Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

RIGOROUS THESIS

Inflation targeting and inflation perceptions: an empirical analysis.

Author: **Kateřina Klubíčková**

Supervisor: **doc. Roman Horváth, Ph.D.**

Academic Year: **2013/2014**

Bibliographic record

Klubíčková, K. (2013). *Inflation targeting and inflation perceptions: an empirical analysis*. (Rigorous thesis). Charles University in Prague.

Volume: 109 140 characters

Declaration of Authorship

I hereby declare that I compiled this thesis independently under the guidance of my supervisor, using only the listed resources and literature.

I hereby declare that this thesis was not used to obtain another degree.

I grant the Charles University permission to reproduce and distribute copies of this thesis document in whole or in part, provided I am credited as the author per generally accepted citation standards.

Prague, 2 August 2013

Kateřina Klubíčková

Signature

Acknowledgments

I would like to express my deepest gratitude to the thesis supervisor, doc. Roman Horváth, Ph.D., for his patience, support and priceless guidance. Apart from that, I would like to thank P. Polák for advice regarding MS Excel functions and N. Klubíčková for valuable comments.

Abstract

In this thesis we examine the effect of introduction of inflation targeting as a monetary policy regime on the difference between actual inflation and perceived inflation. Perceived inflation is used in the analysis in contrast with previous research, because inflation perceptions are extracted from consumer surveys conducted in individual European Union countries on the whole population sample and thereby enable us to examine the effect that the introduction of inflation targeting has across the whole population.

A panel data set of 19 European Union members and 1 candidate, including 7 inflation targeters, is used in the analysis, with monthly information from the period beginning in January 1990 and ending in December 2012.

Based on the analysis using fixed-effects model with specific dummy variables to capture the difference-in-differences element, we find that inflation targeters experience lower differences between actual and perceived inflation and that the difference between actual and perceived inflation decreases after the introduction of inflation targeting. Furthermore, various groups divided according to socio-economic characteristics of the consumer survey respondents tend to be affected in a different way by the introduction of inflation targeting, although to a limited extent.

JEL Classification	E31, E52, E58, C23
Keywords	inflation targeting, perceived inflation, difference-in-differences, socio-economic characteristics

Author's e-mail	k.klubickova@gmail.com
Supervisor's e-mail	roman.horvath@gmail.com

Abstrakt

V této práci zkoumáme vliv zavedení inflačního cílování jako režimu monetární politiky na rozdíl mezi skutečnou a vnímanou inflací. Na rozdíl od předchozích výzkumů používáme vnímanou inflaci, protože je získávána ze spotřebitelských průzkumů prováděných v jednotlivých zemích Evropské unie na vzorku celé populace, a tudíž nám umožňuje analyzovat efekt zavedení inflačního cílování napříč populací.
V práci používáme panelová data sestávající z 19 členů Evropské unie a 1 kandidátské země, včetně 7 zemí provádějících inflační cílování. Panel obsahuje měsíční data z období, které začíná lednem 1990 a končí prosincem 2012.
Na základě analýzy s použitím modelu fixních efektů se speciálními dummy proměnnými pro zachycení efektu rozdílu v rozdílech jsme zjistili, že v zemích cílujících inflaci je menší rozdíl mezi skutečnou a vnímanou inflací a že po zavedení inflačního cílování dochází k absolutnímu zmenšení tohoto rozdílu. Kromě toho jsou jednotlivé skupiny rozdělené na základě socio-ekonomických charakteristik respondentů spotřebitelských průzkumů zavedením inflačního cílování ovlivněny různým způsobem, ačkoli se velikost rozdílů liší pouze do jisté míry.

Klasifikace E31, E52, E58, C23

Klíčová slova inflační cílování, vnímaná inflace, rozdíl v rozdílech, socio-ekonomické charakteristiky

E-mail autora k.klubickova@gmail.com

E-mail vedoucího práce roman.horvath@gmail.com

Content

List of Tables

List of Figures

List of Abbreviations

BS Balance Statistic

CPI Consumer Price Index

CZK Czech Crown

DM German (Deutsche) Mark

EU European Union

EC European Commission

ECB European Central Bank

HICP Harmonized Index of Consumer Prices

IPI Index of Perceived Inflation

IT Inflation Targeting

OLS Ordinary Least Squares

1. Introduction

Consumer surveys often show discrepancies between actual and perceived inflation. Yet it is the subjective perception of inflation that affects real behaviour of economic agents. That is the reason why it is extremely important for economists as well as policy makers to examine and measure inflation perceptions and their relationship with actual, i.e. officially reported, inflation. According to Aucremanne et al. (2007), Leung (2009), Bryan and Venkatu (2001), Del Giovane and Sabbatini (2006) or Döhring and Mordonu (2007), inflation perceptions differ across socio-economic groups, depending e.g. on the goods and services included in individual consumption baskets of consumers, the groups' financial literacy or the reference prices the consumers use. General conclusion of the researchers is that higher perceived inflation has been observed among the youngest and oldest age groups, women, low-income, less-educated groups or people with non-white ethnicity.

Several countries all over the world have adopted a specific approach of monetary policy, so called inflation targeting, which is based on committing to controlling inflation and achieving a certain explicit inflation target. Through inflation targeting, central banks communicate their goals more transparently and with greater degree of accountability and credibility. These factors should help the public get more accurate idea about the actual level of inflation and thereby possibly reduce the difference between actual and perceived inflation.

Even though inflation targets may help the public realise the true level of inflation more accurately if the target is credible enough and thereby mitigate the difference between perceived and actual inflation, there has been a striking lack of focus on the impact of the introduction of inflation targeting on the development of perceived inflation. Economists' attention has mainly focused on examining the difference between actual and perceived inflation and possible determinants of such difference, mostly in connection with the introduction of the euro currency in individual European countries, as well as on the reasons for different inflation perceptions across socio-economic groups.

For this thesis, we got inspired by the work of Johnson (2002), Levin et al. (2004) and Capistran and Ramos-Francia (2007). These authors studied the relationship between expected and actual inflation in connection with adoption of inflation targeting. They all came to the conclusion that introduction of inflation targeting as a monetary policy regime usually leads to a reduction in the level of expected inflation and anchoring of inflation expectations. As we have already mentioned, inflation targeting has some characteristics that could lead to a similar development in the relationship between perceived and actual inflation after its adoption.

The aim of this thesis is thereby to examine the impact of the adoption of inflation targeting on the relationship and discrepancy between actual and perceived inflation and how this impact differs across various socio-economic groups (divided by age, sex, education and income), as this topic has not been discussed in the literature so far. Previous research focused on the relationship between inflation targeting and inflation expectations, but inflation expectations are mostly extracted from surveys conducted among a narrow group of professional forecasters (this is e.g. the case of Johnson, 2002; or Capistran and Ramos-Francia, 2007). On the other side, inflation perceptions are extracted from consumer surveys, where a large sample of respondents represents the whole population of a certain economy. This is the reason why we focus on inflation perceptions, because by looking at the relationship between actual and perceived inflation, instead of expected inflation, we can get a much wider perspective on how the whole population's perceptions about inflation are influenced by the introduction of inflation targeting.

For the assessment, we used data about actual inflation from the International Monetary Fund International Financial Statistics and perceived inflation data from the Joint Harmonised European Union Programme of Business and Consumer Surveys published regularly by the European Commission. These surveys contain data from several countries that have adopted an inflation target as well as from a control group of countries without the inflation target. From this data, we created a panel data set that is further used for analysis. The data set is unbalanced, as data for individual countries begin in different time periods.

In the empirical analysis, we used a difference-in-differences model applied on the unbalanced panel data set in order to first examine whether the introduction of inflation targeting has an impact on the difference between perceived inflation and actual inflation and second examine whether the size of the impact is in some way influenced by various socio-economic characteristics of the survey respondents.

At the beginning of the empirical analysis, we calculated a simple correlation between the actual and perceived inflation for inflation-targeting countries before and after the introduction of inflation targeting. Except for Hungary, the correlation coefficient for all countries from the periods after the introduction was higher than 50 %, which points to a rather strong relationship between perceived and actual inflation. Moreover, for all countries for which the data before and after inflation targeting introduction are available, again except for Hungary, the correlation coefficient increased with the adoption of this regime.

Afterwards, we focused on the size of the difference between actual and perceived inflation (a so called inflation gap) in the periods following the introduction of inflation targeting for inflation

targeters and non-targeters. The inflation gap was always remarkably smaller in targeting countries than in non-targeting ones.

We further performed a fixed-effects model regression containing dummy variables to capture the difference-in-differences factor using the total data on actual and perceived inflation. From the obtained results, we can conclude that the coefficient of $ITactive$ which describes the impact of the introduction of inflation targeting on the inflation gap, was statistically significant at the 5% level of significance and at the 1% level of significance when average European inflation was included into the model as an additional explanatory variable. It had a negative sign, which was in line with our expectations – the introduction of inflation targeting leads to a decrease of the inflation gap.

Afterwards, we did the regressions using data containing various socio-economic characteristics of individual respondents. The results showed that the impact of inflation targeting introduction truly was heterogeneous across different socio-economic groups, although the calculated size of the impacts within individual groups did not differ drastically (it was always in the order of units). Moreover, the coefficient capturing the effect of inflation targeting introduction was statistically significant in all models at least at the 5% level of significance and always had the expected negative sign, which confirmed the results obtained from the regression using total-economy data.

Finally, given that values of perceived inflation range from -100 to +100, whereas values of actual inflation are usually relatively small positive numbers, we transformed the actual inflation data, so that they would fall into the interval from -100 to +100 (i.e. be directly comparable to the perceived inflation data). Using this data set, we again calculated the difference between perceived and actual inflation and used this alternative inflation gap in our analysis. The sign of the coefficient of $ITactive$ remained negative, although the coefficient itself turned insignificant in this additional regression.

The reminder of this thesis is organised as follows. Part 2 provides a summarizing review of existing research, part 3 describes different approaches to perceived inflation measurement, part 4 explains used data, part 5 provides details about hypotheses and used methodology, part 6 presents the results, part 7 concludes and sources are listed in part 8. Appendix A contains tables with results of the empirical analysis and Appendix B consists of graphs showing the development of perceived and actual inflation.

This thesis is based on the author's master thesis defended at the Institute of Economic Studies, Charles University, in June 2013. Opponents' and reviewers' comments have been taken into

account and implemented into the thesis. Adjustments made to the original master thesis include mainly conducting Wald (F) test and Breusch-Pagan LM test for the appropriateness of using panel data approach, as advised by the reviewers.

2. Literature review

2.1. Perceived inflation, its relationship with actual inflation and factors behind the inflation gap

In the past years, the issue of perceived inflation and its difference from the actual (observed) inflation has attracted a lot of economists' attention. Consumer surveys show that the actual inflation expressed by price indices, such as CPI (Consumer Price Index) or HICP (Harmonized Index of Consumer Prices), can often be remarkably different from the level of inflation subjectively perceived by individual economic agents. Yet it is this subjective perceived inflation that agents rely on when making decisions about their economic activity, as most people do not search for official data about the current level of inflation on a regular basis. The gap between perceived and actual inflation (a so called inflation gap) can also lead to undermining the credibility of a country's monetary policy. Another unfavourable consequence of a large inflation gap is that economic agents cannot assess prices correctly, which has a negative impact on the allocation efficiency of the price system (Brachinger, 2006). Sturm et al. (2009) warn against the ability of inflation perceptions to deteriorate inflation expectations, which can in turn have consequences for wage claims and decisions about investment. High perceived inflation can also lead to an underestimation of the purchasing power and consequently to a reduction in households' spending.

All these facts make it very important for economists as well as for policy makers to focus on measuring perceived inflation, comparing its level to the development of actual inflation and trying to keep the inflation gap as small as possible (Diaz et al., 2009).

An important discussion about the issue of the difference between perceived and actual inflation started during the introduction of the single European currency (the euro) on January 1, 2002, when most of the countries that changed their national currencies for the euro reported an unexpected increase in the level of perceived inflation (ECB, 2007), even though the aggregate levels of actual inflation were mostly unaffected by the euro-changeover (Sturm et al., 2009; Brachinger, 2006). Consequently, a number of economists have focused on the difference between perceived and actual inflation, on its possible determinants as well as on factors influencing the difference. Some of the theories are connected directly with the euro-changeover, but most of them can be used to describe the development of inflation perceptions in general.

Brachinger (2006) described how inflation perceptions are generally created. First, consumers tend to compare prices of goods and services to so called reference prices/points (a reference price is a price considered by consumers as reasonable for a given type of product; it is usually influenced by past development of the product's price, by prices of the product's substitutes etc.) and afterwards feel the differences between actual prices and reference prices as gains (in case when the prices are lower than the reference prices) or losses (in case when the prices are higher than the reference prices). Second, the gains and losses are not evaluated equally - consumers perceive increases in prices (losses) much stronger than their reductions (gains); according to Brachinger (2006), an increase in price has twice as strong an impact on perceived inflation as a reduction in price. This evaluation is performed by the consumer for every price change she faces. Third, price changes are assessed by the consumer in the moment of purchase, which means that the more often the consumer purchases certain goods and services, the more often she feels their price changes. That is the reason why people are more affected by prices of goods and services they purchase more often (such as food or clothing). Accordingly, the higher the frequency of the consumer's confrontation with price increases, the higher her perceived inflation. Analogically, if the consumer is confronted with a reduction in price of rarely purchased goods, her inflation perceptions will in most cases remain unaffected.

In his paper, Brachinger introduced a so called Index of Perceived Inflation (IPI), which is based on the three mentioned factors affecting price perceptions. Unlike the Balance Statistic (BS), a widely used qualitative measure of perceived inflation based on data from consumer surveys, IPI is based on official data about inflation.

Hoffmann et al. (2006) reacted on Brachinger's work by critically studying the assumptions that according to Brachinger influence the creation of inflation perceptions. They claim that the assumption of price increases having twice as strong an impact on perceived inflation as price reductions leads to a systematic overvaluation of price increases. The consumer will perceive higher prices even if a price of one product rises by the same amount as a price of another product decreases (e.g. if the price change is CZK 100, we will have 2 x 100 (price increase) – 1 x 100 (price decrease) = 100 (which means an overall increase of the price level). The assumption that perceived inflation depends on the frequency of purchases is criticised, because the authors find a discrepancy between the frequency weights used by Brachinger in the formulation of his IPI and the traditional share of expenditures on given goods. They support this argument by giving an example – 10 most important (officially used) items for the creation of a consumer price index represent 40% share of the total expenditures on consumption, but only 7% share in

IPI. They also criticise Brachinger for assigning too little weight to large but seldom purchased items.

Badarinza and Buchmann (2009) focused on the role of media coverage in the process of creation of public opinion about price developments. Through media, information can reach more people, which leads to a limited heterogeneity of opinions among the public (people agree with each other more, because they create their opinions based on the same media source), but on the other hand the information provided by the media enable people to create more accurate opinions and predictions about the future, which consequently mitigates deviations in expectations and perceptions of the reality. Badarinza and Buchmann (2009) kept track of the number of articles in the newspapers and on the internet that contained the word "inflation" in the headline or in the main paragraph and compared this number to the overall amount of articles in the economy-related section. They found a negative relationship between the amount of the news about inflation and the difference between perceived and actual inflation and confirmed their hypothesis that an increasing number of news about inflation reduces the heterogeneity of beliefs about inflation.

