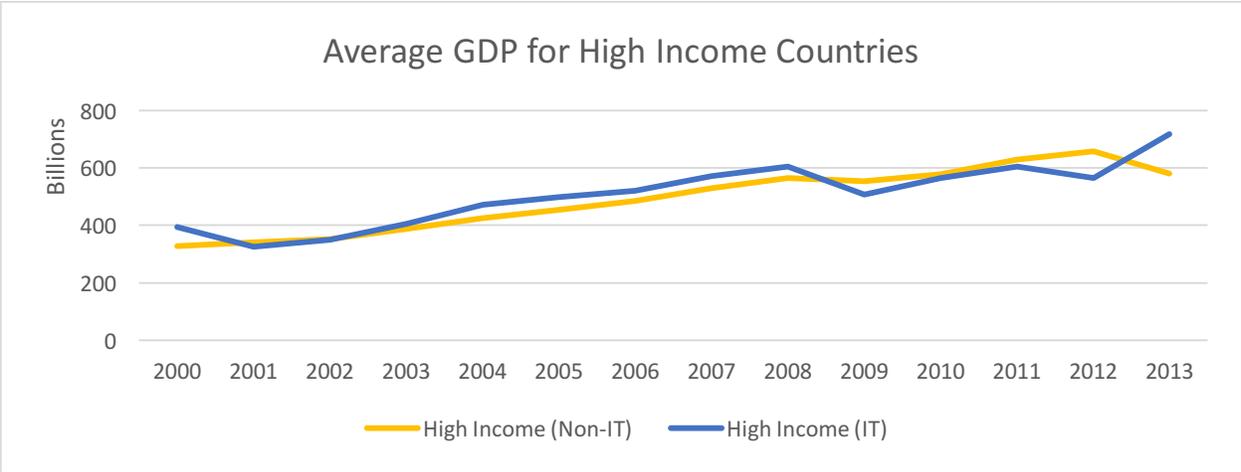


Figure 4 Average GDP for high income countries. Author's elaboration

High income countries that use the inflation targeting as monetary framework experienced lower inflation than those countries that don't use IT. Even though, the inflation targeting is related to decrease inflation rate and reduce its volatility, it does not make countries immune to external shocks. Prove to this claim is the increase in inflation rate in 2008 for all countries. During this year we experienced what many economists claim to be the "worst financial crisis since the Great Depression". During these years, different banks declared bankruptcy and had to shut down their operations, like Lehman Brothers in the USA. After this financial crisis, IT-countries managed to keep a lower inflation rate than non IT-countries.

