10.2478/cer-2013-0023

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Empirical Assessment of Inflation Targeting (Analysis of Selected Economic Statistics)

Abstract

Inflation Targeting (IT) is used by about 30 countries (both developed and developing countries) around the world, and the number of countries was said to increase (IMF 2005). IT strategy was created as a way of getting inflation under control. The global crisis of recent years has given a new perspective to IT strategy and its effectiveness. The most obvious way of analyzing the effects of IT is to compare characteristics of inflation for periods before and after its implementation. So in my research I try to answer following comparative aspects: First, how does IT strategy work, and second, how does it work in the situation of global turmoil? I analyzed the years before and after implementation of IT strategy for those countries which employ it, as well as its implementation and effect during the time of the global crises.

1. Introduction

Inflation and its volatility are considered as one the most harmful factors for an economy and economic agents. This is why IT strategy was designed and implemented in many countries, both developed and developing. Its role is to aid in getting inflation under control. Its usefulness has been confirmed by many researches and observations on inflation in IT countries. The recent years, which include the global financial crisis, present a very good opportunity to try and

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verify the effectiveness of the strategy in bringing and keeping inflation at a chosen level. The negative consequences of the global crisis, observed in many countries, both IT and non-IT, have given rise to voices claiming IT strategy has come to an end as a result of the global crisis. Although such statements seem to be overreactions, they can be viewed as an announcement of a change in the role of IT. Attention should be shifted from the exclusive relationship between monetary policy and inflation to the relationship between monetary policy and financial markets and their stability, such as asset price bubbles in various segments of the financial market. There are many empirical researches on the results of the IT strategy, but the crisis aspects seem to be new in the Polish literature on the subject.

To assess the effect of IT strategy I analyze the basic information and parameters on inflation. I calculate average inflation and standard deviation for all countries employing an IT strategy in order to compare inflation and its volatility before and after the implementation of an IT strategy. The time range is from the 1980s to 2011, hence my observations cover the period of the global financial crisis. Thus I additionally try to determine the effects of the crisis on IT perspectives and compare the behavior of inflation in all these countries during the crisis. Data was taken from the database indexmundi, available at: http://www.indexmundi.com/factbook/.

My hypothesis is the following: IT strategy is very helpful in bringing inflation to the desired level, and getting inflation under control, but it is not able to guarantee a stable inflation rate at a chosen level without regard to external conditions, especially in the complicated crisis environment.

2. IT strategy

Inflation targeting was introduced in New Zealand in 1990. As Murray (2006) points out, when inflation targeting was implemented in New Zealand, it was viewed as a special case, because New Zealand was a small open economy that had just announced a number of audacious reforms aiming at liberalizing the economy, both nationally and internationally. These New Zealand actions were accepted with equanimity, because New Zealand was an emerging economy, too small to cause any problems for any other country. However, when the Bank of Canada announced that it was going to follow New Zealand's lead a year later, the reaction was somewhat different and the introduction of an IT strategy in Canada was received with much less enthusiasm. Canada was quite different from New Zealand, since it was an industrialized economy with an average inflation in the 1980s of 6.5%, which in 1990 had decreased to 5%. As Murray

(2006 p. 3) notes, BIS bankers were puzzled as to why any prudent central bank would risk its reputation by accepting such an explicit obligation. However, following the Canada's successful implementation of an IT strategy, developed countries decided to adopt one as well: United Kingdom, Sweden, Australia and so on. Some researchers identified three waves in the process of IT strategy's expansion: the first wave covering years 1990-1993, when seven countries introduced an IT strategy; the second, and most numerous, wave took place in the period 1998-2002 (12 countries), and last one from 2005, when another eight countries decided to implement an IT strategy. The second wave in the process is specific, marked by the fact that a group of emerging-market economies began to adopt the strategy[1]. There are 27 IT countries[2] that currently use inflation targeting, and three other countries - Finland, the Slovak Republic and Spain – that adopted it but then abandoned it when they joined the EU. Table 1 below shows the countries currently using an IT strategy and gives data on the target inflation rate and average inflation rate in period from 1990-2008. Additionally the Table contains the data on year of adoption of an IT strategy.

Table 1. Inflation targeting countries

Country	Inflation targeting adoption date	Average inflation rate in period before IT	Target inflation rate
New Zealand	1990	10	1-3
Canada	1991	4.7	2 +/-1
United Kingdom	1992	6.5	2 +/-1
Sweden	1993	5.2	2 +/-1
Australia	1993	6.3	2-3
Czech Republic	1997	12.6	3 +/-1
Israel	1997	23.4	2 +/–1
Poland	1998	32	2.5 +/–1
Brazil	1999	657	4,5 +/–2
Chile	1999	21.5	3 +/–1
Colombia	1999	22.8	2-4
South Africa	2000	6.5	3-6
Thailand	2000	3.24	0,5-3

[1] It is worth noting that in many emerging-market economies the adoption of IT was preceded by economic reforms, although in other countries IT was introduced rapidly, as a response to financial or currency crises that caused the abandonment of previous monetary arrangements and led to the search for new nominal anchors for monetary policy (case of Brazil, Libanio 2010, p. 1).