Sturm et al. (2009) found that the intensity with which the media report about inflation and price changes is connected with the creation of inflation perceptions in an asymmetric manner. Reports about rising prices have on average a much larger effect on perceived inflation than news about falling prices.

The impact of media coverage was also examined by Hoffmann et al. (2006), in this case in connection with the euro-changeover. The authors claim that the media often warned against increasing prices after the introduction of the single currency and a lot of people built their inflation perceptions based on these warning reports.

Duffy and Lunn (2010) focused on the possibility that inflation perceptions were affected by inflation expectations. They examined whether individuals who expect an increase in prices afterwards perceived higher inflation, being affected by their beliefs. Yet this hypothesis was not confirmed, as the authors did not find a relationship between expected and perceived inflation. Döhring and Mordonu (2007) supported this result by claiming that expected inflation had only a limited effect on the creation of inflation perceptions.

Different results were obtained by Traut-Mattausch et al. (2004). By conducting an experiment, the authors studied if the expected increase in prices after the euro-changeover somehow influences the level of perceived inflation. Participants of the experiment were divided into three groups and were given two restaurant menus – one had prices in German Marks (DM) and the

other in euros. For the first group of participants, all prices were converted from DM to euros in using the correct exchange rate, for the second group using an exchange rate that was by 15 % lower than the correct one and for the third group using an exchange rate that was by 15 % higher. The participants were asked to estimate the percentage difference between the prices in DM and in euros. In all groups, the result was that all estimations were biased towards price increases; i.e. people claimed that prices were increased when the conversion rate was correct and unbiased, that prices remained the same when they actually decreased and in the case when prices were increased, people felt even higher increase. Traut-Mattausch et al. (2004) assigned this difference between reality and price perceptions to changes in expectations – when people believe in price increases after the euro-changeover, they are more likely to succumb to this belief and perceive higher inflation afterwards. The more pessimistic people are about future development of inflation, the higher their overestimation of inflation. The authors explained this phenomenon by a "selective error correction" hypothesis. The hypothesis is built upon the assumption that consumers perform numerical calculations while evaluating price changes and that there are very strong expectations connected to the results of these calculations. The results which are in line with the expectations are not further examined by the consumer and are accepted. Yet, the results which are in some way different from the expectations are under further inspection and are sometimes even recalculated. That is the reason why confirmations of wrong expectations are often neglected, but results which are not in line with expectations are mostly re-evaluated.

Many authors (such as Brachinger, 2006) claim that inflation perceptions are formed on the basis of frequently purchased items – people are very likely to feel that the price of food has increased, because they are confronted with this change rather often, but they are much less likely to realise that the price of a television or a car has decreased, as they do not purchase such items frequently. Döhring and Mordonu (2007) examined this hypothesis using the index of out-of-pocket expenditures, which includes expenditures for food, beverages, tobacco, transportation etc. Yet the authors came to the conclusion that the index of out-of-the-pocket expenditures does not explain the inflation gap any better than the general HICP. Aucremanne et al. (2007) confirmed this conclusion.

Further, some authors have focused on the influence of house price developments on inflation perceptions. Döhring and Mordonu (2007) found residential property prices as relevant for the formation of inflation perceptions. According to them, households have a broader view of the overall costs of living and include residential prices into their inflation perceptions. They also point out that if residential property prices increase, property owners can feel wealthier (a so

called wealth effect) and as a consequence, their perceived inflation could be lowered by this factor.

Aucremanne et al. (2007) assessed whether it makes any difference if we compare perceived inflation to actual inflation measured by HICP (which is available since 1996) or by CPI (which is available since 1986). Most studies use the comparison of perceived inflation with HICP, because for the European Union, HICP provides comparable measures of consumer price inflation and is thereby used for cross-country analysis. They claimed that we have to take into account that consumers might create their inflation perceptions based on CPI and not HICP, which might have an impact on the size of the inflation gap. Yet the authors found analogical results when comparing perceived inflation to actual inflation measured by HICP and by CPI.

D'Elia (2005) suggested that the inflation gap should be bigger when firms have strong market power and lower when there is an improvement in market efficiency (e.g. during public information campaigns or as a consequence of some competition-strengthening measures).

Ranyard et al. (2008) focused on the price knowledge of consumers and their ability to recall past prices, besides offering a summary of previous research regarding perceived inflation. The authors found that consumers posses only a limited ability to accurately recall both current and past prices, which consequently influences inflation perceptions. The authors also offer a summary of previous research on perceived inflation.

2.2 The impact of socio-economic characteristics on the inflation gap

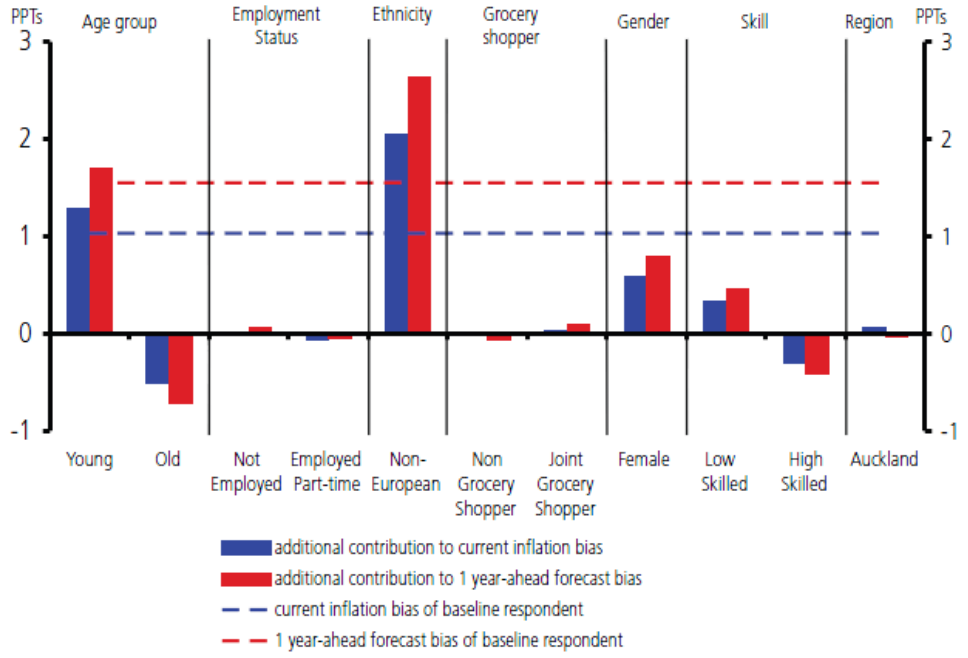
In this chapter, we focus on the influence of socio-economic characteristics in more detail, because we are going to examine this influence further in our own analysis.

Döhring and Mordonu (2007) as well as Aucremanne et al. (2007) studied whether inflation perceptions somehow depend on the socio-economic characteristics of economic agents. They found that different socio-economic groups experienced different levels of perceived inflation. Higher perceived inflation was observed among elderly people, women, low-income or less-educated groups. The reason for heterogeneous inflation perceptions among various socio-economic groups is that their individual consumption baskets might be different from the official consumption basket that is used for measuring HICP, respectively CPI, or that certain goods and services might have different weights in their individual consumption baskets (people have heterogeneous consumption patterns). Also, Aucremanne et al. (2007) claim that e.g. women might have higher inflation perceptions, because they are usually in charge of daily shopping and are thereby more often confronted with price changes. The reason for higher perceived inflation

of low-income groups is that they spend a larger proportion of their income on basic necessities, such as food, than wealthier individuals.

Leung (2009) examined how biases in inflation perceptions are created, because any bias can distort households' decision making in the economy. Her results show that women tend to perceive higher inflation than men, people with higher income and higher skills, as well as people with European ethnicity have a lower inflation bias. Besides, Leung found that young people (under 25 years) have a higher inflation bias than people aged 25 and over. Together with the results of Aucremanne, et al. (2007), we can conclude that there is a U-shaped relationship between age and the level of perceived inflation – young people under 25 years of age tend to have higher perceived inflation which decreases as they grow older, but when they become elderly, perceived inflation tends to rise again. The following figure illustrates how different socio-economic characteristics contribute to the inflation bias.

Figure 1: Contribution of key demographic characteristics to inflation perception bias.



Source: Leung (2009).

Bryan and Venkatu (2001) also point out that the way in which individuals estimate inflation is significantly and systematically linked to their demographic characteristics. They reported higher perceived inflation for people with low incomes, non-white ethnicity and for younger people (in this case compared to middle-aged individuals); these results are similar to those of Leung (2009). Moreover, they found that married people have lower perceived inflation than single people. The main finding of Bryan and Venkatu (2001) is that men have lower perceived inflation than women. A simple explanation offered for this phenomenon might be that men usually have

higher education and income than women, which is connected with lower perceived inflation (as already mentioned). Yet even when the authors held constant age, income, education, race and marital status, men perceived lower inflation than women. Bryan and Venkatu (2001) do not find any convincing evidence that this is caused by different structure of men's and women's shopping baskets, the frequency of their shopping or their knowledge of official reporting statistics (such as CPI or HICP), but are unable to find the true factor behind the phenomenon.

Another paper covering the topic of demographic characteristics and their influence on inflation perceptions is that by Del Giovane and Sabbatini (2006). Authors also claim that consumption baskets of individuals differ from the average basket used for the calculation of the actual, official, rate of inflation based on their specific social and economic situation - for example in wealthier individuals' consumption baskets, both essential and non essential items are significant, whereas less well-off individuals spend most of their income on essential items. If price of an essential items changes, it will therefore have a larger effect on perceived inflation of a less well-off individual.

Del Giovane et al. (2008) arrive at similar results as Bryan and Venkatu (2001) - they found that higher perceived inflation is much more likely felt by women (twice as many women as men report higher perceived inflation compared to actual inflation), people with lower education (up to secondary school) and those who are unemployed. According to the authors, inflation perceptions are also linked to people's professions; students, housewives or unemployed report higher perceived inflation, while retailers or entrepreneurs have lower perceived inflation. Moreover, individuals in financial distress (those who have loans etc.) often perceive higher inflation levels.

2.3 Inflation targeting

Inflation targeting is a monetary policy based on announcing explicit quantitative targets for inflation and explicit public commitment to controlling inflation as the primary policy objective. It also strongly emphasizes policy transparency and accountability. According to Hammond (2012), at the start of 2012 twenty seven central banks were considered fully fledged inflation targeters, and several others were in the process of establishing a full inflation-targeting regime. Besides that, a number of other economies have adopted some elements of inflation targeting and implemented them into their monetary policy. According to Roger (2010), since New Zealand adopted inflation targeting in 1990, the framework has developed in two important aspects. First, there has been an increase in the transparency of this policy and communication of the monetary policy authorities with the public. Inflation targeting central banks usually publish

reports about the development of inflation and the implementation of monetary policy as well as minutes from their policy meetings. Second, central banks have been focusing on flexible form of inflation targeting, i.e. not strictly achieving the inflation target at all times, but also focusing on other objectives, such as the development of output.

According to Roger and Stone (2005), levels and ranges of inflation targets tend to be quite similar across countries - medium-term targets for 12-month inflation rates are usually between 1 and 3 % (always measured by CPI) and ranges are usually 2 percentage points wide.

According to Johnson (2002), countries adopt inflation targeting due to a number of reasons: they want 1) to communicate their monetary policy goals more clearly with the general public, 2) to create accountability for the achievement of the determined goals and 3) to influence expected inflation. Another reason for adoption of inflation targeting is the desire to reduce actual inflation (Mishkin and Schmidt-Hebbel, 2002). According to the authors, inflation targeting has often been adopted by countries that on average experience higher levels of inflation and inflation targeting has indeed helped them reduce inflation during or shortly after the implementation of inflation targeting regime.

According to Svensson (1997), one of the most important advantages of inflation targeting adoption is monetary policy focusing directly on achieving low and stable inflation expressed by a specified quantitative target. Such target enables the public to directly evaluate the performance of monetary policy by comparing the realised inflation to the inflation target. Moreover, it provides an easy measurement of the credibility of monetary policy by comparing expected inflation to the target. Such an easy evaluation of the monetary policy increases its accountability.

According to Roger and Stone (2005), the target ranges serve as a threshold for policy accountability, because when the inflation rate moves outside the range, standards of accountability of the monetary policy are usually tougher than when the inflation is inside the range, and the central bank has to face much more pressure to explain whether there has been a failure of the policy and what should be done in order to bring the inflation rate back into the range.

A lot of economists analysed economic performance of targeting countries before and after the inflation targeting introduction and compared them to non-targeting countries. A general overview of the experience with inflation targeting regime is presented by Mishkin and Schmidt-Hebbel (2002). According to this overview, inflation targeting has been successful in comparison to both inflation targeters' pre-targeting experience and alternative monetary policy regimes in

improving economic performance of the economy and in controlling inflation levels, although much still remains to learn about how to best operate this monetary policy regime.

Roger (2010) found that inflation targeting reduces volatility in output and inflation and that the countries which adopted inflation targeting performed better regarding reductions in inflation rates and improvements in average output growth rates than non-targeters. These results are similar to those of Mishkin and Schmidt-Hebbel (2002) who confirm reduction in output volatility and major progress in reducing inflation after the adoption of inflation targeting in most countries. Moreover, Mishkin and Schmidt-Hebbel (2002) found strong evidence that inflation as well as inflation expectations tend to be more stable in targeting economies and are less vulnerable to increases during expansions of the business cycle.

Crowe (2010) built his research upon the general consensus that inflation targeting increases transparency of monetary policymaking. He defines transparency as the removal of information asymmetries, e.g. between the central bank and the private sector, and examined whether inflation targeting helped the private sector to better predict inflation. He came to the conclusion that adoption of inflation targeting lead to improved inflation forecasts of the private sector conditional on the initial forecast error the forecasters made. Those who initially made the biggest errors were the most influenced by the introduction of inflation targeting (their forecasts experienced the biggest improvement).

Mishkin and Schmidt-Hebbel (2002) present similar results to those of Crowe (2010), claiming that transparency and communication are reinforced with inflation targeting. Introduction of inflation targeting usually improves central banks' communication with the public (publishing inflation reports, meeting minutes, inflation forecasts etc.), which consequently leads to significant upgrades in transparency of the monetary policy.

Walsh (2009) presented a list of reasons why inflation targeting could influence the economy. He also studied whether the listed hypotheses are actually true. First, the central bank can use the announced inflation target to align the public's expectation of target rates with the actual goals of the monetary policy and thereby reduce the costs of achieving low inflation in terms of real economic activity. Second, if there is an inflation shock that causes the public to incorrectly increase their estimate of the policy target, a large decline in output is usually necessary to mitigate the consequent increase in actual inflation. Yet by the ability to anchor the public's expectations of future inflation, inflation targeting should lead to lower volatility of inflation and improve the short-term trade-off between the output gap and inflation volatility (i.e. lower the volatility of inflation as well as volatility of real economic activity). Third, by reducing the

inflation forecast errors of the public, inflation and the output gap should become more stable. Fourth, inflation targeting might make the central bank sacrifice other macroeconomic goals and objectives to maintaining low inflation. Such behaviour would then lead to an increase of the volatility of the real economy. This is often the main critique of the inflation targeting regime. Last but not least, Walsh (2009) claims that the formal commitment to a publicly announced inflation target, which is an important feature of this monetary policy, might have a positive impact on the private sector's inflation expectations and should thereby make achieving and keeping low inflation much easier.