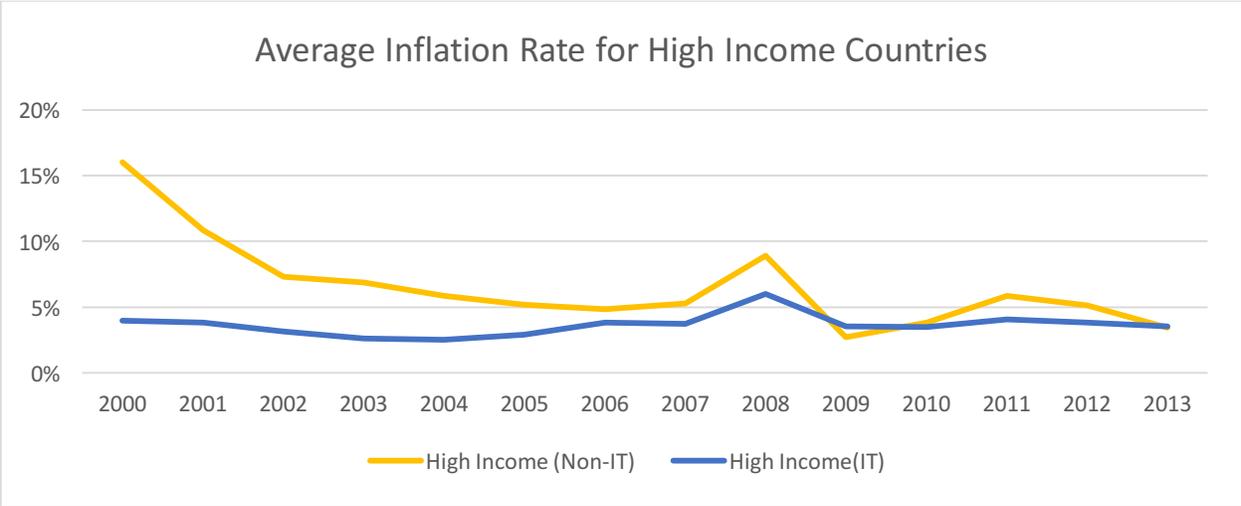


Figure 5 Average inflation rate for high income countries. Author's elaboration.

Figure 6 shows the evolution of the average GDP for low income countries. In this graph we can see that low income countries that implemented inflation targeting have higher GDP than those countries that have not applied this monetary regime.

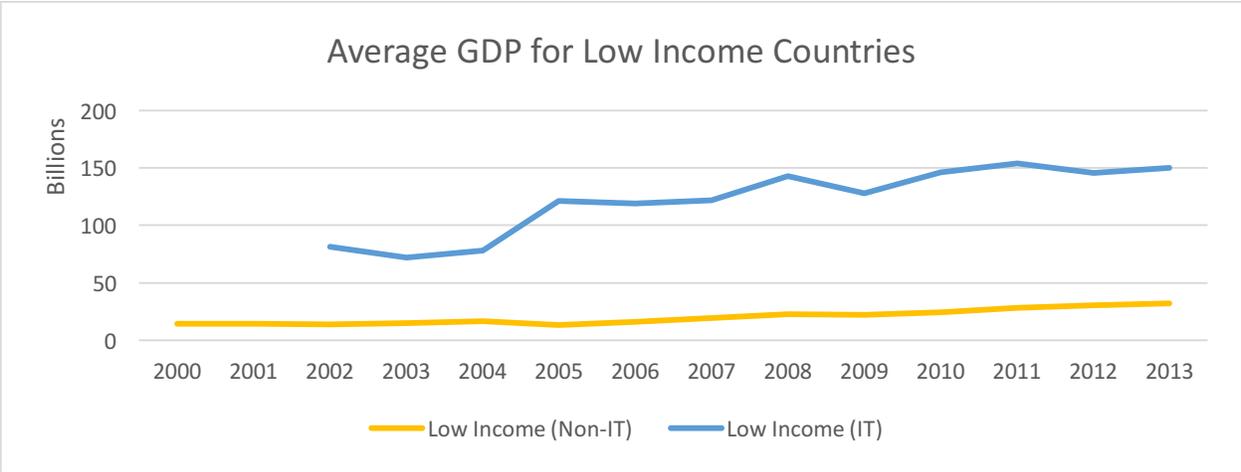


Figure 6 Average GDP for low income countries. Author's elaboration.

Figure 7 shows the behavior of the inflation rate for this group of countries. For both IT-countries and non IT-countries inflation rate have been roughly the same over the years, however, IT-countries experienced lower inflation rate during the 2008 financial crisis than the non IT-countries.