[2] In 2012 the Dominican Republic announced the implementation of an IT strategy, but is not included in the analyses because of a lack of comparative data.

Korea	2001	5.2	3 +/–1
Mexico	2001	19.5	3 +/–1
Iceland	2001	3.2	2.5 +/–1.5
Norway	2001	2.5	2.5 +/–1
Hungary	2001	4.2	3 +/–1
Peru	2002	48.5	2 +/–1
Philippines	2002	8.9	4.5 +/–1
Guatemala	2005	6.9	5 +/–1
Indonesia	2005	8	4-6
Romania	2005	30.6	3.,5 +/–1
Turkey	2006	55.2	6.5 +/–1
Serbia	2006	9.8	4-8
Ghana	2007	18.7	14.5 +/–1
Dominican Republic[3]	2012	16.2	5.5% in 2012, 4% as the long term target +/–1

Source: Roger S., (2010) *Inflation Targeting Turns 20*, Finance & Development March, p.1, own calculations, data from indexmundio.

Table 1 shows that the countries adopting an IT strategy did it in different, sometimes opposite, conditions with regard to the rate of inflation. Some countries did it with a very low inflation rate i.e. Switzerland (0.9%), Norway (2.5%) and Iceland (3.2%), while others experienced a very high, even double or triple-digit, inflation rate, such as Armenia (710%), Brazil (657%), Turkey (55.2%) or Peru (48.5%). An even more varied situation appears when we take into account the whole inflationary history of given countries. Some of the countries had, in the period prior to adoption of an IT strategy, much higher inflation rates (even hyperinflation)[4]. Looking at the data in Table 1, one can also observe various ways of setting the target. Some countries chose a corridor, i.e. Serbia with a corridor of 4-8%, or a level with possible deviation, i.e. Poland (2.5+/–1p%), where the chosen level is 2.5% and the tolerated deviation 1% down or up. The choice of inflation target is not obvious, it is only important that it is greater than zero, and for the developed countries it is about 2%, while for the developing countries higher levels are indicated, oscillating at about 5%.

Inflation targeting is one of many monetary policy strategies. Mishkin (2001. p. 1) presents the most important features of IT strategy, distinguishing IT from other monetary policy strategies. Hence inflation targeting encompasses:

[3] The Dominican Republic's case is not analyzed in this research because the period of its IT strategy is too short to draw conclusions.

[4] More detailed analyses of IT countries inflation situation in next part of paper.

- public announcement of medium-term numerical targets for inflation;
- institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated;
- an information-inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for establishing the setting of policy instruments;
- increased transparency of the monetary policy strategy through communication with the public and the markets about the plans, objectives, and decisions of the monetary authorities;
- increased accountability of the central bank for attaining its inflation objectives.

But these features are not only characteristics of an IT strategy. According to Heintz and Ndikumana (2010, p. 6), the importance and uniqueness of IT lies in the crucial relation between strategy and inflation expectations: "If inflation targeting does not have a significant impact on expectations, inflation targeting may not be overly distinct compared to monetary policy which simply attempts to reduce inflation, or sustain inflation at low levels." As Hammond (2012, p.5) states. a major advantage of inflation targeting is that it combines elements of both rules and discretion in monetary policy, and can be therefore often characterized as "constrained discretion". An IT framework combines a numerical target for inflation in the medium term (rule) and a response to economic shocks in the short term (discretion) King (2005, p. 14).

3. Review of empirical studies on IT strategy

IT strategy works in a specific manner for a country's economic environment, while influencing the environment at the same time. Thus two types of empirical approaches can be distinguished. The first focuses on the results of IT strategy, and the second on conditions (necessary, favorable and adverse) in which IT works. IT was designed to tame inflation, so the most obvious way of empirical verification of IT is assessment of the impact of IT on inflation, its volatility, and inflation expectations in a given country. An analysis of inflation and its volatility can yield answers to questions concerning the effects and effectiveness of IT strategy. This is done by comparing inflation records of a given country or group of countries (i.e. developed and developing countries) before and after the implementation of an IT strategy. In addition to the one-country approach comparative methodology can also be used. This approach compares the achievements of an IT country with similar countries

which have not applied an IT strategy. This can help answer the question whether an IT strategy is unique and constitutes the only way of controlling inflation. Other authors deal with other problems and variables affected by IT strategy, such as the costs of deflation, conducting of monetary policy, exchange rate, sacrifice ratio, interest rate, output, financial variables, vulnerability to crisis, or current account. The second string of researches and empirical studies concentrates on the implications of some specific features of the IT regime. This investigates such factors as the influence of different degrees of central bank credibility on the trade-off between output and inflation in IT countries (Céspedes, Soto 2005) or the "fear of floating" strategy as an optimal policy in emerging market economies that adopt IT (Gallego, Jones 2005). Other issues include the pro-cyclical and asymmetric nature of monetary policy in three Latin American IT countries (Brazil, Chile and Mexico) and the implications for economic stabilization and growth in these economies (Libanio 2005), as well as the usefulness of an IT strategy for highly financially dollarised economies (Leiderman et al. 2006).