Walsh's (2009) empirical results are as follows: adoption of inflation targeting has a "non-negative" (as described by the author) impact on the economy. It means that inflation targeting does not seem to remarkably contribute to low and stable inflation in industrial countries (experiences of industrialized inflation-targeters are very similar to those of industrialized non-targeters), but contrary to what was suggested by theory, there has been no increase in the volatility of the real economic activity in industrialized inflation-targeters. For emerging countries, the benefits of inflation targeting are much bigger - the regime has brought not only more stable real activity, but also lower and more stable inflation. In emerging as well as in industrialized countries, inflation targeting has helped anchor inflation expectations.

Mishkin and Schmidt-Hebbel (2007) analysed differences in behaviour of inflation targeters and inflation non-targeters as well as differences between pre- and post-targeting experiences of inflation targeters. Their results are mostly in line with the previously mentioned ones and present a well-arranged summary of findings about inflation targeting.

Regarding the level of inflation, Mishkin and Schmidt-Hebbel (2007) claim that inflation targeters were able to reduce the average inflation rates from 12, 6 % before adoption to 4, 4 % afterwards. In more detail, emerging targeters achieved an average 6, 0% inflation after the adoption and industrial-targeters reached 2, 2% inflation rate. In line with Walsh (2009), results of Mishkin and Schmidt-Hebbel (2007) show that emerging countries gain more from inflation targeting adoption regarding inflation reduction than industrial economies (they record only a statistically weak reduction in inflation compared to industrial non-targeting countries).

Besides gaining more in terms of inflation reduction, emerging targeters also experienced larger reductions in output and inflation volatility after the adoption compared to the group of industrial targeters.

When assessing the difference between industrial targeters and non-targeters, Mishkin and Schmidt-Hebbel (2007) suggest that there was not a significant gain in terms of inflation level reduction, but inflation and output persistence is slightly lower in targeters than in non-targeters.

Ball and Sheridan (2004) also analysed if inflation targeting has an impact on countries' economic performance (expressed by the level of inflation, output and interest rates). Yet they found only a little evidence that inflation targeting leads to a reduction in the average level, variability and persistence (i.e. impact of a shock remaining in the economy for a significantly long time) of inflation, as suggested by other researchers. The authors claimed that targeting countries experienced higher average inflation before the adoption of inflation targeting than non-targeters and after the adoption, they converged to the lower inflation levels of non-targeters, but otherwise found no statistically significant differences between the targeters and non-targeters. The authors suggested that the difference between their results and results of other academic papers might have been caused by different treatment of regression to the mean (i.e. countries who perform poorly in the pre-targeting period tend to improve more that those who performed well simply because their initial poor performance offers a greater room for improvement).

Yet according to Capistran and Ramos-Francia (2007), specific contribution of inflation targeting is rather difficult to identify, because in the recent years, most countries have got their inflation levels under control, which must necessarily be taken into account when evaluating the effects of inflation targeting to avoid mistaking general decline in inflation levels for reduction of inflation caused by the introduction of inflation targeting.

de Carvalho Filho (2011) examined inflation targeting with regard to the global financial crisis of 2008. On a sample of both developed and emerging countries he found that inflation targeting countries performed better than non-targeting ones during the crisis – targeting countries' growth after the crisis was higher both in absolute terms and relative to pre-crisis growth levels. de Carvalho Filho (2011) claims the reason for this better performance is that inflation targeting countries were able to lower nominal as well as real policy rates by more and respond better to threats of deflation than inflation non-targeters.

2.4 Impact of inflation targeting on inflation expectations

In this part, we are going to focus on the papers examining the impact of the introduction of inflation targeting on inflation expectations and related issues. This topic deserves our attention here, because the characteristics of the relationship between expected and actual inflation have some common features with the relationship between perceived and actual inflation. Most importantly, like data on perceived inflation, expected inflation data are also extracted from

public-opinion surveys (although the data on inflation expectations usually come from surveys conducted among a group of professional forecasters, while data on inflation perceptions come from surveys conducted on a sample of the whole population). That is the reason why we find research about the impact of inflation targeting adoption on the relationship between expected and actual inflation significant for our own analysis.

Johnson (2002) studied the change of expected inflation after inflation targeting introduction. He took a treatment group of five inflation targeters and a control group of six non-targeting countries and analysed them using panel data approach. The panel enabled him to increase the precision of the estimation by increasing the number of observations of years with inflation targeting. Moreover, it made it easier to control for worldwide events that might have affected the overall level of expected inflation. Johnson (2002) came to the conclusion that introducing inflation targets helped reduce the level of expected inflation in most examined countries in most analysed years (at least by 1-2 percentage points in years after the inflation targeting introduction), but it was not successful in reducing the dispersion of inflation forecasts.

Similar topic was analysed by Capistran and Ramos-Francia (2007). The authors claim that theoretically, under perfect and symmetric information and full credibility of the inflation target, the target would be the optimal forecast of inflation, because economic agents could be confident that the central bank would always take all steps necessary to put the inflation back to the target. The authors compared the dispersion of inflation expectations in targeting and non-targeting countries and found out that the dispersion of long-term inflation expectations was lower under the inflation targeting regime (i.e. inflation targeting helped anchor the inflation expectations). Yet when they separated countries into developed and emerging ones, it came out that the results were driven by the developing countries and there was no effect of the inflation targeting in the dispersion of long-term inflation expectations in developed economies. Based on this finding, the authors concluded that the adoption of inflation targeting brings greater benefits to countries which have experienced high and variable inflation (typical feature of emerging economies). However, Capistran and Ramos-Francia (2007) claim that the lack of effect of inflation targeting on developed countries' dispersion of inflation expectations might have been caused by the use of expected inflation data from professional forecasters, who might have had a homogenous view on the future development of inflation and the results might have been different if data from consumer surveys were used.

Levin et al. (2004) investigated the behaviour of inflation expectations in a sample of targeting and non-targeting countries. Their results suggest that long-term inflation expectations are

significantly more anchored in targeting countries than in non-targeting countries, which is similar to the results obtained by Capistran and Ramos-Francia (2007).

3. Measurement of perceived inflation

There are various ways of measuring perceived inflation. The most common is the balance statistic, which will also be used in the empirical part of this thesis, mainly because the data can be easily obtained from the European Commission. Besides, we will use the balance statistic to be able to compare the results with other studies which use it as a perceived inflation measurement most often.

3.1 Balance statistic of perceived inflation (BS)

Most commonly used method of measurement of perceived inflation is the official method provided by the European Commission. The Commission performs regular consumer surveys based on which it derives the information about inflation perceptions. Every month, 23 000 randomly chosen respondents-consumers across the whole population from individual European countries fill in a questionnaire prepared by the Commission. This form includes a question about inflation perceptions of the respondents:

> How do you think that consumer prices have developed over the last 12 months?

The respondents have to choose their answer from a given list of alternatives:

> The prices have 1) "risen a lot", 2) "risen moderately", 3) "risen slightly", 4) "stayed about the same", 5) "fallen", and 6) "do not know".

All answers are then used for the calculation of a so called balance statistic, which is a difference between the percentages of respondents answering 1) "risen a lot" and 2) "risen moderately" and the percentages of respondents answering 4) "stayed about the same" and 5) "fallen". Different weights are assigned to each answer to account for the difference between extreme and conservative categories of answers. Answers in categories 1) and 5) have only half the weight in comparison with the answers in categories 2) and 4). One can see that the answers from categories 3) and 6) do not affect the values of the balance statistic. The formula for the calculation of the balance statistic is:

$$BS = P(1) + \big(0{,}5P(2) - 0{,}5P(4)\big) - P(5) \tag{1}$$

where $P(1)$ is the percentage of all respondents who have chosen category 1) as their answer, $P(2)$ is the percentage of all respondents who have chosen category 2) as their answer etc. The BS is a qualitative measure, which means it provides information on the change in perceived

inflation, but it does not say anything about the level of perceived inflation. The values of BS are in the interval from -100 to +100. The value BS = 20 would e.g. mean that the share of respondents who think prices have risen is higher by 20 percentage points than the share of respondents who think the opposite. Yet we cannot determine consumers' exact estimation of the price level development (e.g. that the rate of inflation according to consumers is 5 %). (European Commission, 2006) The following figure summarises the differences in the measurement of the actual and perceived inflation.

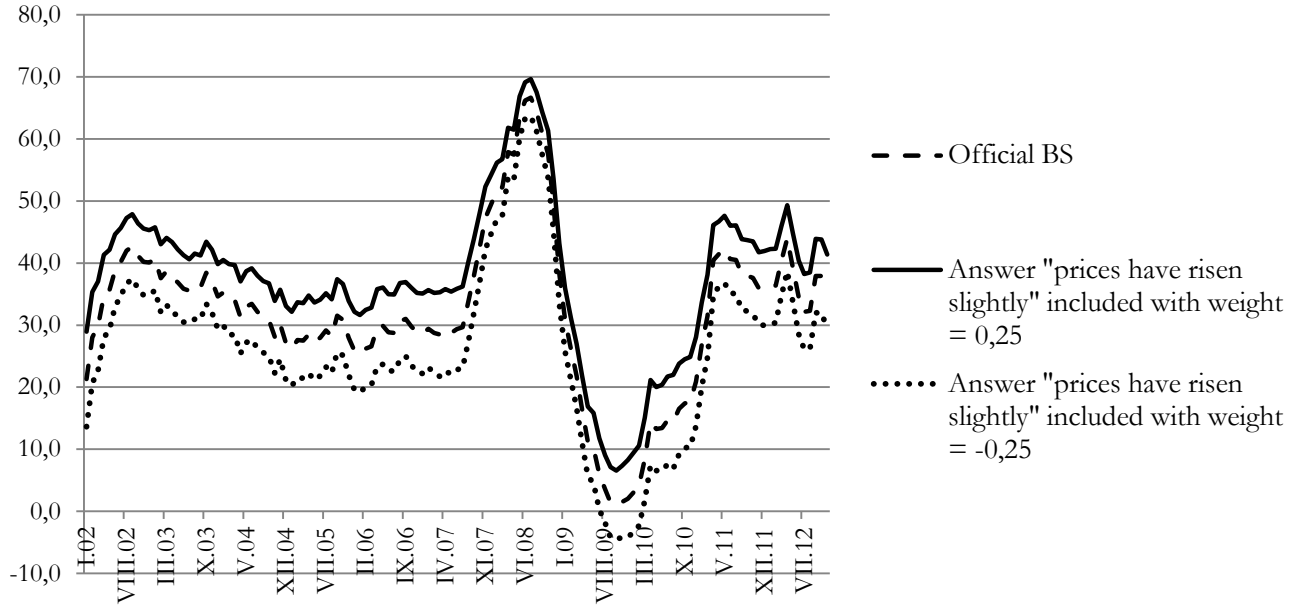
Table 1: Differences in the measurement of actual and perceived inflation.

	actual inflation	**perceived inflation (BS)**
level	aggregate economy	individual consumer
household	representative population	individual household
consumption basket	fixed set of representative goods and services	convenience goods according to the consumer's preferences
price collection	thousands of prices per month	during the act of buying
calculation	all weighted price changes translated into an index	based on surveys on the public's estimation of price developments over the last 12 months

Source: Own work based on Fluch and Stix (2005).

According to Lacina (2007), this way of measuring perceived inflation has certain disadvantages. First, given categories of answers to the question about the development of prices can be understood differently by individual respondents. A consumer who is very sensitive to price changes can choose answer 1) already at the moment when a price rises by just 1 %, whereas another consumer uses this answer only if the price increase is much more significant. Second, there is a problem with the different weights assigned to the categories of answers and the omission of category 3) "prices have risen slightly" from the calculation of BS. From January 1999, this answer is in average chosen by nearly 24 % of respondents and its omission reduces the number of respondents by almost a quarter. The following figure shows the resulting BS if the answer 3) "prices have risen slightly" is included in the calculation with the weight of 0, 25, resp. -0, 25. The difference between the official BS and the re-calculated BS reaches up to 7, 6 percentage points, which is already quite a significant discrepancy.

Figure 2: Official BS and BS with answer 3) "prices have risen slightly" included.



Source: Own calculation.

Due to the existing drawbacks of the BS, particularly the impossibility of direct comparison with actual inflation, the EC has since May 2003 started collecting direct quantitative information about people's inflation perceptions in countries of the Eurozone. The EC has added two questions (one about perceived and one about expected inflation) to its consumer survey that provide data about consumers' subjective opinions of inflation. The quantitative question about inflation perception is: "By how many percent do you think that consumer prices have gone up/down over the past 12 months? (Please give a single figure estimate): consumer prices have increased by .....%/decreased by .....%. Yet this dataset is for experimental purposes only and is not regularly published at present.

Using this experimental dataset, Ferrucci et al. (2010) have also found a gap between perceived and actual inflation, which is in line with the results found when using answers from the qualitative questions. Moreover, consumers tend to be consistent with their opinions about inflation when answering both the qualitative and quantitative questions – those who think inflation has "risen a lot" also estimate the highest perceived inflation.

Del Giovane et al. (2008) proposed a way how to transform the qualitative BS into a quantitative measure, which could be directly compared to the official statistics of inflation. They regressed the official inflation on the BS and interpreted the fitted values of the regression as a quantitative measure of perceived inflation. This approach assumes that in the long run, perceived inflation is equal to the actual one. Yet the obtained quantitative measure was too sensitive to the choice of estimation period, so the authors in the end used the qualitative BS in their further research.

3.2 Index of Perceived Inflation (IPI) by H. W. Brachinger

One of the alternative methods of perceived inflation measurement is the Index of Perceived Inflation (IPI) of Brachinger (2006). The IPI measures the rate of perceived inflation directly based on official data, not data from consumer surveys. The aim of the IPI is to measure to what extent the consumer is affected by inflation based on her subjective perceptions from daily purchases. This index is constructed upon the three assumptions about inflation perceptions' creation already described in the literature review. I will summarise them once more in short – when consumers perceive prices, they compare prices of goods and services to reference prices and evaluate the differences as gains (when the actual prices are lower than the reference prices) or losses (in the opposite case). Moreover, consumers tend to perceive price increases more strongly than price decreases. Besides, consumers are more influenced by changes in price of goods they purchase more often (such as food or clothing), which leads to higher perceived inflation in cases where consumers are frequently confronted with increased prices. The IPI is calculated according to the following formula:

$$IPI_L^{v,t} = \sum_{i:p_t(i)>p_v(i)} \left[c\frac{p_t(i)}{p_v(i)} - (c-1)\right] f_i^0 + \sum_{i:p_t(i)\leq p_v(i)} \frac{p_t(i)}{p_v(i)} f_i^0 \qquad (2)$$

where c, according to Brachinger, is a coefficient equal to 2, expressing that an increase in price has twice times stronger influence on perceived inflation than a decrease in price. $p_t(i)$ is the present price of a certain good, $p_v(i)$ is the reference price of this good (e.g. price for which the good was bought last time) and f_i^0 is the frequency with which this good is purchased.