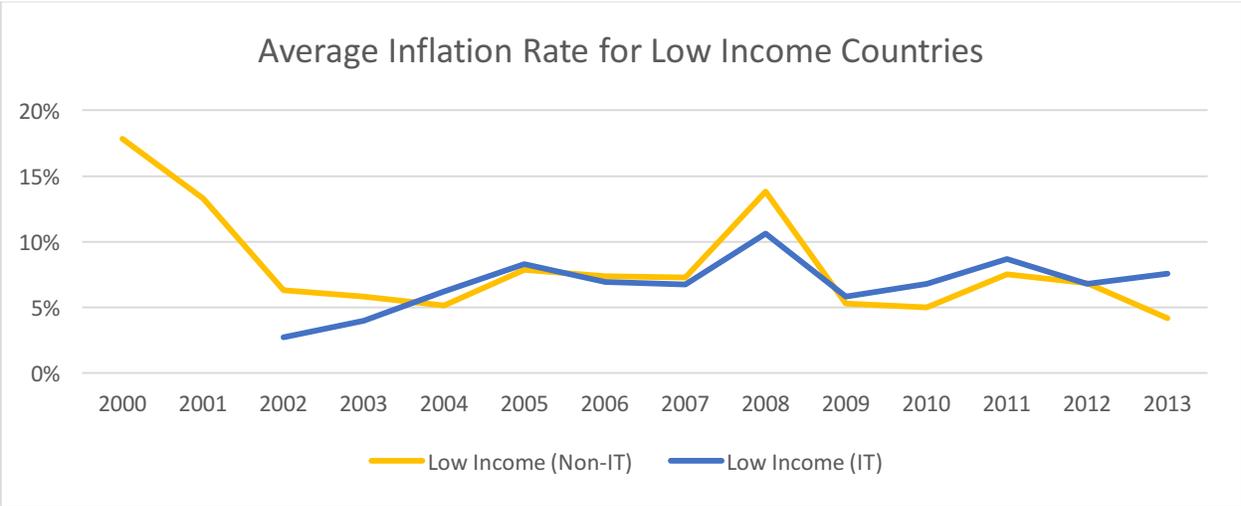


Figure 7 Average inflation rate for low income countries. Author's elaboration

Methodology

For this investigation we will use an unbalanced panel data collected from 1990 to 2014 for 129 countries. When using this type of data, the estimation of the parameters is based on fixed effects or on random effect models. The former is used when it is presumed that there is an unobserved effect that is correlated with each explanatory variable in all periods. This methodology subtracts the time average to each individual, which will eliminate the unobserved effect (because it is believed its constant). The latter methodology assumes that there is some sort of correlation between the explanatory variables and the unobserved effect. In order to estimate the parameters, the random effect methodology subtracts a portion of the time average to each

individual that depends on the variance of the error term, variance of the unobserved effect and the number of time periods and then estimates the parameters using generalized least squares.

We will use in this investigation the fixed effect and pooled OLS estimations and specify the following regressions:

$$y_{i,t} = \beta_0 + \beta_1 y_{i,t-1} + \beta_2 Inf_{i,t-1} + \beta_3 Inf_{i,t-1}^2 + \beta_4 k_{i,t} + \beta_5 l_{i,t} + \beta_6 educ_{i,t} + \delta_1 IT_{i,t} + \epsilon$$

$$Inf_{i,t} = \beta_0 + \beta_1 GovExp_{i,t} + \beta_2 i_{i,t} + \beta_3 Inf_{i,t-1} + \beta_4 Inf_{i,t-1}^2 + \delta_1 IT_{i,t} + v$$

where y represents the logarithm of the GDP in current US dollars; Inf is the inflation rate, k is the gross capital formation as a percentage of GDP; l is the total labor force as a percentage of total population, $educ$ correspond to education, $GovExp$ is the government current account balance as a percentage of the GDP and i is the real interest rate. We include the inflation term squared in order to capture marginal effects of this variable. Table 3 summarizes the list of variables used in this study. The variable of interest for the investigation is the dummy variable IT . Results of the fixed effect and pooled OLS estimates are presented in Table 4.

In general, lagged GDP and capital formation were statistically significant in the determination of the GDP, determining between 0.95% to 0.99% and 0.20% to 0.50%, respectively. Total labor didn't have a statistically significant impact over GDP, according to the pooled OLS estimates, but the opposite using the fixed effect estimations. According to the latter methodology, total labor is related with an increase of output between 0.40% and 0.50%. Different measures of education, as an approximation of productivity, did not have a significant impact on GDP. Even though both methodologies captured decreasing marginal effects of inflation rate on GDP, this effect is very small (close to 0) and not statistically significant.

For both methodologies and controlling for different measures of education, inflation had a very small effect (ranging from 0.20% to 1.81%) on GDP and it is not statistically significant. Judging by the R-squared, the pooled OLS model explained 99% of the GDP determination, whereas the fixed effect model explained 89%. The former methodology shows that this monetary framework has a positive effect of 0.80% after controlling for primary and secondary enrollment, whereas for these same productivity measures, the fixed effect model shows an impact of 1.81%.