Reviews of the literature on empirical analyses of IT has been carried out by, *inter alia*, Garcia-Solanes and Torrejón-Flores (2006), Angeriz and Arestis (2007), and Hammond (2012). Garcia-Solanes and Torrejón-Flores (2006) provides a review of empirical studies on the results of IT strategy before 2006 and it may be said that the obtained results are difficult to term conclusive with respect to proving the hypothesis that IT is a conducive monetary policy strategy. In a similar vein, Angeriz and Arestis concluded that the empirical evidence available in 2007 produced mixed results, and that the case with respect to developing countries is less clear-cut. Also Hammond (2012, p. 6) states that the empirical evidence on the performance of inflation targeting is not unanimous, although he supports the thesis that IT exercises a positive impact on inflation and inflation expectations, both in industrialized and emerging market economies (EMEs).

Tables 2 and 3 below show empirical results in a synthetic way. Table 2 demonstrates the results of empirical studies supporting the hypothesis that IT is effective way of conducting monetary policy, while Table 3 concentrates on those researches questioning the above hypothesis.

Table 2. Synthetic characteristics of chosen empirical researches supporting IT

Author(s)	Year	Scope	Conclusions
Corbo, Landerrechte, Schmidt-Hebbel	2002	industrial and developing IT countries	IT contributed to improving the macroeconomic results in both groups of countries
Calderón, Schmidt-Hebbel	2003	Latin America and Caribbean countries	IT countries have been able to reduce both inflation rates and inflation-target misses systematically following adoption of the new monetary regime
Batini, Kuttner, Laxton	2005	EMEs	IT in EMEs brings about significant positive results in those countries, compared to those that follow other strategies
IMF	2005, 2006	EMEs	IT in EMEs brings significant benefits to the IT countries, compared to countries following other strategies; when IT is linked to an improvement in macroeconomic performance, it also brings about lower risk of currency crises relative to other alternative regimes
King	2005	industrial countries and EMEs	IT strategy, by anchoring expectations and enforcing credibility, reduces variability in the output gap and lowers the sacrifice-ratio
Rose	2007	IT and non-IT countries	There is very little difference between current account averages of targeting and non-targeting countries
Guillermo Ortiz Martínez	2008	Emerging economies	Once the preconditions for a stable economy are met, IT can be used to lead the economy from a high- to a low-inflation equilibrium, since the correction of fundamentals may not be sufficient to eliminate high inflation
Habermeier et al	2009	IT countries	Inflation-targeting countries appear to have done better than others in minimizing the inflationary impact of the 2007 surge in commodity prices
Carvalho-Filho	2010		The monetary policy of IT countries has appeared to be more suited to dealing with the crisis
Roger	2010	low-income IT and non-IT countries	Among low-income economies, non-IT countries experienced larger increases in inflation than IT countries, although their growth rates fell by similar amounts

Source: own elaboration.

A review of the information presented in Table 2 supports the hypothesis that IT is a good way of achieving objectives such as stabilizing inflation, eliminating inflation expectations, increasing GDP growth, or shifting the economy to a low inflation equilibrium. The conclusion that IT has a beneficial impact on improvements in overall economic performance is derived from such

observations that inflation levels, inflation volatility, and interest rates have declined after countries adopted inflation targeting, and output volatility has not worsened after the adoption of inflation targeting (Mishkin, Schmidt-Hebbel, 2007 p. 292)

Table 3. Synthetic characteristics of chosen empirical researches questioning the usefulness of IT

Author(s)	Year	Scope	Conclusions
Bernanke, Woodfort[5]	1999	developed and EMSs	IT does not make a difference in cost nor the speed of price stabilization compared to alternative regimes
Rogoff	2003		The decrease in worldwide inflation can be erroneously recognized as a result of inflation targeting
Levin, Natalucci, Piger	2004	emerging markets	IT is not associated with an instantaneous decline in private-sector inflation forecasts, especially over the long-term horizon; inflation expectations are not noticeably more volatile in non-IT vs. IT economies
Mello, Moccero	2007	Latin America	The effects of IT on both interest rates and output volatility are unclear in all analyzed countries
McDermott, McMenamin	2008	Latin American countries	There are different reactions of IT and non-IT central banks, but this has not resulted in lower inflation expectations
Walsh	2009	developed economies	Macroeconomic experiences among both inflation targeting and non-targeting developed economies have been similar
Sobrino	2010	19 IT countries	Current account balances worsen after the adoption of inflation targeting, even after accounting for global shocks

Source: own elaboration.

The results in Table 3 indicate a variety of reservations and conditions regarding the economic outcomes of IT strategies in different groups of countries. They show that IT can be treated as a cost-free way of stabilizing inflation only under certain conditions, with many claims regarding co-integrity, because the lower inflation achieved by countries using IT may be caused by domestic reforms or by conducive international conditions, which resulted in a worldwide trend of declining inflation levels and volatility, interest rates, and output volatility in the 1990s (Mishkin, Schmidt-Hebbel, 2007 p. 292). Hence IT strategy should not be considered as a unique way of achieving low and stable inflation.