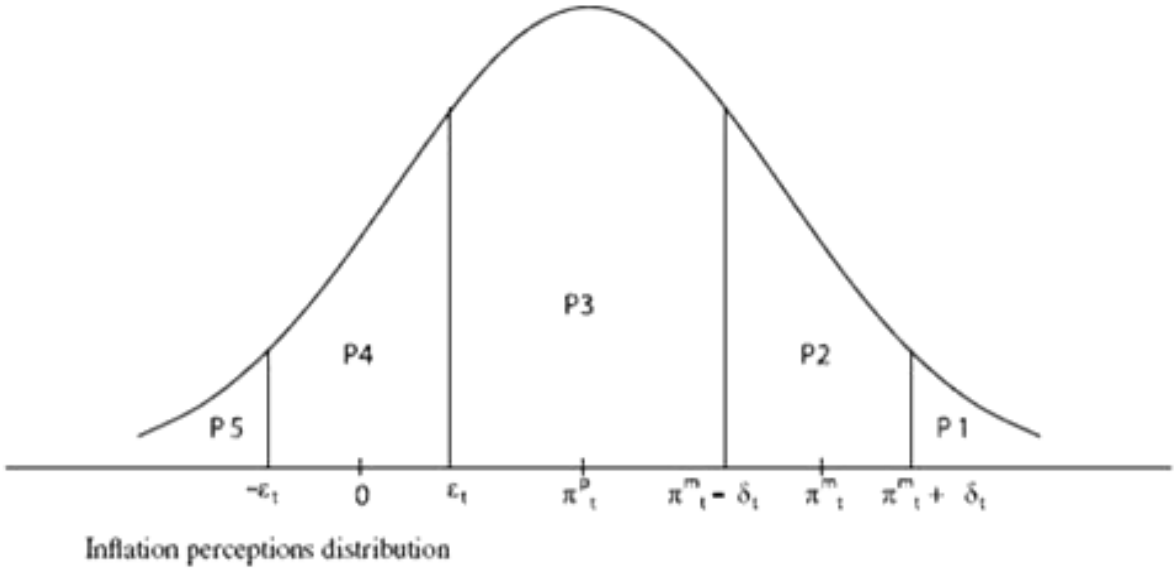
3.3 Methodology of Diaz, Duarte and Rua

Another alternative measure of perceived inflation is offered by Diaz et al. (2009), who came with a new perspective about the issue of the inflation gap. The authors say that the balance statistic is a reliable measure of perceived inflation only under certain circumstances - when the actual inflation is stable (i.e. when the change of actual inflation is close to zero). Also, the BS is of a qualitative nature, which means it cannot be directly compared to the actual inflation. To avoid the factors limiting the use of the BS, the authors suggest measurement based on a generalized version of Carlson – Parkin probabilistic method that uses information about perceived inflation from consumer surveys of the EC. Diaz et al. (2009) thereby build their model upon the same consumer surveys and the same categories of answers as the BS, but they assume that the respondents answer according to their subjective probability density function associated with the variable under question. Then they are able to connect the share of respondents giving an answer from a certain category to a portion of the area under the aggregate probability density function.

Diaz et al. (2009) introduce a new reference point for the evaluation of the inflation perceptions' development, a so called moderate inflation rate. They add that in the question about perceived inflation, respondents in fact answer whether in their opinion the year-on-year inflation rate is 1) "above its moderate level", 2) "at its moderate level", 3) "below its moderate level", 4) "nil" or 5) "negative". According to the authors, any method used for the measurement of perceived inflation should reflect not only the different allocation of answers in the consumer survey, but also be a function of the moderate inflation rate.

We arrive at the rate of perceived inflation by the following steps: P_{it} is the percentage of respondents who have chosen an answer from category *i)* in time *t*. The shares of individual answers can be considered as the maximum likelihood estimates of the areas under the perceptions' distribution function which are divided by the relevant thresholds Z_{it}.

Figure 3: The distribution of inflation perceptions.



Source: Diaz et al. (2009).

Let *F* be the cumulative normal standard distribution function, then we can define the thresholds Z_{it} as:

$$Z_{1t} = F_t^{-1}(1 - P_{1t}) \quad (3)$$

$$Z_{2t} = F_t^{-1}(1 - P_{1t} - P_{2t})$$

$$Z_{3t} = F_t^{-1}(1 - P_{1t} - P_{2t} - P_{3t})$$

$$Z_{4t} = F_t^{-1}(P_{5t})$$

According to this method, the rate of perceived inflation is equal to:

$$\pi_t^p = \frac{-Z_{3t}-Z_{4t}}{Z_{1t}+Z_{2t}-Z_{3t}-Z_{4t}}\pi_t^m \quad (4)$$

where π_t^m is the moderate inflation rate which best reflects the individual's guess of the permanent or trend rate of inflation.

4. Data

In the thesis, we are going to work with two types of data regarding inflation. First are the values of actual inflation (official reported inflation rate) measured by CPI. CPI provides information about the average changes in the prices of consumer goods and services purchased by households. Laspeyers formula is usually used for the CPI measurement. Inflation measured by CPI is available since 1980 for selected countries, for most of them it is available approx. from the late 1980s. CPI is compiled in accordance with international statistical guidelines. The data regarding actual inflation are obtained from the database of the International Monetary Fund International Financial Statistics and are expressed as annual percentage changes in the price level in individual countries measured with a monthly frequency (percentage change relative to the same month in the previous year). We use these monthly data about actual inflation in order to ensure consistency and comparability with the data about perceived inflation, which are expressed on a monthly basis as well. CPI inflation is used because the inflation targets are always linked to CPI inflation, not to HICP inflation (another measurement of actual inflation often used in European countries).

Besides actual inflation for each country in our sample, we also use average European inflation as a control variable. This inflation is again in the form of CPI and is measured on a monthly basis. The data are obtained from OECD Statistics database.

Second are the values of perceived inflation. This type of inflation is the public's subjective perception of the current price level. Perceptions are affected by a wide range of different factors, including psychological influences, and are thereby difficult to measure precisely. At present, information obtained by so called Consumer Confidence Barometer surveys, a part of Joint Harmonised EU Programme of Business and Consumer Surveys, are used for the assessment of inflation perceptions. Besides the data about inflation perceptions, the consumer survey questionnaire includes information about the economic situation and income of individual

households, country, occupation, education, age and sex of the respondent. This type of data is obtained from the archives of the EC[1].

From the data we create a panel data set containing both inflation-targeting and non-targeting countries. We are focusing only on EU and its candidate countries, because we need the data on perceived inflation from Joint Harmonised EU Programme of Business and Consumer Surveys, which are clearly available only for European countries. Other countries all over the world naturally also perform consumer surveys and extract inflation perceptions from them, but the methodology might not be the same as in the EU surveys, so we are only going to focus on EU member and candidate countries in order to ensure that results are consistent across the analysed economies. The panel is unbalanced because the perceived inflation data begin at different times across different countries (we do not have an observation for each country in every time period). Yet the fact that the panel data set is unbalanced does not pose a significant problem for the analysis, because we use Stata software and its `xt` commands for panel data can handle even unbalanced data sets.

The aim of this thesis is not only to examine the impact of the introduction of inflation targeting on the general difference between perceived and actual inflation, but also to analyse this impact on a number of groups divided according to various socio-economic characteristics. We are thereby going to use perceived inflation data for whole economies as well as individual perceived inflation data based on sex of respondents (two groups: men and women), on age of respondents (four groups: age 16-29, 30-49, 50-64 and 65+), on achieved education level of respondents (three groups: primary, secondary and further education) and on income of the respondents' household (four groups: total income in 1^{st}, 2^{nd}, 3^{rd} and 4^{th} quartile).

Given that perceived inflation measured by the BS attains values ranging from -100 to +100, whereas actual inflation measured by the CPI usually (except from cases such as hyperinflation or deflation) attains values that are positive and approximately between zero and ten, the two data series are not directly comparable, as has already been mentioned in the literature review. Such incomparability does not pose a significant problem for the empirical analysis, because we are interested in the development of the difference between the two inflations, not in their individual absolute values. Yet we have decided to transform the actual inflation data into a data set that would be comparable to perceived inflation and try to use it to examine whether our hypotheses could be confirmed also on this alternative data set. The transformation is done as follows: we take the values of actual inflation, find the maximum value and assign it the value of +100

[1] http://ec.europa.eu/economy_finance/db_indicators/surveys/time_series/index_en.htm

(maximum possible value of perceived inflation). Then we find the minimum value of actual inflation and assign it the value of -100 (minimum possible value of perceived inflation). Remaining values of actual inflation are then linearly interpolated on the interval from -100 to +100.

As the treatment group of inflation-targeters, we are going to use all European Union member countries and one European Union candidate that have adopted inflation targeting as their monetary policy regime (i.e. at present seven countries - the Czech Republic, the United Kingdom, Sweden, Poland, Hungary, Romania and Turkey), and as the control group, we are going to use thirteen European Union member countries without inflation targets (inflation non-targeters). The control group contains Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Slovenia, Slovakia and Spain. For other non-targeting EU countries, the data on perceived inflation were either not available or available only for a too short period of time and could not have been used. For Poland, only total data for the whole economy are published, data based on socio-economic characteristics are not available. Moreover, the data are only available for the period after inflation targeting introduction. For Sweden and Turkey, the data are available only from the periods after the introduction of inflation targeting.

One issue connected with the data is that according to Mishkin and Schmidt-Hebbel (2002), it is often quite difficult to determine the exact date of inflation targeting adoption. This uncertainty is claimed to be caused by inflation targeting being adopted gradually over time, not at one point in time. We are going to use the date when inflation targeting was adopted in the individual countries as determined in Hammond (2012) who provides an overview of the current state of the monetary regime in the world. The following table presents a summary of the used adoption dates.

Table 2: Inflation targeting adoption dates.

Country	Date of IT adoption
Czech Republic	December 1997
Hungary	June 2001
Poland	January 1998
Romania	August 2005
Sweden	January 1995[2]
Turkey	January 2006
United Kingdom	October 1992

Source: Hammond (2012).

[2] IT regime was announced in January 1993 and applied as of January 1995 -> the latter date is used.

5. Hypotheses and methodology

This part is dedicated to the description of the examined hypotheses and the used methodology.

5.1 Hypotheses

Based on the previous research regarding both inflation targeting and perceived inflation, the hypotheses are as follows.

Hypothesis #1: Countries with inflation targeting experience lower differences between actual and perceived inflation than countries without inflation targets.

Hypothesis #2: After the introduction of monetary policy based of inflation targeting in a country, the difference between actual and perceived inflation was reduced.

These two hypotheses are based on the belief that inflation targeting may help the public realise the true level of inflation more accurately (if the target is credible enough) and thereby mitigate the difference between perceived and actual inflation. Mishkin and Schmidt-Hebbel (2002) or Crowe (2010) claim that inflation targeting reinforces transparency of the monetary policy and communication of central banks with the public. Given that creation of inflation perceptions is among other factors influenced by news, media coverage and by availability of information about inflation in general (as studied by Hoffmann et al., 2006; Sturm et al., 2009; or Badarinza and Buchmann, 2009), higher levels of monetary policy transparency and communication should improve the difference between perceived and actual inflation.

Hypothesis #3: The impact of inflation targeting on the discrepancy between actual and perceived inflation is influenced by socio-economic characteristics.

Bryan and Venkatu (2001), Del Giovane and Sabbatini (2006), Döhring and Mordonu (2007), Aucremanne et al. (2007) or Leung (2009) examined how various socio-economic characteristics of respondents influence their inflation perceptions. General conclusion from their research is that higher perceived inflation was observed among people aged 25 and less and elderly people, women, low-income, less-educated groups or people with non-white ethnicity, confirming that perceived inflation differs across socio-economic groups.

Johnson (2002), Levin et al. (2004) or Capistran and Ramos-Francia (2007) studied how socio-economic characteristics influence the impact of inflation targeting on the discrepancy between actual and expected inflation. General conclusion is that introducing inflation targeting helps

reduce the level of expected inflation and the dispersion of expectations or helps anchor inflation expectations.

We would like to joint these two sets of research papers and analyse whether socio-economic characteristics influence the impact of inflation targeting on the discrepancy between actual and perceived inflation.

5.2 Methodology

For the analysis, we are going to apply a difference-in-differences method on the unbalanced panel data set. According to Capistran and Ramos-Francia (2007), the difference-in-differences estimator controls not only for fixed effects (like a general fixed-effects estimator), i.e. omitted variables that do not change over time within each country but differ across individual countries, but it also controls for time-fixed effects, which are variables that differ from month to month but do not change across individual countries within each month.

5.2.1 Difference-in-differences estimator

The difference-in-differences approach will enable us to examine whether the introduction of inflation targeting has an impact on the level of perceived inflation and its difference from the actual inflation. The difference-in-differences method is generally used to analyse the impact of some kind of a measure, event, treatment etc. by comparing the treatment group before the introduction of the measure to the treatment group after the introduction of the measure as well as to a chosen control group. We will basically compute a double difference between perceived and actual inflation - one will be over time (i.e. before and after inflation targeting adoption) and one will be across the chosen subjects (i.e. between inflation-targeters and inflation non-targeters).

In such set-up, in which one of the analysed groups is exposed to a treatment at some point of time and another group is not, the average difference in the control group is subtracted from the average difference in the treatment group. The over-time comparison of inflation-targeters and inflation non-targeters removes any biases between the treatment group and the control group resulting from permanent discrepancies between them and the comparison across subjects also removes any biases resulting from trends.

The difference-in-differences method was used by Capistran and Ramos-Francia (2007) for assessing how inflation targeting affects the dispersion of inflation expectations. We are going to describe their methodology in further details as it is an inspiration for our own empirical work. At the beginning, they set an average date of adoption of inflation targeting in targeting countries

(March 1998 in their sample). Afterwards, they calculated the average dispersion over time for the periods before and after the adoption of inflation targeting for each of the countries included in their treatment group of inflation-targeters. Second, they calculated the average dispersion for the periods before and after the previously determined average date of adoption for each of the countries included in their control group of non-targeters. Finally, they implemented the difference-in-differences method using the following regression in order to compare the change in dispersion of inflation expectations in inflation-targeters with the change in dispersion in non-targeters.

$$CV_{final,i} - CV_{initial,i} = \gamma_0 + \gamma_1 DIT_i + \Gamma' Controls_i + \varepsilon_i \quad (5)$$

where $CV_{final,i}$ is the average of the coefficients of variation for country i after the adoption of inflation targeting (or after March 1998 for countries without inflation targeting), $CV_{initial,i}$ is the average of the coefficients of variation for country i before the adoption of inflation targeting (or before March 1998 for countries without inflation targeting), DIT_i is a dummy that takes the value of one if country i is an inflation-targeter and zero if not and $Controls_i$ is a vector of control variables (the authors controlled for the initial level of dispersion in order to avoid the reversion to the mean effect, for the change in the variance of inflation to account for the effect that changes in the volatility of inflation could have on the changes in the dispersion and for the change in the level of inflation in each individual country.