Using a sample of countries with high income (using the World Bank classification) we estimated the effects of adopting the inflation targeting frame work using fixed effects model. For these countries, this adoption is not statistically significant, but its related to positive effects that ranges from 1.31% to 3.15%, however controlling for tertiary education, the adoption of this framework has a negative effect of 0.20%. Repeating the same analysis for low income countries, we get a positive relationship between this monetary regime and GDP, meaning that the adoption of the inflation targeting framework increases the GDP between 1.01% and 1.51%, however this relationship is not statistically significant. For this group of countries, after controlling for secondary education enrollment we get a negative relationship between IT and GDP, but it is not statistically significant. Detailed results are shown in Table 5.

Different methodologies and different samples yielded mixed evidence of the relationship between IT framework and GDP determination. In general, this regime has a positive relationship with GDP (the adoption of the IT framework increases GDP), but there is not enough evidence to conclude that the relationship is significant.

Analyzing the inflation specification previously described we found that the government current account balance plays a significant role determining inflation rate; the pooled OLS showed that marginal increase of the current account balance is related with a decrease of 0.057 in inflation, however the fixed effect model showed a similar relationship, but a higher magnitude (0.079 vs 0.057). Both methodologies showed the expected relationship between inflation rate and real interest rate. A marginal increase of real interest rate is related with a 0.18 and 0.25 decrease in inflation, for the pooled OLS and fixed effect model, respectively. The pooled OLS model captured marginal effect of lagged inflation, showing marginal decreasing return on inflation, however, this effect was not captured by the fixed effect model.

According to the pooled OLS results, adopting inflation targeting regime is related with a decrease in inflation rate of 0.74, but this effect is higher when used the fixed effect methodology (0.75 vs 0.74). Although these estimates show the right sign, only the pooled OLS estimates are statistically significant. Table 6 shows the results in detail.

In Table 7 we show the results for the fixed effect model using high and low income countries. Current account balance has more weight determining inflation in high income countries than low income one (0.124 vs 0.016). For low income countries, inflation rate showed a stronger inertial component than high income countries (0.134 vs 0.101), but for both group of countries, this variable was not statistically significant. For both type of countries, the real interest rate was statistically significant and was related to a decrease of inflation of 0.22 (for high income countries) and 0.30 (for low income countries).

Using high income countries, the fixed effect model showed that the adoption of the inflation targeting framework was related to a decrease in inflation of 1.99, but for low income countries this monetary framework is associated with an increase in inflation of 0.623. This last result has the opposite sign that it was expected. We analyzed the inflation rate at the year of adoption of the low income countries and noticed that for some years, new countries adopting this monetary framework had higher inflation rate than the low income countries that already were using this regime.

Philippines, in 2002, was the first low (middle) income country that adopted IT regime, and it had a 2.72 inflation rate. The following year, Bangladesh adopted this regime, with an inflation rate of 5.66%. In 2005, Guatemala changed its monetary framework for the IT regime and had an inflation rate of 9.10%. This might be a partial explanation of why the fixed effect estimator had a positive relationship between inflation rate and the adoption of IT regime, instead of a negative one.

So far we have studied the effects of Inflation Targeting on GDP and inflation rate, however nothing has been said about the inverse relationship. A very interesting question to answer would be: what is the causality relationship between these variables? Given that there are many countries with different GDP levels and inflation rates that adopt this monetary regime, it is not entirely clear which is the causal relationship. It is hard to say if countries adopt the IT regime because they have “high” GDP and “low” inflation rate, or if they achieve “high” GDP and “low” inflation rate because they implemented this monetary framework. The decision to adopt IT is not well understood and could be influenced by many other factors that were not taken into account in this study.