[5] The volume edited by Bernanke and Woodford (2005) explores many dimensions of IT for both developed and emerging market economies.

An interesting study devoted to IT strategy was presented by Cavoli and Rajan[6] (2006), who sought to assess various configurations in the execution of IT strategy and compare them with other monetary strategies. Instead of empirical historical data, they use the open economy model to find such consequences of various monetary regimes like inflation rate and its volatility, growth rate, interest rate, and exchange rate. They distinguished six different monetary regimes, using criteria such as the way of conducting policy (simple or optimal monetary policy), the monetary policy objectives (strict or flexible policy) and the commitment of monetary authorities (committed or discretionary). Their results confirm that the most effective strategies for reducing inflation are Strict IT as committed or Strict IT as discretionary. Higher inflation and its volatility is connected with a flexible IT in an open economy, so strategy should aim at the same time at inflation, output, and the exchange rate. The results of Cavali and Rajan's research can be very helpful in assessing the meaning of various monetary regimes, while at the same time they allow us to observe the trade-off between inflation and output which is present in the IT strategies. Table 4 below presents sensitivity of output to the monetary regime.

Table 4. Ranking of the monetary strategies with respect to their impact on output

Monetary policy regimes	Standard Deviation of Output
Strict IT as Committed	13.76
Flexible open economy IT without partial adjustment	7.88
Flexible open economy IT	6.42
Strict IT	5.58
Flexible IT	4.16
Strict IT as Discretionary	3.33
Flexible IT as Committed	2.26
Flexible IT as Discretionary	1.42

Source: own elaboration based on data from Cavoli T., R.S. Rajan, (2006) Monetary policy rules for small and open developing economies: a counterfactual policy analysis, 'Journal of Economic Development', volume 31, number 1, June 2006, p. 12.

Table 4 shows that the output is most changeable in the strategy consisting of Strict IT as Committed, while the Flexible IT as Discretionary yields the smallest changes in output. Cavoli and Rajan's study confirms the usefulness of IT (in both variants; committed and flexible) in reducing inflation,

[6] Their paper uses a model calibrated from Thailand data to suit small open Asian economies like Korea, Indonesia, Thailand and the Philippines, which have promoted the use of monetary policy rules fashioned around an inflation objective.

but at the same time shows that this can be achieved at the expense of higher output volatility. A more general conclusion is: as long as inflation is under control and is in line with the short term inflation target, monetary authorities are able to react in an active way in order to achieve other objectives such as output, exchange rate, or stability of financial assets.

In order to assess the results of empirical studies and their variety it is worthwhile to note that IT strategy is usually an element of a process of reforming economic or monetary policy and making them more effective. Experience shows that in many countries (especially developing countries) IT can be regarded as the crowning culmination of a reform process. So it is not easy to isolate the effects of the application an IT strategy from the overall effects of reforms undertaken. A simplified observation about everything that happens after implementing an IT strategy can lead to an erroneous attribution of all the positive and negative processes taking place in that period to the IT strategy. So the co-integration problem makes empirical verification quite difficult, and at the same it can be a reason for the varying assessments of IT strategy reached by various authors.

4. Empirical assessment of IT with respect to the financial crisis

Here I try to compare inflation for the periods before and after the implementation of an IT strategy. The length of the analyzed periods for each country are different because of their inflation history. Especially in countries with a very high and variable inflation, analysis was made of the years before IT only with a certain stabilization of inflation, in order to compare the behavior of inflation after the introduction of IT strategy. Additionally, special emphasis is placed on the years 2007-2008.

Table 5 below provides data on the length of the analyzed periods, and the highest and lowest inflation rates in the analyzed periods. In some countries, additional observations were made, taking into account the specificity of the behavior of inflation, for example, the elimination of one-time observations which clearly deviate from the prevailing trend (an outlier). Table 6 provides data on the arithmetic average of inflation and standard deviation in both comparable periods. The arithmetic mean is aimed at showing how levels of inflation have changed, while the standard deviation is to indicate inflation variability. A high volatility of inflation can be seen as more harmful than a high level inflation. The standard deviation should be analyzed in relation to the average value, as a deviation of 1 percentage point is completely different for an average of 1 or 2% than for an average of 10%. Generally I assumed that the

lower the standard deviation is, the less variable is inflation. This means a more favorable situation for economic agents, because they can more easily build their inflation expectations and take inflation, and by extension economic policy, into account in their strategies.