The coefficients of variation used in the regression are a measure of inflation expectations dispersion created by dividing the interquartile range of expectations dispersion across inflation forecasters by the absolute value of the median forecast times 100. The measure takes into account the differences in the dispersion caused by differences in the levels of inflation across countries and over time. The interquartile range and median forecast are calculated from the monthly inflation forecasts - e.g. USA November 2006 forecasts for next year's inflation were 2, 10 was first quartile, 2,21 median and 2,50 third quartile, so we are arriving at interquartile range of 0, 4 and coefficient of variation of 18, 6.

The model Capistran and Ramos-Francia (2007) used has one disadvantage – given that they measure the difference between average dispersion after and before the adoption of IT, their number of observations equals the number of individual countries used in the analysis. In our case that would mean seven countries from the treatment group and thirteen countries from the control group. Unfortunately, for three countries from the treatment group (namely Poland, Sweden and Turkey), the data regarding perceived inflation begin limited to the period after the IT adoption date, so we are not able to calculate the average inflation gap before the IT adoption,

which leaves us with only four countries from the treatment group that could be used in the model based on Capistran and Ramos-Francia (2007). Results from such a model will not be very reliable, which is the reason we use a different version of the difference-in-differences model that is created by including certain dummy variables into a general fixed-effects estimator, and apply it on the unbalanced panel data set.

According to Villa (2012) or Imbens and Wooldridge (2007), the general difference-in-differences model is as follows.

$$y = \beta_0 + \beta_1 d_{treatment} + \beta_2 d_{period} + \beta_3 d_{treatment} d_{period} + (\beta_4 Controls) + u \quad (6)$$

where y is the outcome of interest (in this case the difference between perceived and actual inflation; inflation gap), $d_{treatment}$ is a dummy variable capturing whether a country belongs to the treatment group of inflation targeters ($d_{treatment} = 1$) or to the control group of inflation non-targeters ($d_{treatment} = 0$), d_{period} is a dummy variable capturing whether it is a period before the introduction of the certain measure (in this case inflation targeting) ($d_{period} = 0$) or after ($d_{period} = 1$). β_3 is the coefficient of interest, because it expresses the difference-in-differences, i.e. the impact of the introduction of inflation targeting on the outcome of interest. It is also possible to add controls variables to the equation ($Controls$). Such a model specification can be applied on repeated cross-sections data or on panel data (this is our case). In this particular case, the regression equation is then as follows.

$$gap = \beta_0 + \beta_1 ITcountry + \beta_2 after + \beta_3 ITactive + (\beta_4 oecdeuropecpi) + u \quad (7)$$

where gap is the difference between perceived and actual inflation, $ITcountry$ is a dummy equal to one if a country belongs to the treatment group, $after$ is a dummy equal to one for periods after the introduction of inflation targeting and $ITactive$ captures the interaction between $ITcountry$ and $after$, i.e. periods in which the inflation-targeters use inflation targeting as their monetary policy regime.

This regression equation is used for the overall analysis of the impact of inflation targeting on the inflation gap (when gap is calculated from the total data) and for the individual analyses of the influence of socio-economic characteristics on the impact of inflation targeting on the inflation gap (when gap is calculated from the data obtained from respondents with varying socio-economic characteristics). All regressions are estimated, as already mentioned, via a fixed-effects panel data model.

Regarding control variables, previous research of Capistran and Ramos-Francia (2007) or Johnson (2012) suggests that e.g. average world inflation could be controlled for in the models. Based on this, we included a variable capturing the average European (instead of world, given that we analyse only European countries) actual inflation into the regressions – variable $oecdeuropecpi$. This average inflation was obtained from the OECD Statistics database.

The use of the fixed-effects model is approved by first conducting Wald (F) test for fixed effects and Breusch-Pagan LM test for random effects to examine whether the data should be treated as a panel and second conducting a Hausman specification test, which compares fixed- and random-effects panel data models and suggests the more suitable one. Under H_0 of the Hausman specification test, both estimators are consistent, but the random-effects model is more efficient, and under H_A, random-effects model is not consistent.

In case of panel data, it is common that observations within each group of the panel (each country in our case) are correlated in a certain way, i.e. that errors in the model are correlated within country i but are not correlated between countries i and j (so called "clustered errors"). Due to this feature of panel data, it is advisable to always use clustered standard errors for the estimation (Bertrand et al., 2004). In our case, this is done by using the `cluster(country)` command in the specification of each regression.

The estimate of the coefficient of interest, β_3, is as follows:

$$\widehat{\beta_3} = (E[gap|after = 1, ITcountry = 1] - E[gap|after = 0, ITcountry = 1]) - (E[gap|after = 1, ITcountry = 0] - E[gap|after = 0, ITcountry = 0]) \quad (8)$$

The difference-in-differences model can also be estimated by directly using a built-in Stata module `diff`. In this module, it is required to specify the variable of interest (outcome variable) and consequently period and treatment dummies. The module then does an estimation of the same equation as in (6), but it performs a linear regression, not a fixed-effect estimation, so it neglects the panel-dimension of the data set. The results are afterwards arranged into a different output table than in the case of fixed-effects model. $\widehat{\beta_3}$ in the last column of the table is the coefficient of interest. Clustered standard errors are again used in this estimation.

We are going to use both versions of the difference-in-differences estimation - at first the fixed-effects panel data model (further referred to as FE) and then the linear regression `diff` Stata module (further referred to as LR). The LR model is used only in order to confirm whether the LR procedure returns the coefficient of interest with the same sign and significance as the FE

and to examine *hypothesis #1* that the inflation gap is lower in inflation-targeting countries in those periods when inflation targeting regime is active.

In usual cases when difference-in-differences estimator is used, the measure is adopted on a certain date, which makes determining the dummy variable d_{period} very simple for both treatment and control groups. Yet in case of inflation targeting, each country adopts the regime on a different date, so it is less straightforward how to determine the period before and after inflation targeting introduction for the control group of inflation non-targeters (for the treatment group, dates of IT introduction are stated in Table 2). We use the same method as Capistran and Ramos-Francia (2007) that calculated the average date of IT adoption of the countries from the treatment group and used it as a threshold for setting the dummy variable d_{period} for non-targeting countries. The calculated average adoption date is July 1999.

6. Results

6.1 Correlation between perceived and actual inflation

At the beginning, we have performed a simple analysis of correlation between perceived inflation (BS) and actual inflation (CPI) for the countries from the treatment group. Based on our hypotheses, we would expect the correlation to be higher after the introduction of inflation targeting, as it should help the public realise the actual level of inflation more easily, and consequently lead to perceived inflation more accurately tracking actual inflation. Results are summarised in the following table.

Table 3: Correlation between perceived and actual inflation for IT countries.

Country	Correlation before IT	Correlation after IT
Czech Republic	0,20	0,84
Hungary	0,87	0,29
Poland	n/a	0,80
Romania	0,17	0,56
Sweden	n/a	0,65
Turkey	n/a	0,56
United Kingdom	0,72	0,81

Source: Own work using Stata.

We can see that for all IT countries except for Hungary, the correlation coefficient from the periods after IT introduction is higher than 50 %, which points to quite a strong relationship between perceived inflation and actual inflation. Moreover, for all countries for which the data before and after IT introduction are available, again except for Hungary, the correlation

coefficient increases with the adoption of IT regime. These results, although based on a simple correlation, generally confirm our expectations.

6.2 *Hypothesis #1*: Countries with IT experience lower inflation gap than countries without IT.

This hypothesis is simply examined by using the LR model that was described above in section 5.2.1. According to Villa (2012), in column Treated (FU) of the LR model output table, there is the calculated mean outcome of the inflation gap of the treatment group and in column Control (FU), there is the mean outcome of the inflation gap of the control group in the follow-up period (after the introduction of inflation targeting). Results of this procedure conducted for the total data can be found in Table 7 (see Appendix A). By simply comparing the two values, we can see that the gap of the treatment group after the introduction of inflation targeting is 9, 597, whereas the gap of the control group in the post-treatment period is 30, 489, i.e. approximately three times bigger. Similar results can be obtained by comparing mean outcomes of the inflation gap of treatment and control groups from the individual socio-economic cases (see tables marked as LR in Appendix A). In the follow-up period, the value of the inflation gap of each treatment group is always at least two times smaller than the value of the inflation gap of the corresponding control group.

6.3 *Hypothesis #2*: After the introduction of IT in a country, the inflation gap was reduced.

The development of actual and perceived inflation and the development of the size of the inflation gap are captured in Figure 4 (see Appendix B). The figure consists of graphs for inflation-targeters only, as on their sample, we can see the development of the variables before and after the introduction of inflation targeting.

This hypothesis is examined by regressing the inflation gap calculated from the total data on perceived inflation and actual inflation on the dummies described in section 5.2.1. Before we began with the estimation, we had checked whether the fixed-effects model is appropriate by conducting first the Wald (F) and Breusch-Pagan LM tests (to assess whether the data are poolable or not and should be treated as a panel) and afterwards the Hausman specification test.

The Wald (F) test for fixed effects is used in order to identify fixed effects within the data. According to Baltagi (2008), if the H_0 of the test is rejected (i. e. at least one group or time intercept is different from zero), there is a fixed effect within the data and the fixed-effects model is better than pooled ordinary least squares (OLS) estimation. The Breusch-Pagan LM test for random effects is used in order to identify random effects within the data. If the H_0 of the test is

rejected, there is a random effect within the data and the random-effects model is better than pooled OLS. If H_0 is not rejected in both tests, it is best to use the pooled OLS estimation, wheres if H_0 is rejected in both cases, we should use either fixed- or random-effects model based on the results of the Hausman specification test. Regarding the Hausman specification test, under H_0, both fixed- and random-effects estimators are consistent, but the random-effects model is more efficient, and under H_A, random-effects model is not consistent.

Results of the Wald (F) test can be found in Table 4 (see Appendix A). The obtained p-value is 0, 000, which means the null hypothesis is rejected and there is a fixed effect present within the data. Results of the Breusch-Pagan LM test can be found in Table 5 (see Appendix A). The obtained p-value is 0, 000, which means the null hypothesis is again rejected and there is a random effect within the data. Based on these results, we can conclude that the data should be treated as a panel and we continue by conducting the Hausman specification test to examine whether fixed- or random-effects estimator should be used.

Results of the Hausman test for the basic regression can be found in Table 6a (see Appendix A). The obtained p-value is 0, 001, which means we could reject the null hypothesis and consequently use the fixed-effects estimator, because it is consistent and more efficient than random-effects model. Hausman test for the additional regression with average European inflation as an independent variable can be found in Table 6b (see Appendix A). The obtained p-value is 0, 000, which again means we could reject the null hypothesis and use the fixed-effects model.

Results of FE are summarised in the following table.

Table 8: "Total" regression (FE).

dependent variable - inflation gap (gap)		
intercept	17.035466*** (5.86)	3.0751433 (0.47)
ITcountry	(omitted)	(omitted)
after	17.46255*** (4.74)	25.460759*** (5.89)
ITactive	-29.932165** (-2.85)	-31.650911*** (-3.07)
oecdeurope_cpi		1.9124987* (1.79)
number of observations	4 445	4445
R^2 (within)	0.141	0.161

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

We can see that the coefficient of $ITactive$, which is the one capturing the impact of the introduction of inflation targeting, is statistically significant at the 5% level of significance. It has a negative sign, which is in line with our expectations – the introduction of inflation targeting leads to a decrease of the inflation gap. Variable $ITcountry$ was omitted from the regression due to multicollinearity of $ITcountry$ and $ITactive$ ($ITactive$ is a product of multiplying $ITcountry$ and $after$) – if Stata detects collinearity between two regressors, it drops one of them. Besides, fixed-effects regression involves subtracting group means from the variables, which means that it is possible only to include time-varying variables into the regression. $ITcountry$ is constant over time, so when Stata subtracts the group mean, it is equal to 0 and the variable is thereby omitted from the model. Yet given that $ITactive$ is our variable of interest, dropping $ITcountry$ is not of significant importance.

The regression in which the average European actual inflation is included as a control variable results in significance of both the actual inflation variable (although only at the 10% level of significance) and the $ITactive$ variable, which is significant at the 1% level. The average European inflation has a positive sign, which can signal that higher overall inflation leads to a greater difference between perceived and actual inflation. Such phenomenon was mentioned e.g. by Brachinger (2002), who claimed that consumers tend to react more strongly to price level increases than to decreases and this behaviour can lead to greater inflation gap in an environment of higher inflation.

Results from the LR model are presented in Table 7 (see Appendix A). We can see that the coefficient of interest in the last column "Diff-in-diff" is again statistically significant at the 1% level of significance and has the desired negative sign. R^2 of the two models is comparable - 0, 14.

Results from the total-data regression are further confirmed by results from the regressions that use data obtained from respondents with varying socio-economic characteristics (Tables 9 – 16) – in all cases, the coefficient $ITactive$ is statistically significant at least at the 5% level of significance and has a negative sign. In regression with the average European actual inflation as an explanatory variable, the $ITactive$ coefficient's significance increases, while the average actual inflation itself is usually significant at the 10 % level of significance or slightly insignificant. The average actual inflation coefficient always has a positive sign, which was mentioned above.

Based on the results of all the models, we can conclude that *hypothesis #1* was confirmed - the introduction of inflation targeting regime truly leads to a decrease in the inflation gap.

6.4 *Hypothesis #3*: The impact of IT on the inflation gap is influenced by socio-economic characteristics.

This hypothesis is examined by regressing the inflation gap calculated from the data about actual inflation and about perceived inflation obtained from respondents with varying socio-economic characteristics on the dummies described in section 5.2.1. We intend to compare results between men and women, among four age groups, three education groups and four income groups.

6.4.1 Comparison of results - men and women.

Results of FE estimation are summarised in the following table.

Table 9: "Men and women" regression (FE).

dependent variable - inflation gap (gap)				
	Men	**Women**	**Men**	**Women**
intercept	12.585784*** (5.75)	18.855562*** (8.75)	-2.4041379 (-0.38)	10.682932* (1.75)
ITcountry	(omitted)	(omitted)	(omitted)	(omitted)
after	14.632838*** (3.77)	15.956061*** (4.34)	23.276915*** (6.12)	20.668883*** (6.19)
ITactive	-18.157663** (-2.87)	-20.782867*** (-3.14)	-20.486606*** (-4.31)	-22.052626*** (-4.10)
oecdeurope_cpi			2.0523051** (2.23)	1.1189338 (1.25)
number of observations	4 223	4 223	4 223	4 223
R^2 (within)	0.010	0.122	0.122	0.129

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

For both groups, the coefficient of interest capturing the impact of the introduction of inflation targeting, $ITactive$, is statistically significant - at the 5% level of significance for men and at the 1% level of significance for women - and it has a negative sign, reflecting that the introduction of inflation targeting leads to a decrease in the difference between perceived and actual inflation. Moreover, the $ITactive$ coefficient has different values for men and for women, which is in line with the expectations. Although the difference is not remarkably large, women seem to be affected more by the introduction of inflation targeting, as it causes the inflation gap to decrease by approximately 18, 2 for men and by 20, 8 for women. R^2 of the model for men and for women is comparable – 0, 1 for men and 0, 12 for women.