Conclusion

The Inflation Targeting Regime was first adopted by New Zealand in 1989. This monetary policy framework requires policy-makers to commit to a target inflation that is consistent with the potential GDP growth, so that the general population would base their economic decision upon that inflation target. In theory, the IT regime can potentially decrease inflation, reduce the volatility of inflation and GDP growth, but these positive effects are more evident in developed countries rather than developing countries. This thesis project studied these benefits using data of 58 inflation targeting countries and 71 non-inflation targeting countries from 1990 to 2014.

The panel evidence shows that there is a small positive relationship between this monetary policy framework and GDP, but it is not statistically significant. In this study we found that the effects of IT regime on GDP are greater in high income countries than on developing countries, which is different to what is commonly found in other investigations.

The adoption of inflation targeting is linked to a decrease of inflation rate, although not statistically significant. We found that in developing countries this relationship is opposite to the theoretical correlation, due to the constant increase of inflation level of new developing countries that implement the IT regime.

Even though the results shown are not statistically significant, there are non-economic benefits related to this monetary framework that are not considered in this study. The inflation target framework helps the central bank to have more independence to conduct monetary policy and also increases the accountability, so that this entity is not left alone to do what it pleases with no consequences.

Further research

This investigation could be improved if more observations are added. Using more observations, estimations are more precise, with which we could draw better conclusions on what is the relationship between inflation targeting regime and GDP and inflation rate. More observations can be obtained by relaxing the selection criteria that is used: in this investigation we only used countries that had at least 50% of information on GDP, Inflation, Capital formation, Labor, and Government deficit.

Generally, the relationship between IT and other macroeconomic variables is studied using time series models. However, this can be also analyzed using panel data that accounts for time variations. In order to improve further researches, we recommend using more lags of time variables, doing this will capture any autocorrelation that might be implied in the model. Another issue worth considering is endogeneity: since it is not very clear the decision process of countries to adopt the inflation targeting framework, having this framework as an endogenous variable is a possibility that should be taken into account for additional research.

Further investigations should be able to test the causal relationship between the adoption of the Inflation Targeting regime and GDP and inflation rate. This will shed more light on the matters of which conditions are necessary for the implementation of this framework and have a clear idea of what the benefits are.

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Annex

Table 2: List of countries used

| Country | Classification | Inflation Targeting since |
|--------------------------|----------------------|---------------------------|
| Albania | Upper middle income | 2009 |
| Algeria | Upper middle income | |
| Angola | Upper middle income | |
| Armenia | Lower middle income | 2006 |
| Australia | High income: OECD | 1993 |
| Azerbaijan | Upper middle income | 2014 |
| Bahamas, The | High income: nonOECD | |
| Bahrain | High income: nonOECD | |
| Barbados | High income: nonOECD | |
| Belarus | Upper middle income | 2013 |
| Belgium | High income: OECD | |
| Belize | Upper middle income | |
| Benin | Low income | |
| Bhutan | Lower middle income | |
| Bolivia | Lower middle income | |
| Botswana | Upper middle income | 2006 |
| Brunei Darussalam | High income: nonOECD | |
| Bulgaria | Upper middle income | |
| Burkina Faso | Low income | |
| Burundi | Low income | |
| Cambodia | Low income | |
| Cameroon | Lower middle income | |
| Canada | High income: OECD | 1991 |
| Central African Republic | Low income | |
| Chad | Low income | |
| Colombia | Upper middle income | 1999 |
| Comoros | Low income | |
| Congo, Dem. Rep. | Low income | |
| Costa Rica | Upper middle income | 2011 |
| Croatia | High income: nonOECD | |
| Cyprus | High income: nonOECD | |
| Denmark | High income: OECD | |
| Djibouti | Lower middle income | |
| Dominican Republic | Upper middle income | 2012 |
| Ecuador | Upper middle income | |