Table 5. Basic data on inflation rates in the IT countries

Country	Number of years		Lowest observed inflation		Highest observed inflation	
	before IT	after IT	before IT	after IT	before IT	after IT
Armenia	13	6	-0.791	2.96	5273.449	9.02
Australia	8	19	0.99	0.25	9.08	4.63
Brazil	19	14	3.21	3.64	2951.63	14.78
Canada	8	22	3.951	0.136	5.816	2.91
Colombia	20	12	10.875	2.27	30.374	9.22
Czech Republic	6	14	8.43	0.11	22.3	6.35
Chile	12	21	9.94	-1.38	35.12	12.7
Ghana	8	5	10.15	8.7	32.9	19.29
Guatemal	4	7	5.5	1.9	8.1	11.4
Hungary	11	11	10.1	3.4	34.2	7.4
Iceland	11	12	1.49	2.05	6.8	12.6
Indonesia	15	7	3.8	3.8	12	13
Israel	11	21	16.6	-0.4	48.7	12.31
Korea	14	16	2.3	1.4	9.3	4.6
Mexico	17	8	6.9	3.4	35.1	34.3
New Zealand	9	23	2.6	-0.15	17.1	4
Norway	10	11	1.2	0.5	4.1	3.7
Peru	3	18	23.7	0.2	75.5	11.6
Philippines	9	15	2.97	2.81	18.5	9.3
Poland	8	13	11.8	0.8	70.3	10.1
Romania	8	6	9	4.84	59.1	7.84
Serbia	5	4	2.9	6.17	17.28	12.43
South Africa	9	11	5.2	1.4	9.8	11.5
Sweden	8	19	3.01	-0.27	6.6	3.44
Switzerland	7	12	0.02	-0.71	1.8	2.43
Thailand	19	11	-9.43	-0.85	7.99	5.47
Turkey	26	5	8.2	6.2	111	10.4
United Kingdom	14	17	2.5	0.87	16.85	4.5

Source: http://www.indexmundi.com/factbook/

The data contained in Table 5 shows that the in IT countries a decrease in inflation can be observed; in the years after IT lower inflation rates are usually recorded than in years before IT.

5. Brief characteristics of inflation targeters

To get a better understanding of the situation in IT countries I prepared brief characteristics of them with regard to inflation. In many cases this can be treated as an explanation of the calculus made. Additionally I focus on the inflation in year prior the global crisis, i.e. 2007, and the year 2008.

Armenia: A vast difference in data if you take into account the seven years prior to the introduction of IT, when inflation was relatively low with a standard deviation of 2.7. The inclusion of further observations aggravates the situation year by year, because there were years of very high inflation exceeding 5000%, and an increase in inflation from 4.4% (2007) to 8.9% (2008), exceeding the highest permissible level for inflation targeting by 4 percentage points.

Brazil: An undoubted success in terms of inflation stabilization, but it should be noted that before the introduction of IT Brazil had managed to reach the level of inflation which, after IT, was seen as desirable. Taking into account the period of very high inflation in the years 1987-1994 would decrease the very unfavorable data for the period prior to IT, but on the other hand repeated high inflation is the reason for its use of IT as a strategy for building confidence towards the CB. There was an increase in inflation from 2.3% (2007) to 4.4% (2008), but still within the permissible inflation targeting levels.

Canada: The years 1980-1982, with inflation in excess of 10%, were eliminated, assuming that the next period of low inflation blurred the impression and changed inflation expectations. Average inflation after the introduction of IT has decreased, but standard deviation increased, suggesting its greater volatility, but at lower levels of inflation the interpretation may be different. An increase in inflation from 2.1% (2007) to 2.4% (2008) was recorded.

Czech Republic: Rapid reduction in inflation after implementing IT (from 10.7 to 2.1%). Afterwards inflation was in the target corridor with two exceptions: 4.7% (2001) and 6.3% in the crisis year 2008, which was an increase from 2.9% in 2007.

Chile: A country with spectacular success in the fight against inflation. From 1991 Chile has recorded a systematic decline in inflation. Prior to IT there were periods of high and unstable inflation, then low inflation (average of 21% to less than 5%), with large fluctuations before (deviation of more than 6%) and

two times lower after (3.5%). Chile experienced a period of significant inflation in the crisis year 2008, as well as pre-crisis 2007, when inflation reached more than 7% compared to less than 3% in previous years (taking into account the anomaly reduces the average inflation rate by about 0.4 %; an increase in inflation from 4.4% (2007) to 8.7% (2008), exceeding the highest permissible inflation target level by 5 percentage points.

Colombia: A success story, but stabilization at a relatively high level, higher than the inflation target. An increase in inflation from 5.5% (2007) to 7.0% (2008), exceeding the highest permissible inflation targeting level by 3 percentage points.

Ghana: A county with episodes of high inflation (1981 and 1983), so IT can be view as a strategy to eliminate the burden of recurrent inflation as a result of weakness of the government, state, and policy. The period after the last episode of high inflation years (1994-1997) was not taken into account. There was an increase in inflation from 10.7% (2007) to 16.5% (2008), slightly exceeding the highest permissible inflation targeting level (by 1 percentage point).

Guatemala: a slight reduction in the average inflation, by only 0.2%, but with a quite large standard deviation, which may suggest a greater variability: an increase of 1% to 3%. Relatively little data, based on just four observations before the introduction of IT. It must be remembered inflation was unstable, usually double-digit oscillating around 10-12%, but with much higher inflation episodes of the order of 30%, for example in 1991-1992 and 1996. There was an increase in inflation from 6.8% (2007) to 11.4% (2008), exceeding the highest permissible inflation targeting level by 7 percentage points.