The regression in which the average European actual inflation is included as a control variable results in significance of the $ITactive$ coefficient at the 1% level for both men and women. The

coefficient still has the desired negative sign. The average European inflation again has a positive sign, as was the case of the total data regression above.

Results from the LR model are summarised in Table 10 (see Appendix A). The difference-in-differences coefficient is significant for both sex groups at the 1% level of significance and has the desired negative sign. Furthermore, as can be seen from columns Control and Treated in the follow-up period, the inflation gap in targeting countries is approx. seven times smaller for men and three times smaller for women than in non-targeting countries in times when the targeting countries have IT as their monetary policy regime.

6.4.2 Comparison of results – age groups.

Results of the FE model are summarised in the following table.

Table 11: "Age" regression (FE).

dependent variable - inflation gap (gap)								
	Age 16-29	**Age 30-49**	**Age 50-64**	**Age 65+**	**Age 16-29**	**Age 30-49**	**Age 50-64**	**Age 65+**
intercept	9.7181789***	14.147567***	17.702082***	21.230287***	-.41032341	1.4804642	6.7350763	9.9717729
	(4.67)	(6.57)	(7.84)	(9.32)	(-0.07)	0.23)	(0.99)	(1.67)
ITcountry	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
after	15.930116***	16.260472***	15.919704***	13.511175***	21.770677***	23.565073***	22.243784***	19.99916***
	(4.34)	(4.30)	(4.10)	(3.76)	(6.68)	(6.46)	(5.62)	(6.21)
ITactive	-17.140848**	-20.66316***	-21.92131***	-18.923413**	-18.71421***	-22.63121***	-23.62492***	-20.66378***
	(-2.83)	(-3.27)	(-3.20)	(-2.49)	(-3.85)	(-4.72)	(-4.37)	(-3.34)
oecdeurope_cpi					1.3867633*	1.7342825*	1.5015687	1.5429858*
					(1.68)	(1.86)	(1.55)	(1.80)
number of observations	4 222	4 223	4 222	4 195	4222	4223	4222	4195
R^2 (within)	0.126	0.117	0.113	0.088	0.138	0.133	0.125	0.101

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

Same as in the previous "Men and women" regression, the coefficient of interest, $ITactive$, is statistically significant at the 5% level of significance for the youngest and oldest income groups and at the 1% level of significance for the two groups in-between and it has a negative sign. Moreover, the coefficient has different values for each of the four age groups, which is in line with the expectations – different age groups are influenced in a heterogeneous way by the introduction of inflation targeting.

Respondents who seem to be affected the least by the introduction of inflation targeting are those aged from 16 to 29 (i.e. the youngest age group in the survey). The impact then gradually increases with the age of the respondents and people aged from 50 to 64 seem to be affected the most. Finally, the size of the impact of inflation targeting introduction on people aged 65+ then decreases again and is between the youngest group and the second youngest group (those aged from 30 to 49).

These results resemble those of Döhring and Mordonu (2007), Aucremanne et al. (2007) or Leung (2009) who found that the size of the inflation gap was high for young individuals, decreased as people grew older and increased again for retired people. In our case, young individuals' difference between perceived and actual inflation tends to decrease by the smallest proportion of all aged groups, then the inflation gap seems to decrease by more as people grow older and again tends to decrease less for retired people.

The regression in which the average European actual inflation is included as a control variable results in significance of the $ITactive$ coefficient at the 1% level for all age groups. The coefficient still has a negative sign. The youngest group of respondents remains to be the least influenced one and people aged from 50 to 64 seem to be affected the most (same results as in the regression without the control variable). The average European inflation again has a positive sign, as was the case of the total data regression, and is significant at the 10% level with the exception of the "Age 50 – 64" group.

Results from the LR model are summarised in Table 12 (see Appendix A). The difference-in-differences coefficient is significant for all age groups at a 1% level of significance and has the desired negative sign. Furthermore, as can be seen from columns Control and Treated in the follow-up period, the inflation gap in targeting countries is smaller than in non-targeting countries in times when the targeting countries have IT as their monetary policy regime for all age groups.

6.4.3 Comparison of results – education groups.

Results of the FE model are summarised in the following table.

Table 13: "Education" regression (FE).

dependent variable - inflation gap (gap)						
	Education primary	**Education secondary**	**Education further**	**Education primary**	**Education secondary**	**Education further**
intercept	20.941705***	14.031808***	8.3342412***	12.562654**	4.4636679	-3.296542
	(8.86)	(6.17)	(3.77)	(2.29)	(0.71)	(-0.45)
ITcountry	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
after	15.425485***	17.646667***	18.237618***	20.257342***	23.138653***	24.909966***
	(4.23)	(4.36)	(4.65)	(6.42)	(6.17)	(6.25)
ITactive	-19.911482**	-23.046333***	-23.81695***	-21.213312***	-24.324133***	-25.333382***
	(-2.44)	(-3.53)	(-3.73)	(-2.90)	(-4.62)	(-5.20)
oecdeurope_cpi				1.1471954	1.3039989	1.5842602
				(1.46)	(1.42)	(1.46)
number of observations	4 223	4 222	4 222	4223	4222	4222
R^2 (within)	0.124	0.144	0.133	0.132	0.153	0.145

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

Same as in the previous regressions, the coefficient of interest, $ITactive$, is statistically significant at the 5% level of significance for the "Education primary" group and at the 1% level of significance for the "Education secondary" and "Education further" groups and it has a negative sign. Moreover, the coefficient has different values for each of the three education groups, which is in line with the expectations – different education groups are influenced in a heterogeneous way by the introduction of inflation targeting.

The least affected group of respondents are those with only primary education. The impact then increases and is attains the highest value for respondents with further (i.e. more than secondary) education.

These results are again in line with previous research on perceived inflation. Döhring and Mordonu (2007), Aucremanne et al. (2007) or Del Giovane et al. (2008) found that the difference between perceived and actual inflation was the highest for individuals with low levels of education and the smallest for highly educated people.

The regression in which the average European actual inflation is included as a control variable results in significance of the $ITactive$ coefficient at the 1% level for all three groups. The coefficient still has a negative sign. The way how the individual education groups are affected by inflation targeting remains the same as in the regression without the control variable. The average European inflation again has a positive sign, as was the case of the total data regression.

Results from the LR model are summarised in Table 14 (see Appendix A). The difference-in-differences coefficient is significant for all three education groups at the 1% level of significance and has the desired negative sign. Furthermore, as can be seen from columns Control and Treated in the follow-up period, the inflation gap in targeting countries is smaller than in non-targeting countries in times when the targeting countries have IT as their monetary policy regime for all education groups.

6.4.4 Comparison of results – income groups.

Results of the FE model are summarised in the following table.

Table 15: "Income" regression (FE).

dependent variable - inflation gap (gap)								
	Income 1Q	**Income 2Q**	**Income 3Q**	**Income 4Q**	**Income 1Q**	**Income 2Q**	**Income 3Q**	**Income 4Q**
intercept	21.065586***	16.550839***	12.77362***	8.7865366***	13.92157**	6.7809012	1.1517913	-4.4446664
	(9.87)	(7.63)	(5.97)	(4.33)	(2.50)	(1.14)	(0.18)	(-0.58)
ITcountry	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
after	16.420588***	16.785011***	17.274522***	16.653321***	20.535355***	22.414945***	23.968193***	24.004512***
	(4.72)	(4.75)	(4.60)	(4.18)	(6.55)	(6.70)	(6.57)	(5.61)
ITactive	-22.93114***	-19.97576***	-20.73351***	-25.28357***	-24.01661***	-21.48115***	-22.48718***	-25.43827***
	(-3.39)	(-2.90)	(-3.41)	(-6.33)	(-4.14)	(-3.78)	(-4.94)	(-6.43)
oecdeurope_cpi					.97966223	1.3404001	1.5945969*	1.7523604
					(1.20)	(1.56)	(1.69)	(1.55)
number of observations	4 161	4 160	4 155	4 102	4 161	4 160	4 155	4 102
R^2 (within)	0.135	0.130	0.130	0.111	0.141	0.140	0.143	0.125

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

Same as in the previous regressions, the coefficient of interest, $ITactive$, is statistically significant at the 1% level of significance for all groups. The coefficient always has a negative sign. Moreover, the coefficient has different values for each of the four income groups, which is in line with our expectations – different income groups are influenced in a heterogeneous way by the introduction of inflation targeting.

Those who seem to respond in the strongest way to the introduction of inflation targeting are members of the group with highest income, which corresponds to findings of previous research (see Bryan and Venkatu, 2001, Döhring and Mordonu, 2007, Aucremanne et al., 2007 or Leung, 2009) – individuals with the highest income experience the lowest inflation gap. Yet the group that seems to respond to the introduction of inflation targeting in the second strongest way is the one with the lowest income, which is surprising. The two remaining groups with income in the second and third quartile are in-between.

The regression in which the average European actual inflation is included as a control variable results in significance of the $ITactive$ coefficient at the 1% level for all income groups. The coefficient still has a negative sign. The way how the income groups are affected by inflation targeting remains the same as in the regression without the control variable (described above). The average European inflation again has a positive sign, as was the case of the total data regression.

Results from the LR model are summarised in Table 16 (see Appendix A). The difference-in-differences coefficient is significant for all income groups at a 1% level of significance and has the desired negative sign. It can again be seen from columns Control and Treated in the follow-up period that the inflation gap in targeting countries is smaller than in non-targeting countries in times when the targeting countries have IT as their monetary policy regime for all income groups.

6.4.5 Summary of *Hypothesis #3*

To summarise the results from all regressions of the inflation gap calculated from the data about actual inflation and about perceived inflation obtained from respondents with varying socio-economic characteristics, we can say that the analyses have shown that the impact of inflation targeting introduction is heterogeneous across different socio-economic groups, although the calculated size of the impacts within individual groups did not differ drastically, it was always in the order of units. The $ITactive$ coefficient was statistically significant in all models at least at the 5% level of significance (and in a number of cases at the 1% level of significance) and always had a negative sign pointing to the decrease of the inflation gap caused by the introduction of inflation targeting.

The regressions which contained also the average European actual inflation as an additional explanatory variable resulted in significance of the $ITactive$ coefficient at the 1% level for all groups. The coefficient always had a negative sign. The way how the groups were affected by the introduction of inflation targeting remained the same as in the regressions without this control variable. The average European inflation always had a positive sign, as was the case of the total data regression.

6.5 Analysis using interpolated data

In the last part of the analysis, we have performed the same fixed-effects regression, only on the linearly interpolated data, as described in section 4. This analysis was done in order to see whether the hypotheses could be confirmed also on the alternative transformed data, where both actual and perceived inflation attain the values ranging from -100 to +100. Results from these regressions can be found in Appendix A – tables 17 – 21.

In all regressions, the $ITactive$ coefficient had a negative sign, again pointing to a decrease of the inflation gap after the introduction of IT. Yet the coefficient was insignificant in all regressions. This might have been caused by the way the interpolation of the actual inflation changed the original development path of the inflation gap – e.g. there were periods when the original inflation gap increased, but the interpolated inflation gap sometimes increased and sometimes decreased, not following the original development anymore. This might have lead to the break of the relationship between the inflation gap and the introduction of inflation targeting discovered while using the original, untransformed, data.

The average European inflation that is included in the model as an explanatory variable seems to have a negative impact on the interpolated inflation gap. This is in contradiction with the model using original data, where the coefficient of the average inflation has a positive sign. Yet when we look at the correlation between the inflation gap and the average European inflation (in the following table), we can see that it is negative in both cases. The discrepancy in the signs of the coefficient is thereby probably caused by different model specifications.

Table 22: Correlation between inflation gap and average European inflation.

Model	Correlation coefficient
Original data	-0.0788
Interpolated data	-0.2638

Source: Own work using Stata.

7. Conclusion

In the thesis, we focused on the influence that the introduction of inflation targeting has on the relationship between perceived and actual inflation.

It is the perceived inflation and not the actual, officially reported, inflation that affects real behaviour of consumers. Yet due to a variety of reasons perceived inflation often differs from the actual one, which makes it highly important for economists and policy makers to examine and measure inflation perceptions and their difference from actual inflation.

According to Hammond (2012), as of 2012 twenty seven countries were considered fully fledged inflation targeters. Through inflation targeting, central banks communicate their goals more transparently and with greater degree of accountability and credibility. These factors should help the public get more accurate idea about the actual level of inflation and thereby possibly reduce the difference between actual and perceived inflation.

Yet even though the inflation targeting regime might help the public realise the true level of inflation more accurately if the target is credible and thereby mitigate the difference between perceived and actual inflation, there has been a lack of focus on the impact of the introduction of inflation targeting on the development of perceived inflation and the inflation gap so far. Some economists have focused on examining the difference between actual and perceived inflation and possible determinants of such difference, but mostly in connection with the introduction of the euro currency in individual European countries, as well as on the reasons for different inflation perceptions across socio-economic groups. Others (e.g. Johnson, 2002; Levin et al., 2004; or Capistran and Ramos-Francia, 2007) have studied the relationship between expected and actual inflation in connection with the adoption of inflation targeting. They came to the conclusion that introduction of inflation targeting usually leads to a reduction in the level of expected inflation and anchoring of inflation expectations.

For the thesis, we decided to combine these two mentioned sets of research papers and to examine whether the introduction of inflation targeting has some influence on the difference between perceived and actual inflation and whether various socio-economic characteristics influence the impact of inflation targeting on the discrepancy between actual and perceived inflation. We intentionally focused on inflation perceptions and not on inflation expectations that were used in previous research, because inflation expectations are mostly extracted from surveys conducted among a narrow group of professional forecasters, whereas inflation perceptions are extracted from consumer surveys, where a large sample of respondents represents the whole population of a certain economy. By looking at the relationship between actual and perceived

inflation instead of expected inflation, we can get a much wider perspective on how the whole population's perceptions about inflation are influenced by the introduction of inflation targeting.

Using actual inflation data from the International Monetary Fund International Financial Statistics and perceived inflation data from the Joint Harmonised EU Programme of Business and Consumer Surveys published regularly by the European Commission (both reported on a monthly basis), we created an unbalanced panel data set containing a treatment group of six EU countries and one candidate that have adopted inflation targeting and a control group of thirteen EU countries without the inflation targeting regime.

For the empirical analysis, we used a difference-in-differences model applied on the unbalanced panel data set in order to first examine whether the introduction of inflation targeting has an impact on the difference between perceived inflation and actual inflation and second examine whether the size of the impact is in some way influenced by various socio-economic characteristics of the survey respondents. The difference-in-differences element was constructed by including dummy variables capturing 1) whether a country is inflation-targeter, 2) whether it is a post- of pre-treatment period and 3) interaction term of the first two dummies into a general fixed-effects estimator.