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|-----------------------------|----------------------|------|
| Egypt, Arab Rep. | Lower middle income | |
| El Salvador | Lower middle income | |
| Equatorial Guinea | High income: nonOECD | |
| Estonia | High income: OECD | |
| Ethiopia | Low income | |
| Fiji | Upper middle income | |
| Finland | High income: OECD | 1993 |
| France | High income: OECD | |
| Greece | High income: OECD | |
| Guinea-Bissau | Low income | |
| Guyana | Lower middle income | |
| Honduras | Lower middle income | |
| Hong Kong SAR, China | High income: nonOECD | |
| Hungary | High income: OECD | 2001 |
| Iceland | High income: OECD | 2001 |
| Iran, Islamic Rep. | Upper middle income | |
| Ireland | High income: OECD | |
| Israel | High income: OECD | 1997 |
| Italy | High income: OECD | |
| Jamaica | Upper middle income | |
| Japan | High income: OECD | 2013 |
| Jordan | Upper middle income | |
| Kazakhstan | Upper middle income | 2015 |
| Korea, Rep. | High income: OECD | 1998 |
| Kuwait | High income: nonOECD | |
| Kyrgyz Republic | Lower middle income | |
| Lao PDR | Lower middle income | |
| Latvia | High income: nonOECD | |
| Lesotho | Lower middle income | |
| Luxembourg | High income: OECD | |
| Macao SAR, China | High income: nonOECD | |
| Macedonia, FYR | Upper middle income | |
| Madagascar | Low income | |
| Malaysia | Upper middle income | |
| Mali | Low income | |
| Malta | High income: nonOECD | |
| Mauritania | Lower middle income | |
| Mauritius | Upper middle income | |
| Mexico | Upper middle income | 2000 |

| | | |
|---------------------------------------|----------------------|------|
| Bangladesh | Lower middle income | 2003 |
| Morocco | Lower middle income | |
| Nepal | Low income | |
| Netherlands | High income: OECD | |
| New Zealand | High income: OECD | 1989 |
| Nicaragua | Lower middle income | |
| Norway | High income: OECD | 2001 |
| Oman | High income: nonOECD | |
| Panama | Upper middle income | |
| Paraguay | Upper middle income | |
| Peru | Upper middle income | 2001 |
| Poland | High income: OECD | 1998 |
| Portugal | High income: OECD | |
| Qatar | High income: nonOECD | |
| Romania | Upper middle income | 2005 |
| Sao Tome and Principe | Lower middle income | |
| Saudi Arabia | High income: nonOECD | |
| Senegal | Lower middle income | |
| Serbia | Upper middle income | |
| Slovenia | High income: OECD | |
| Solomon Islands | Lower middle income | |
| South Africa | Upper middle income | 2000 |
| Spain | High income: OECD | 1995 |
| St. Lucia | Upper middle income | |
| St. Vincent and the Grenadines | Upper middle income | |
| Swaziland | Lower middle income | |
| Sweden | High income: OECD | 1995 |
| Switzerland | High income: OECD | 2000 |
| Syrian Arab Republic | Lower middle income | |
| Tajikistan | Lower middle income | |
| Thailand | Upper middle income | 2000 |
| Togo | Low income | |
| Tonga | Upper middle income | |
| Trinidad and Tobago | High income: nonOECD | |
| Turkey | Upper middle income | 2006 |
| Georgia | Lower middle income | 2009 |
| United Kingdom | High income: OECD | 1992 |
| United States | High income: OECD | |

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|--------------------|----------------------|------|
| Uruguay | High income: nonOECD | 2007 |
| Vanuatu | Lower middle income | |
| Yemen, Rep. | Lower middle income | |
| Ghana | Lower middle income | 2007 |
| Guatemala | Lower middle income | 2005 |
| Indonesia | Lower middle income | 2005 |
| Kenya | Lower middle income | 2014 |
| Malawi | Low income | 2012 |
| Moldova | Lower middle income | 2010 |
| Mongolia | Upper middle income | 2012 |
| Mozambique | Low income | |
| Niger | Low income | |
| Pakistan | Lower middle income | |
| Philippines | Lower middle income | 2002 |
| Sri Lanka | Lower middle income | |
| Uganda | Low income | 2011 |
| Ukraine | Lower middle income | 2015 |

Table 2: List of countries used in this study.