Hungary: Success in controlling inflation, but visible acceleration of inflation in the years of crisis. Reduced the variability of inflation from more than 7% prior IT to less than 1.2% after implementing an IT strategy. There was a decrease in inflation from 7.9% (2007) to 6.1% (2008).

Iceland: A country with a very interesting history of inflation; in the period from 1983 to 1988 it experienced extremely high and variable inflation, also with periods of deflation. The period 1988-1996 is a clear downward trend, and the year 1999 an increase. Following the adoption of IT a decline, but later a growing trend and growth in both inflation and its volatility. Taking into account only the period from 1999 clearly shows a pattern of meeting expectations with respect to IT, but the inclusion of the 1980s may suggest a different assessment, taking into account the elimination of high inflation. Recorded an increase in inflation from 5.1% (2007) to 12% (2008), exceeding the highest permissible inflation targeting level by 8 percentage points.

Indonesia: A country with relatively stable inflation in normal times, but also with periods of higher inflation, such as 1997-1999 (the Asian crisis, and inflation over 50%), or (1982-1985), and even 14% deflation. After the introduction of IT inflation did not change notably, but an increase in inflation from 6.4% (2007) to 9.8% (2008) was recorded, exceeding the highest permissible inflation targeting level by 3 percentage points.

Israel: A country with a history of very high inflation (over 300% from 1984 to 1985 and over 130% in 1980). The introduction of IT in 1992, after a period of very high inflation, has been a success, bringing inflation down to around 5% in the whole considered period after IT, and in the order of 2-3% in the last ten years, although inflation is still unstable with a high variability, ranging from -0.4% deflation to almost 5% in the crisis year of 2008 (an increase from 0.5% in 2007).

South Korea: High inflation at the beginning of the period (21% in 1980, but soon fell to a low level, already down to 3.4% in 1983. It seems that the introduction of IT lowered inflation, and variability has decreased, currently at about 1/3 of the average before IT. Recorded an increase in inflation from 2.5% (2007) to 4.7% (2008), but still within the permissible inflation targeting corridor.

Mexico: A country with a very clear success in controlling inflation. In the years 1980-1988 it had a very high and variable inflation, often exceeding 100% (1983, 1986, 1987), and then declining, only to accelerate again in 1995-1996 (the period of implementation of an IT strategy), followed by a gradual decline to the level of 4-5% in the first decade of the twenty-first century. For these years inflation has been relatively stable, with a standard deviation of 0.8%, It recorded an increase in inflation from 4.0% (2007) to 5.1% (2008), exceeding the ceiling of the corridor.

New Zealand: The first country to introduce IT (in 1990). In previous years inflation was at about 16-17%, but just before IT inflation was stabilized at around 6%. Following the introduction of IT the established level of 2% was achieved quickly, but later a decrease to zero was observed, and then fluctuations in the 2-4% corridor. A quite large 1% standard deviation, where the highest values of standard deviation are associated with the crisis year 2008 and year 2012. The increase in inflation from 2.6% (2007) to 3.9% (2008) exceeded the highest permissible inflation targeting level by almost 1 percentage point.

Norway: In the eighties Norway was experiencing relatively high inflation 14% (1981) and 9% (1987). In 1992-2001, the introduction of IT has stabilized inflation at around 2%. With the introduction of IT a year of higher inflation followed (rising to 3%), then inflation stabilized. It increased to 3.8% in the

crisis year of 2008 (from 0.7% in 2007), which may be the cause of the observed increase in the standard deviation of 0.75% to 0.95%.

Peru: Another country with a spectacular record of taking inflation under control, with very high inflation in the years 1980-1991 turning into hyperinflation (3400% in 1989). The 1992-1994 period brought inflation down to low double-digits (23% in 1994). Following the implementation of IT the next three years brought inflation to below 4%, and in the years 1999-2012 the average inflation rate was 2.6%, with a standard deviation of 1.4%. In 2008 inflation rose to about 6% (an outlier), which was an increase from 1.8% in 2007. Its elimination further improves the results of the analyzed period.

Philippines: A country with relatively stable inflation before IT, with only one period of very high inflation (1984, at 47%). Following the stabilization of inflation, another episode of high inflation occurred in 2002, and IT was introduced, followed by relatively low inflation (average 5.2%, although there was a large growth in the inflation rate in 2008 to over 9%, from 2.8% in 2007). Has a quite unstable standard deviation of 2.1%.

Poland: a country with hyperinflation and high inflation in its history (585% in 1990), but with a decline in inflation from 60% in 1991 to 7.3% in 1999, when IT was introduced. Thereafter there was a decline in inflation (average in 2001-2011 - 2.9%) as well as its variability, although still high at 2.5%. Recorded an increase in inflation in 2008 to over 4%, up from 2.8% in 2007.