The hypotheses were as follows: first, countries with inflation targeting experience smaller inflation gaps than countries without inflation targets; second, after the introduction of inflation targeting in a country, the inflation gap was reduced and third, the impact of inflation targeting on the inflation gap was influenced by socio-economic characteristics.

At the beginning of the empirical analysis, we calculated a simple correlation between the actual and perceived inflation for inflation-targeting countries before and after the introduction of inflation targeting. Except for Hungary, the correlation coefficient for all countries from the periods after the introduction was higher than 50 %, which points to a rather strong relationship between perceived inflation and actual inflation. Moreover, for all countries, again except for Hungary, the correlation coefficient increased with the adoption of the inflation targeting regime.

Afterwards, we focused on the size of the inflation gap in the periods following the introduction of inflation targeting for inflation targeters and non-targeters. The inflation gap was always remarkably smaller in targeting countries than in non-targeting ones.

We further performed the fixed-effects model regression containing dummy variables described above using the total data on actual and perceived inflation. From the obtained results, we were able to conclude that the coefficient of $ITactive$ which describes the impact of the introduction of inflation targeting on the inflation gap, was statistically significant at the 5% level of

significance. It had a negative sign, which was in line with our expectations – the introduction of inflation targeting leads to a decrease of the inflation gap.

After performing the regression with total data, we did the same analysis using data containing various socio-economic characteristics of individual respondents. The results showed that the impact of inflation targeting introduction truly was heterogeneous across different socio-economic groups, although the calculated size of the impacts within individual groups did not differ drastically (it was always in the order of units). Moreover, the coefficient capturing the effect of the inflation targeting introduction was statistically significant in all models at least at the 5% level of significance and always had the expected negative sign, which confirmed the results obtained from the regression using total-economy data. Besides, the results of these regressions were in a lot of cases in line with the results of previous research focusing on the different inflation perceptions across socio-economic groups.

We also included the average European actual inflation as an additional explanatory variable into the fixed-effects model and performed the regression again. The inclusion of the variable lead to an increased significance of the $ITactive$ coefficient (it was always significant at the 1% level) both in the total data regression and in the socio-economic characteristics data regressions. In case of the socio-economic characteristics data regressions, the way how the individual groups were affected by the introduction of inflation targeting remained the same as in the regressions without the control variable.

Finally, we again performed the fixed-effects regressions, only using actual inflation data that had been linearly interpolated data in order to be directly comparable to the perceived inflation data. Such analysis was done in order to see whether the hypotheses could be confirmed also on the alternative transformed data, where both actual and perceived inflation attain the values ranging from -100 to +100. In all regressions, the $ITactive$ coefficient had a negative sign, again pointing to a decrease of the inflation gap after the introduction of IT. It is worth mentioning that the coefficient turned insignificant in these additional regressions. This might have been caused by the way the interpolation of the actual inflation changed the original development path of the inflation gap and thereby the relationship between the inflation gap and the introduction of inflation targeting discovered while using the original, untransformed, data did not hold anymore.

8. Literature and other sources

- Aucremanne, L. et al. (2007). Assessing the gap between observed and perceived inflation in the euro area: is the credibility of the HICP at stake? National Bank of Belgium Working Paper Series, 122.
- Badarinza, C. and Buchmann, M. (2009). Inflation Perceptions and Expectations in the Euro Area: The Role of News. ECB Working Paper No. 1088.
- Ball, L. M. and Sheridan, N. (2004). Does Inflation Targeting Matter? The Inflation-Targeting Debate, National Bureau of Economic Research. Oxford University Press, December 2004.
- Baltagi, B. H. (2008). Econometric Analysis of Panel Data. 4th Edition. Wiley, John & Sons.
- Bertrand, M. et al. (2004). How Much Should We Trust Differences-in-Differences Estimates? Quarterly Journal of Economics, 119(1), 249-275.
- Brachinger, H. (2006). Euro or Teuro?: The euro-induced perceived inflation in Germany. Department of Quantitative Economics Working Paper Series, 5. University of Fribourg, Switzerland.
- Bryan, M. F. and Venkatu, G. (2001). The Curiously Different Inflation Perspectives of Men and Women. Economic Commentary, Federal Reserve Bank of Cleveland, November 2001.
- Capistrán, C. and Ramos-Francia, M. (2010). Does Inflation Targeting Affect the Dispersion of Inflation Expectations? Banco de México Working Papers, No. 2007–11.
- Crowe, C. (2010). Testing the Transparency Benefits of Inflation Targeting: Evidence from Private Sector Forecasts. Journal of Monetary Economics No. 57 (2010).
- D'Elia, E. (2005). Actual and perceived inflation. Working paper, ISAE and Statistical Office of the Municipality of Rome.
- de Carvalho Filho, I. E. (2011): 28 Months Later: How Inflation Targeters Outperformed Their Peers in the Great Recession. The B.E. Journal of Macroeconomics: Vol. 11: Iss. 1.
- Del Giovane, P. and Sabbatini, R. (2006). Perceived and measured inflation after the launch of the euro: explaining the gap in Italy. Giornale degli Economisti e Annali di Economia, Vol. 65, No. 2 (November 2006), p.155-192.

- Del Giovane, P. et al. (2008). What's behind „Inflation perceptions"? A survey-based analysis of Italian consumers. Banca d'Italia Working Papers No. 655, January 2008.
- Diaz, F. et al. (2009). Inflation (mis)perceptions in the euro area. Empirical Economics Vol. 39, No. 2.
- Döhring, B. and Mordonu, A. (2007). What drives inflation perceptions? A dynamic panel data analysis. European Economy Economic Papers, No. 284. European Commission. Brussels.
- Duffy, D. and Lunn, P. (2010). The Euro through the looking glass. Perceived inflation following the 2002 currency changeover. ESRI Working Papers, No. 338.
- European Central Bank (2007). Measured inflation and perceptions in the euro area. ECB Monthly Bulletin, May 2007, pages 63-72. Available at: http://www.ecb.europa.eu/pub/pdf/mobu/mb200705en.pdf.
- European Commission (2006). The Joint Harmonised EU Programme of Business and Consumer Surveys. European Economy Special Report No. 5.
- Ferrucci, G. et al. (2010). Consumers' quantitative inflation perceptions and expectations in the euro area: an evaluation. Conference on Consumer Inflation Expectations Federal Reserve Bank of New York. Available at: http://data.newyorkfed.org/research/conference/2010/consumer/FerrucciFRBNY.pdf.
- Fluch, M. and Stix, H. (2005). Perceived Inflation in Austria – Extent, Explanations, Effects. Monetary Policy & The Economy 03/05.
- Hammond, G. (2012). State of the art of inflation targeting. Bank of England. CCBS Handbook No. 29 – February 2012 version.
- Hoffmann, J. et al. (2006). Index of Perceived Inflation Or EU Consumer Surveys? An Assessment of Professor H. W. Brachinger's Approach. Intereconomics, Review of European Economic Policy, Vol. 41, 2006. Available at: http://ssrn.com/abstract=912456.
- Imbens, G. and Wooldridge, J. (2007). Difference-in-Differences Estimation. The National Bureau of Economic Research Summer Institute „What's New in Econometrics 2007", Lecture 10.
- International Monetary Fund International Financial Statistics.

- Johnson, D. R. (2002). The effect of inflation targeting on the behavior of expected inflation: evidence from an 11 country panel. Journal of Monetary Economics No. 49, 2002.
- Joint Harmonised EU Programme of Business and Consumer Surveys perceived inflation data. Avalilable at: http://ec.europa.eu/economy_finance/db_indicators/surveys/time_series/index_en.htm
- Lacina L. (2007). Euro – naše příští měna. Postrach z jednorázového zdražování po zavedení eura (vnímaná inflace). Prezentace. MZLU Brno. Available at: http://www.mfcr.cz/cps/rde/xbcr/mfcr/Lacina_Lubor_PEF_MZLU_pdf.pdf.
- Leung, C. (2009). The demographics of household inflation perceptions and expectations. Reserve Bank of New Zealand: Bulletin, Vol. 72, No. 2, June 2009.
- Levin, A.T. et al. (2004). The Macroeconomics Effects of Inflation Targeting. Federal Reserve Bank of St. Louis review, July/August 2004 86 (4).
- Mishkin, F. S. and Schmidt-Hebbel, K. (2002). One Decade of Inflation Targeting in the World: What Do We Know and What Do We Need to Know? Central Banking, Analysis, and Economic Policies Book Series. In Loayza, N. (Series Editor), Soto, R., and Schmidt-Hebbel, K. (Series Editor) (ed.), Inflation Targeting: Design, Performance, Challenges, edition 1, volume 5, chapter 4, pages 171-220, Central Bank of Chile.
- Mishkin, F. S. and Schmidt-Hebbel, K. (2007). Does Inflation Targeting Make a Difference? Central Banking, Analysis, and Economic Policies Book Series. In Mishkin, F. S., Schmidt-Hebbel, K. (Series Editor) (ed.) and Loayza, N. (Series Editor): Monetary Policy under Inflation Targeting. Edition 1, volume 11, chapter 9, pages 291-372, Central Bank of Chile.
- OECD Statistics database.
- Ranyard, R. et al. (2008). Perceptions and expectations of price changes and inflation: A review and conceptual framework. Journal of Economic Psychology 29 (2008), pages 378-400.
- Roger, S. (2010). Inflation Targeting Turns 20. IMF - Finance and Development, March 2010.

- Roger, S. and Stone, M. (2005). On Target? The International Experience with Achieving Inflation Targets. IMF Working Paper No. 05/163.
- Sturm, J. - E. et al. (2009). The euro and prices: changeover-related inflation and price convergence in the euro area. European Economy Economic Papers 381.
- Svensson, L.E.O. (1997). Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets. European Economic Review, Elsevier, vol. 41(6), pages 1111-1146, June 1997.
- Traut-Mattausch, E. et al. (2004). Expectancy Confirmation in Spite of Disconfirming Evidence: The Case of Price Increases Due to the Introduction of the Euro. European Journal of Social Psychology 34. Pages 739 - 760.
- Villa, J. M. (2012). Simplifying the estimation of difference-in-differences treatment effects with Stata. MPRA Paper No. 43943, University Library of Munich, Germany.
- Walsh, C. (2009). Inflation targeting: what have we learned? International Finance, Volume 12, Issue 2, pages 195–233, summer 2009.

9. Appendix A – Results tables

- Table 4: Wald (F) test for fixed effects.

. regress gap after ITcountry ITactive oecdeuropecpi

Source	SS	df	MS		Number of obs	= 4445
					F(4, 4440)	= 193.98
Model	400765.119	4	100191.28		Prob > F	= 0.0000
Residual	2293218.74	4440	516.490706		R-squared	= 0.1488
					Adj R-squared	= 0.1480
Total	2693983.86	4444	606.206988		Root MSE	= 22.726

gap	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
after	17.09842	1.29658	13.19	0.000	14.55648	19.64037
ITcountry	21.10469	1.701733	12.40	0.000	17.76844	24.44093
ITactive	-42.18549	1.916622	-22.01	0.000	-45.94303	-38.42796
oecdeuropecpi	.612819	.2320151	2.64	0.008	.1579538	1.067684
_cons	11.36879	1.875521	6.06	0.000	7.691829	15.04574

. xtset country time3

panel variable: country (unbalanced)
time variable: time3, 1990m1 to 2012m12, but with gaps
delta: 1 month

. xtreg gap after ITcountry ITactive oecdeuropecpi, fe

note: ITcountry omitted because of collinearity

Fixed-effects (within) regression					Number of obs	= 4445
Group variable: country					Number of groups	= 20
R-sq:	within = 0.1608				Obs per group:	min = 68
	between = 0.0710					avg = 222.3
	overall = 0.1151					max = 276
					F(3,4422)	= 282.49
corr(u_i, Xb) = -0.2972					Prob > F	= 0.0000
gap	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
after	25.46076	1.037923	24.53	0.000	23.42591	27.49561
Itcountry	(omitted)					
ITactive	-31.65091	1.596416	-19.83	0.000	-34.78069	-28.52114
oecdeuropecpi	1.912499	.1885282	10.14	0.000	1.542889	2.282108
_cons	3.075145	1.476331	2.08	0.037	.1807971	5.969492
sigma_u	17.788307					
sigma_e	17.510432					
rho	.50787161	(fraction of variance due to u_i)				
F test that all u_i=0:						
	F(19, 4422)	= 160.90				
	Prob > F	= 0.0000				

Source: Own calculation using Stata.

- Table 5: Breusch-Pagan LM test for random effects.

gap[country,t] = Xb + u[country] + e[country,t]		
Estimated results:		
	Var	sd = sqrt(Var)
gap	606.207	24.62127
e	313.6798	17.71101
u	201.4506	14.19333
Test: Var(u) = 0		
	chibar2(01)	= 57080.63
	Prob > chibar2	= 0.0000

Source: Own calculation using Stata.

- Table 6a: Hausman specification test – basic regression.

.Hausman fixed random				
	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V-B))
	fixed	random	Difference	S.E.
after	17.46255	17.44042	.0221268	.
Itactive	-29.93217	-30.05552	.1233551	.033147
b = consistent under H0 and Ha; obtained from xtreg B = inconsistent under Ha, efficient under H0; obtained from xtreg				
Test: H0: difference in coefficients not systematic				
chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 13.09 Prob>chi2 = 0.0014 (V_b-V_B is not positive definite)				

Source: Own calculation using Stata.

- Table 6b: Hausman specification test – regression with average European inflation as an independent variable.

.Hausman fixed random				
	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V-B))
	fixed	random	Difference	S.E.
after	25.46076	25.37206	.088695	.
Itactive	-31.65091	-31.7782	.1272855	.
oecdeuropecpi	1.912499	1.896894	.0156044	.
b = consistent under H0 and Ha; obtained from xtreg B = inconsistent under Ha, efficient under H0; obtained from xtreg				
Test: H0: difference in coefficients not systematic				
chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 118.91 Prob>chi2 = 0.0000 (V_b-V_B is not positive definite)				

Source: Own calculation using Stata.

- Table 7: "Total" regression (LR).

	Baseline	Follow-up	Total
Control	1 080	2 094	3 174
Treated	219	1 052	1 271
Total	1 299	3 146	
R-square	0.147		

DIFFERENCE IN DIFFERENCES ESTIMATION

	BASE LINE			FOLLOW-UP			
Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
gap	15.974	36.435	20.462	30.489	9.597	-20.892	-41.354
Std. Error	4.114	3.288	5.266	3.545	8.430	9.145	10.200
t	3.88	22.20	3.89	20.07	46.05	15.94	-4.05
P>|t|	0.001	0.000	0.001***	0.000	0.269	0.034**	0.001***

* Means and Standard Errors are estimated by linear regression.