Table 3: Variable List

| Variable | Description |
|--------------------------------|---|
| GDP | GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used. |
| Gross capital formation | Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. |
| Inflation | Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. |
| Labor force | Total labor force comprises people ages 15 and older who meet the International Labour Organization definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed. While national practices vary in the treatment of such groups as the armed forces and seasonal or part-time workers, in general the labor force includes the armed forces, the unemployed, and first-time job-seekers, but excludes homemakers and other unpaid caregivers and workers in the informal sector. |
| Real interest rate | Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. |
| Current Account Balance | Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income. |

| | |
|------------------------------------|--|
| Primary school enrollment | Gross enrolment ratio. Primary. Total is the total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition. |
| Secondary school enrollment | Gross enrolment ratio. Secondary. All programmes. Total is the total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition. |
| Tertiary school enrollment | Gross enrolment ratio. Tertiary (ISCED 5 and 6). Total is the total enrollment in tertiary education (ISCED 5 and 6), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving. |

Source: World Bank database.

Table 4: Results from estimations (dependent variable: log(GDP))

| Method | Pooled OLS | | | | Fixed Effect | | | |
|-------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Inflation Targeting | 0.004 (0.008) | 0.008 (0.008) | 0.008 (0.008) | 0.005 (0.008) | 0.010 (0.011) | 0.018 (0.012) | 0.016 (0.013) | 0.002 (0.013) |
| Lagged log(GDP) | 0.997*** (0.001) | 0.996*** (0.001) | 0.996*** (0.002) | 0.996*** (0.002) | 0.980*** (0.006) | 0.976*** (0.007) | 0.977*** (0.008) | 0.949*** (0.008) |
| Lagged Inflation Rate | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000* (0.000) | -0.000. (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| Lagged Inflation Rate Squared | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000. (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Capital Formation | 0.002*** (0.000) | 0.002*** (0.000) | 0.002*** (0.000) | 0.003*** (0.002) | 0.002*** (0.000) | 0.003*** (0.000) | 0.003*** (0.000) | 0.005*** (0.001) |
| Total Labor | 0.000 (0.000) | -0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000) | 0.005*** (0.001) | 0.004** (0.002) | 0.004* (0.002) | 0.005*** (0.002) |
| Primary Education | | 0.001 (0.000) | | | | 0.001*** (0.000) | | |
| Secondary Education | | | 0.000 (0.000) | | | | 0.001 (0.000) | |
| Tertiary Education | | | | 0.000 (0.000) | | | | 0.002*** (0.000) |
| Intercept | 0.082** (0.031) | 0.056. (0.033) | 0.112** (0.037) | 0.126** (0.043) | | | | |
| N | 2,750 | 2,381 | 2,131 | 1,955 | 2,750 | 2,381 | 2,131 | 1,955 |
| Total Sum of Squares | 14,300 | 12,571 | 10,982 | 9,530 | 865.66 | 646.4 | 570.38 | 529.56 |
| R Squared Adjusted | 0.994 | 0.993 | 0.993 | 0.993 | 0.902 | 0.890 | 0.884 | 0.884 |
| F-statistic (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Table 4 Results from pooled OLS and fixed effect estimations. Dependent variable: log(GDP). Standard Error in parenthesis. *** indicates significance at 0%; ** indicates significance at 1%; * indicates significance at 5%, . indicates significance at 10%.

Table 5: Results from fixed effect estimations for low and high income countries.
Dependent variable: log(GDP)