Romania: In 1991 there was a sharp rise in inflation from almost zero to 125%, which after five years reached a maximum value of 250%. A decline in inflation can be observed since 1998, and the introduction of IT in 2005 continued this trend. The crisis year of 2008 marked a rise in inflation to nearly 8%, with an average of about 6% (from 4.8% in 2007).

Serbia: A country with a short history of IT. Before IT Serbia had high inflation, exceeding even 80% in 2001, then inflation decreased and stabilized, and the introduction of IT did not especially lower inflation, although within the IT period the volatility in inflation is less. There was an increase in inflation from 6.4% (2007) to 12.4% (2008), exceeding the highest permissible inflation targeting level by 4 percentage points.

South Africa: the years 1980-1989 were a period of relatively high and variable inflation - double-digit but not exceeding 20. In 1999-2001 inflation stabilized at a 5-6% level, which was not maintained thereafter. Since then inflation has increased and has become more unstable, with periods of both deflation and inflation, with a recorded high inflation in 2008 at 11.5% (increase from 7.1% in 2007).

Sweden: This country adopted IT quite early, in 1993. In the early 1980s it had a relatively high inflation of about 18%, but this was reduced to 3% in 1986, after which it began to rise, exceeding 4% for a few years. This period ends with the introduction of IT, and from that time on inflation has not exceeded 4%. It did increase in 2008 to more than 3%, while the average for the period prior was 1.4%. The standard deviation is slightly differentiated (1.14% before and 1.02% after), which may suggest even more volatility of inflation during the IT period.

Switzerland: Looking at its history of inflation it can be said that before the year 2000, and particularly in the period 1980-1995, Switzerland was a country with a very unstable inflation rate, albeit at a relatively low level. It reached a level of about 6% (years 1981 and 1991), but in between, in the year 1986, it dropped to a level of 0.75%. After the introduction of IT it experienced low and stable inflation, which was clearly disturbed in the 2008-2009 crisis years, when it experienced both deflation and inflation accelerated above average (an increase in inflation from 0.7% (2007) to 2.4% (2008). The standard deviation of the IT period is higher, which may indicate a greater variability of inflation.

Thailand: An Asian country with a relatively stable inflation rate in the years 1982-1999. Before the introduction of IT, the average inflation rate in the period was 3.24%, (or 4.02% if we eliminate from analysis the Asian crisis year of 1990, which saw a nearly 10% deflation). During IT the average inflation has been 2.7%, although it reflects a clear rising trend and inflation is currently close to 4%. The crisis year 2008 had a substantial effect on inflation, when it increased to over 5% from 2.3% in 2007. There was also an almost one percent deflation in 2009. One can assume that IT has not contributed significantly to the decline in inflation (after a period of low inflation, it has returned to the pre-IT level) nor to reducing variability.

Turkey: A country with a very high and variable inflation before IT. Following the introduction of IT there has been a clear stabilization at a relatively high (but in Turkish terms low) 8% inflation rate. It has high stability, and experienced a decrease in inflation from 8.8% (2007) to 6.3%, but there are too few observations to appraise the effects and effectiveness of IT in Turkey.

United Kingdom: Before 1993 inflation was quite high, but with observed periods of accelerating inflation and deflation. After the IT period it experienced stable and low inflation, but in the years 2008-2010 a marked change in the behavior of inflation occurred, with fluctuations of 2 to 3 percentage points, and an increase in inflation from 2.3% (2007) to 3.6% (2008), slightly exceeding the highest permissible inflation targeting level.

Table 6. Selected statistical parameters of inflation in the IT countries

Country	average inflation		standard deviation		other data	
	before IT	after IT	before IT	after IT	before IT	after IT
Armenia	710.7	5.84	1645.516	2.26	2.341 (average inflation for prior 7 years)	2.5
Australia	6.3	2.7	2.6	1.2		
Brazil	657.5	6.5	912.4	2.6	5,09(average inflation for prior 2 years)	
Canada	4.7	2.0	0.6	0.7		
Colombia	22.8	5.7	4.7	1.9		
Czech Republic	12.6	2.7	4.8	1.5		
Chile	21.5	4.9	6.7	3.5		
Ghana	18.7	13.2	7.8	4.0		
Guatemala	6.9	6.4	1.0	2.9		
Hungary	21.2	5.1	7.2	1.2		
Iceland	3.2	6	1.6	3.2		
Indonesia	8	7.2	3.1	3.2		
Israel	23.4	5.5	11.1	4.4		
Korea	5.2	3	2.1	0.9		
Mexico	19.5	8.7	9	8.15		SD in 2001-12 0,8
New Zealand	10	2.2	5	1		
Norway	2.5	1.9	0.7	1		
Peru	48.5	4.3	20.4	3.4		
Philippines	8.9	5.2	3.8	2.1		
Poland	32	3.8	17.5	2.5		
Romania	30.5	6.12	77.31	0.9		
Serbia	9.8	9.4	4.5	2.5		
South Africa	6.5	5.9	2.3	1.4		
Sweden	5.2	1.4	1.14	1.02		
Switzerland	0.9	0.7	0.6	0.77		
Thailand	3.2	2.8	3.6	1.8	(4,02), 2 (without data for 1990)	
Turkey	55.2	8.1	27.1	1.6		
United Kingdom	6.5	2.1	3.7	0.9		