| Method | High Income | | | | Low Income | | | |
|-------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Inflation Targeting | 0.013 (0.013) | 0.020 (0.014) | 0.031* (0.015) | -0.002 (0.015) | 0.012 (0.023) | 0.011 (0.024) | -0.012 (0.024) | 0.015 (0.026) |
| Lagged log(GDP) | 0.969*** (0.008) | 0.968*** (0.009) | 0.966*** (0.010) | 0.921*** (0.011) | 0.983*** (0.011) | 0.975*** (0.011) | 0.965*** (0.015) | 0.949*** (0.015) |
| Lagged Inflation Rate | -0.000** (0.000) | -0.000** (0.000) | -0.000. (0.000) | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) | -0.000 (0.000) |
| Lagged Inflation Rate Squared | 0.000*** (0.000) | 0.000** (0.000) | 0.000* (0.000) | 0.000*** (0.000) | 0.000** (0.000) | 0.000* (0.000) | 0.000** (0.000) | 0.000 (0.000) |
| Capital Formation | 0.002*** (0.000) | 0.003*** (0.001) | 0.004*** (0.001) | 0.006*** (0.001) | 0.003*** (0.001) | 0.002** (0.001) | 0.003*** (0.001) | 0.003*** (0.001) |
| Total Labor | 0.006*** (0.002) | 0.006** (0.002) | 0.006** (0.002) | 0.008*** (0.002) | 0.006* (0.003) | 0.002 (0.003) | -0.001 (0.003) | 0.004 (0.003) |
| Primary Education | | 0.000 (0.001) | | | | 0.002*** (0.000) | | |
| Secondary Education | | | -0.000 (0.000) | | | | 0.003*** (0.001) | |
| Tertiary Education | | | | 0.002*** (0.000) | | | | 0.007*** (0.002) |
| N | 1,685 | 1,454 | 1,392 | 1,285 | 1,065 | 927 | 739 | 670 |
| Total Sum of Squares | 553 | 384 | 365 | 346 | 311 | 261 | 205 | 182 |
| R Squared Adjusted | 0.907 | 0.888 | 0.887 | 0.891 | 0.889 | 0.887 | 0.871 | 0.865 |
| F-statistic (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Table 5 Results from fixed effect estimations for low and high income countries. Dependent variable: log(GDP). Standard errors in parenthesis. *** indicates significance at 0%; ** indicates significance at 1%; * indicates significance at 5%, . indicates significance at 10%.

Table 6: Results from pooled OLS and fixed effect estimations. Dependent variable: Inflation.

| Method | Pooled OLS | Fixed Effects |
|------------------------------------|----------------------|----------------------|
| Inflation Targeting (dummy) | -0.741* (0.326) | -0.751 (0.832) |
| Government Current Account Balance | -0.057*** (0.012) | -0.079*** (0.024) |
| Lagged Inflation Rate | 0.739*** (0.049) | 0.086 (0.063) |
| Lagged Inflation Rate Squared | -0.006*** (0.001) | 0.003* (0.001) |
| Real Interest Rate | -0.179*** (0.018) | -0.248*** (0.021) |
| Intercept | 2.968*** (0.303) | |
| | | |
| N | 834 | 834 |
| Total Sum of Squares | 24,218 | 12,094 |
| R Squared Adjusted | 0.414 | 0.178 |
| F-statistic (p-value) | 0.000 | 0.000 |

Table 6 Results from pooled OLS and fixed effect estimations. Dependent variable: Inflation. Standard error in parenthesis. *** indicates significance at 0%; ** indicates significance at 1%; * indicates significance at 5%, . indicates significance at 10%.

Table 7: Results from fixed effect estimations for high and low income countries.
Dependent variable: Inflation

| Classification | High Income | Low Income |
|------------------------------------|----------------------|----------------------|
| Inflation Targeting (dummy) | -1.999* (0.976) | 0.623 (1.486) |
| Government Current Account Balance | -0.124*** (0.027) | -0.016 (0.042) |
| Lagged Inflation Rate | 0.101 (0.081) | 0.134 (0.173) |
| Lagged Inflation Rate Squared | 0.003* (0.002) | -0.000 (0.007) |
| Real Interest Rate | -0.223*** (0.024) | -0.304*** (0.041) |
| | | |
| N | 517 | 317 |
| Total Sum of Squares | 6,199 | 5,894 |
| R Squared Adjusted | 0.209 | 0.166 |
| F-statistic (p-value) | 0.000 | 0.00 |

Table 7 Results from fixed effect estimations for high and low income countries. Dependent variable: Inflation. Standard error in parenthesis. *** indicates significance at 0%; ** indicates significance at 1%; * indicates significance at 5%, . indicates significance at 10%.