Source: own calculations based on data from indexmundi: http://www.indexmundi.com/factbook/

Observing the data in Tables 5 and 6 and analyzing the characteristics of IT countries. it appears that the IT strategy is in many cases associated with decreased inflation and a reduction in its volatility. Spectacular performers are countries such as Armenia, Brazil, Peru, Philippines, Turkey and the European countries, where inflation fell from double digits to single digits, often of only a few percent. The most spectacular results were achieved by Brazil, where inflation fell from 657% to 6.5%, and Armenia, where the difference between average inflation before and after implementing IT is more than 700%. But the inability of IT in some countries to achieve the desired level of inflation and its variability seems to suggest that an IT strategy is not a guarantee for stabilizing inflation. With respect to the impact of the financial crisis, one can note that in almost all IT countries an increase in inflation was observed, with decreases occurring in only two countries (Hungary and Turkey). What's more, in some countries the inflation rate exceeded the highest permissible inflation targeting level. So IT failed to keep inflation along the desired path, although some have suggested that inflation-targeting countries have done better than others in minimizing the inflationary impact of the crisis of 2008 (Habermeier et al. 2009 p. 29).

6. Conclusions

IT strategy seems to be an attractive way of conducting monetary policy because of its simplicity on one hand, and on other owing to the belief that monetary policy can be reduced to getting inflation under control. Low and stable inflation creates a good framework for domestic agents, as well as external investors. IT strategy seems to have different meanings for different countries. Some implemented it after achieving low inflation and the strategy was to confirm to all agents that the central bank is committed to maintain this level, while for others IT is a way to achieve the desired level of inflation and its variability. So the most interesting question is whether IT is itself a strategy of building a low and stable inflation rate, or whether it is only a confirmation of reforms and adjustments aimed at removing the structural, economic and sometimes social and institutional causes of inflation. The type of analysis done in this paper is not able to answer this question. It does however permit the conclusion that an IT strategy is associated with a decrease in inflation and in its volatility, and in some countries, like Brazil or Armenia, spectacular outcomes can be observed. But other countries have not achieved the desired inflation level yet. IT has turned out not to be a guarantee of low and desired inflation levels, because in times of crisis an increase in inflation took place in almost all IT countries. What's more, in some countries the inflation rate exceeded the

highest permissible inflation targeting level. The question is whether this is a consequence of intentional loosening of monetary policy aimed at avoiding a decline in GDP, or whether it is the result of the central bank's inability to control inflation using the tools available to it in the case of an external origin of inflation and the stimuli of the world economy. In both cases the answer can be used as an argument for changing IT strategy. It may suggest that IT is oriented too one-sidedly, or that it is in general an ineffective monetary strategy because is not able to achieve aims. The IT strategy seems to be a good monetary policy for stable times however.

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Streszczenie

EMPIRYCZNA OCENA STRATEGII CELU INFLACYJNEGO (ANALIZA WYBRANYCH DANYCH EKONOMICZNYCH)

Strategia celu inflacyjnego jest jedną z wielu strategii monetarnych, charakterystyczne dla nie jej koncentracja na inflacji jako zmiennej ekonomicznej, którą bank centralny może zarządzać i jednocześnie przekonanie, że inflacja jest tak istotna dla podmiotów gospodarczych i gospodarki, że można za jej pomocą wpływać na zachowania podmiotów. Celem zarządzania inflacją w strategii celu inflacyjnego jest sprowadzenie i utrzymywania jej na wybranym pożądanym poziomie. Celem artykułu jest weryfikacja empiryczna, czy strategia celu inflacyjnego okazała się być skuteczna w osiąganiu celu, jaki przed nią się stawia oraz czy możliwość realizacji tego celu jest uzależniona od warunków zewnętrznych, jakim jest kryzys globalny. Analiza obejmuje wszystkie kraje stosujące strategię celu inflacyjnego i obejmują lata 1990-2010. Poczynione badania pozwalają wyciągnąć wniosek, że obserwacja sytuacji inflacyjnej przed i po wprowadzeniu strategii celu inflacyjnego wskazuje na spadek inflacji i jej zmienności po wprowadzeniu strategii. Nie można jednak jednoznacznie mówić o zależności przyczynowo-skutkowej. Obserwacja zachowania inflacji w krajach celu inflacyjnego w czasie kryzysu globalnego wskazuje, że z reguły nie udało im się utrzymać inflacji na wcześniejszym poziomie, a niejednokrotnie inflacja przekroczyła dopuszczalne zakładane poziomy. Pytanie jest czy jest to efekt odejścia od zobowiązań zawartych w strategii, czy też niemożności jej realizacji. W obu przypadkach może to wskazywać na nieadekwatność strategii celu inflacyjnego w sytuacji globalnego kryzysu ekonomicznego i przynajmniej na konieczność jej modyfikacji.