**Clustered Std. Errors.

***Inference: *** p<0.01; ** p<0.05; * p<0.1.
Source: Own calculation using Stata.

- Table 10: "Men" and "Women" regression (LR).

	men			women		
	Baseline	Follow-up	Total	Baseline	Follow-up	Total
Control	1 107	2 093	3 200	1 107	2 093	3 200
Treated	141	882	1 023	141	882	1 023
Total	1 248	2 975		1 248	2 975	
R-square	0.150			0.161		

DIFFERENCE IN DIFFERENCES ESTIMATION

		BASE LINE			FOLLOW-UP			
	Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
men	gap	14.773	33.689	18.916	26.978	3.513	-23.465	-42.381
	Std. Error	3.935	3.415	5.210	3.335	9.598	10.161	9.909
	t	3.75	20.31	3.63	18.43	41.48	14.74	-4.28
	P>|t|	0.001	0.000	0.002***	0.000	0.719	0.033**	0.000***
women	gap	21.289	38.652	17.363	34.148	9.385	-24.763	-42.126
	Std. Error	4.183	2.397	4.821	3.744	9.308	10.033	9.758
	t	5.09	28.53	3.60	24.72	46.99	13.16	-4.32
	P>|t|	0.000	0.000	0.002***	0.000	0.327	0.024**	0.000***

* Means and Standard Errors are estimated by linear regression.

**Clustered Std. Errors.

***Inference: *** p<0.01; ** p<0.05; * p<0.1.

Source: Own calculation using Stata.

- Table 12: "Age" regression (LR).

	Age 16-29			Age 30-49			Age 50-64			Age 65+		
	Baseline	Follow-up	Total	Baseline	Follow-up	Total	Baseline	Follow-up	Total	Baseline	Follow-up	Total
Control	1 106	2 093	3 199	1 107	2 093	3 200	1 106	2 093	3 199	1 081	2 093	3 174
Treated	141	882	1 023	141	882	1 023	141	882	1 023	139	882	1 021
Total	1 247	2 975		1 248	2 975		1 247	2 975		1 220	2 975	
R-square	0.141			0.169			0.161			0.130		

DIFFERENCE IN DIFFERENCES ESTIMATION

		BASE LINE			FOLLOW-UP			
	Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
Age 16-29	gap	12.137	28.924	16.787	25.209	3.447	-21.762	-38.548
	Std. Error	4.361	2.476	5.015	3.499	9.194	9.838	9.663
	t	2.78	18.92	3.35	15.87	37.80	12.87	-3.99
	P>|t|	0.012	0.000	0.004**	0.000	0.712	0.040**	0.001***
Age 30-49	gap	16.393	35.940	19.547	30.115	4.139	-25.975	-45.522
	Std. Error	4.052	3.310	5.232	3.508	9.989	10.587	10.207
	t	4.05	22.30	3.74	20.30	45.10	15.25	-4.46
	P>|t|	0.001	0.000	0.002***	0.000	0.684	0.025**	0.000***
Age 50-64	gap	19.218	40.572	21.354	32.751	8.209	-24.542	-45.897
	Std. Error	3.996	3.365	5.224	3.444	9.788	10.376	10.205
	t	4.81	25.56	4.09	23.15	49.42	16.93	-4.50
	P>|t|	0.000	0.000	0.001***	0.000	0.413	0.029**	0.000***
Age 65+	gap	22.678	41.531	18.853	33.806	13.065	-20.741	-39.593
	Std. Error	4.061	3.216	5.180	3.288	8.607	9.213	9.259
	t	5.58	28.54	3.64	26.06	48.06	14.56	-4.28
	P>|t|	0.000	0.000	0.002***	0.000	0.146	0.037**	0.000***

* Means and Standard Errors are estimated by linear regression.

**Clustered Std. Errors. ***Inference: *** p<0.01; ** p<0.05; * p<0.1.

Source: Own calculation using Stata.

- Table 14: "Education" regression (LR).

	Education primary			Education secondary			Education further		
	Baseline	Follow-up	Total	Baseline	Follow-up	Total	Baseline	Follow-up	Total
Control	1 107	2 093	3 200	1 106	2 093	3 199	1 106	2 093	3 199
Treated	141	882	1 023	139	884	1 023	140	883	1 023
Total	1 248	2 975		1 245	2 977		1 246	2 976	
R-square	0.149			0.162			0.156		

DIFFERENCE IN DIFFERENCES ESTIMATION

		BASE LINE			FOLLOW-UP			
	Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
Education primary	gap	23.374	42.388	19.014	35.337	12.420	-22.917	-41.930
	Std. Error	4.012	3.069	5.051	3.841	9.490	10.238	10.468
	t	5.83	29.57	3.76	26.49	49.93	14.92	-4.01
	P>|t|	0.000	0.000	0.001***	0.000	0.207	0.038**	0.001***
Education secondary	gap	15.363	37.051	21.687	30.217	6.806	-23.411	-45.099
	Std. Error	4.019	2.830	4.916	3.529	9.445	10.082	9.948
	t	3.82	23.03	4.41	19.57	47.13	17.21	-4.53
	P>|t|	0.001	0.000	0.000***	0.000	0.480	0.032**	0.000***
Education further	gap	9.520	29.271	19.752	25.203	1.195	-24.009	-43.760
	Std. Error	4.412	4.098	6.022	3.509	8.795	9.469	9.608
	t	2.16	14.34	3.28	13.99	39.98	15.13	-4.55
	P>|t|	0.045	0.000	0.004***	0.000	0.893	0.021**	0.000***

* Means and Standard Errors are estimated by linear regression.

**Clustered Std. Errors.

***Inference: *** p<0.01; ** p<0.05; * p<0.1.

Source: Own calculation using Stata.

- Table 16: "Income" regression (LR).

	Income 1Q			Income 2Q			Income 3Q			Income 4Q		
	Baseline	Follow-up	Total	Baseline	Follow-up	Total	Baseline	Follow-up	Total	Baseline	Follow-up	Total
Control	1 051	2 089	3 140	1 051	2 089	3 140	1 052	2 090	3 142	1 053	2 090	3 143
Treated	140	881	1 021	141	879	1 020	141	872	1 013	90	869	959
Total	1 191	2 970		1 192	2 968		1 193	2 962		1 143	2 959	
R-square	0.167			0.159			0.168			0.152		

DIFFERENCE IN DIFFERENCES ESTIMATION

		BASE LINE			FOLLOW-UP			
	Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
Income 1Q	gap	22.732	42.268	19.537	36.169	12.320	-23.849	-43.386
	Std. Error	4.033	3.141	5.112	3.659	8.928	9.648	9.616
	t	5.64	28.95	3.82	26.40	50.85	15.04	-4.51
	P>|t|	0.000	0.000	0.001***	0.000	0.184	0.024**	0.000***
Income 2Q	gap	18.546	39.235	20.689	32.593	9.101	-23.491	-44.180
	Std. Error	4.039	2.696	4.856	3.456	9.770	10.363	9.997
	t	4.59	26.22	4.26	22.61	48.76	16.43	-4.42
	P>|t|	0.000	0.000	0.000***	0.000	0.364	0.036**	0.000***
Income 3Q	gap	14.892	34.382	19.490	29.576	4.397	-25.179	-44.668
	Std. Error	4.190	3.870	5.704	3.469	9.611	10.218	9.871
	t	3.55	19.93	3.42	19.12	44.42	15.12	-4.53
	P>|t|	0.002	0.000	0.003***	0.000	0.653	0.024**	0.000***
Income 4Q	gap	9.986	25.632	15.646	24.394	-0.527	-24.921	-40.567
	Std. Error	4.531	6.508	7.930	3.354	9.261	9.850	10.682
	t	2.20	12.39	1.97	14.28	35.66	11.53	-3.80
	P>|t|	0.041	0.001	0.064*	0.000	0.955	0.021**	0.001***

* Means and Standard Errors are estimated by linear regression.
**Clustered Std. Errors. ***Inference: *** p<0.01; ** p<0.05; * p<0.1.
Source: Own calculation using Stata.

- Table 17: Interpolated "total" regression (FE).

dependent variable - interpolated inflation gap (gap_inter)	
intercept	65.006006*** (14.40)
ITcountry	(omitted)
after	22.05862*** (6.55)
ITactive	-1.6835238 (-0.10)
oecdeurope_cpi	-.27137603 (-0.29)
number of observations	4 445
R^2 (within)	0.247

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

- Table 18: Interpolated "men and women" regression (FE).

dependent variable - interpolated inflation gap (gap_inter)		
	Men	**Women**
intercept	58.77633*** (12.86)	71.8634*** (16.42)
ITcountry	(omitted)	(omitted)
after	20.321101*** (7.94)	17.71306*** (7.55)
ITactive	-16.25655 (-1.30)	-14.69053 (-1.11)
oecdeurope_cpi	-.07135172 (-0.09)	-1.004723 (-1.23)
number of observations	4 223	4 223
R^2 (within)	0.266	0.281

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

- Table 19: Interpolated "age" regression (FE).

dependent variable - interpolated inflation gap (gap_inter)				
	Age 16-29	**Age 30-49**	**Age 50-64**	**Age 65+**
intercept	60.770759***	62.661115***	67.916157***	71.133126***
	(15.54)	(13.33)	(13.69)	(16.81)
ITcountry	(omitted)	(omitted)	(omitted)	(omitted)
after	18.809755***	20.609192***	19.282867***	16.794457***
	(7.39)	(8.39)	(7.43)	(7.08)
ITactive	-18.034692	-14.111904	-13.123978	-16.828531
	(-1.41)	(-1.12)	(-1.01)	(-1.20)
oecdeurope_cpi	-.73668695	-.38940891	-.62187993	-.56714633
	(-0.90)	(-0.46)	(-0.75)	(-0.71)
number of observations	4 222	4 223	4 222	4 195
R^2 (within)	0.299	0.272	0.261	0.234

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

- Table 20: Interpolated "education" regression (FE).

dependent variable - interpolated inflation gap (gap_inter)			
	Education primary	**Education secondary**	**Education further**
intercept	73.743305*** (19.40)	65.532327*** (14.70)	57.772117*** (10.74)
ITcountry	(omitted)	(omitted)	(omitted)
after	17.301461*** (6.32)	20.202685*** (8.22)	21.973998*** (9.70)
ITactive	-15.529805 (-0.98)	-12.671811 (-1.05)	-11.662562 (-1.10)
oecdeurope_cpi	-.97649598 (-1.24)	-.81352632 (-1.01)	-.53326499 (-0.60)
number of observations	4 223	4 222	4 222
R^2 (within)	0.284	0.306	0.284

Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

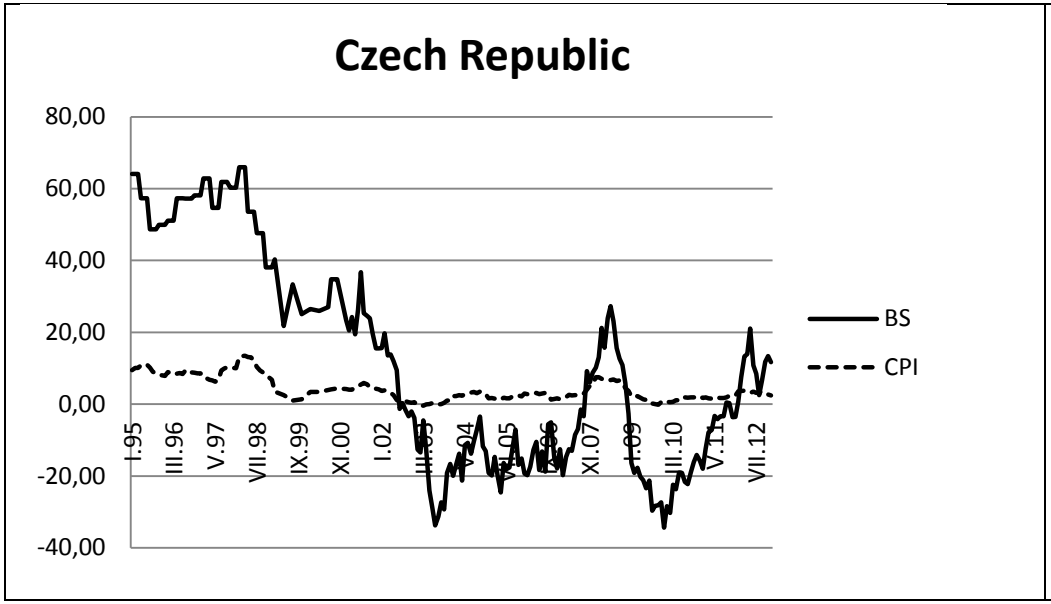
- Table 21: Interpolated "income" regression (FE).

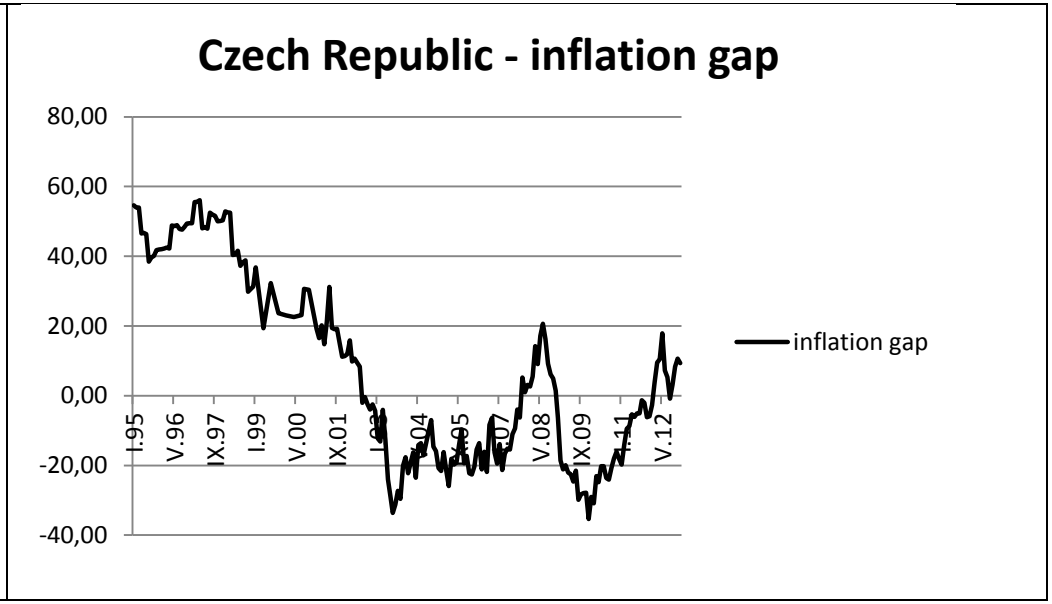
dependent variable - interpolated inflation gap (gap_inter)				
	Income 1Q	**Income 2Q**	**Income 3Q**	**Income 4Q**
intercept	74.977133***	67.930164***	62.388793***	50.484756***
	(18.39)	(15.97)	(13.66)	(8.34)
ITcountry	(omitted)	(omitted)	(omitted)	(omitted)
after	17.41248***	19.267366***	20.799651***	20.756385***
	(7.18)	(7.64)	(7.86)	(7.93)
ITactive	-13.098224	-15.465139	-14.423598	-15.021998
	(-0.94)	(-1.12)	(-1.20)	(-0.92)
oecdeurope_cpi	-1.1285582	-.77370181	-.52327073	-.67757791
	(-1.36)	(-0.95)	(-0.63)	(-0.69)
number of observations	4 161	4 160	4 155	4 102
R^2 (within)	0.286	0.290	0.285	0.262

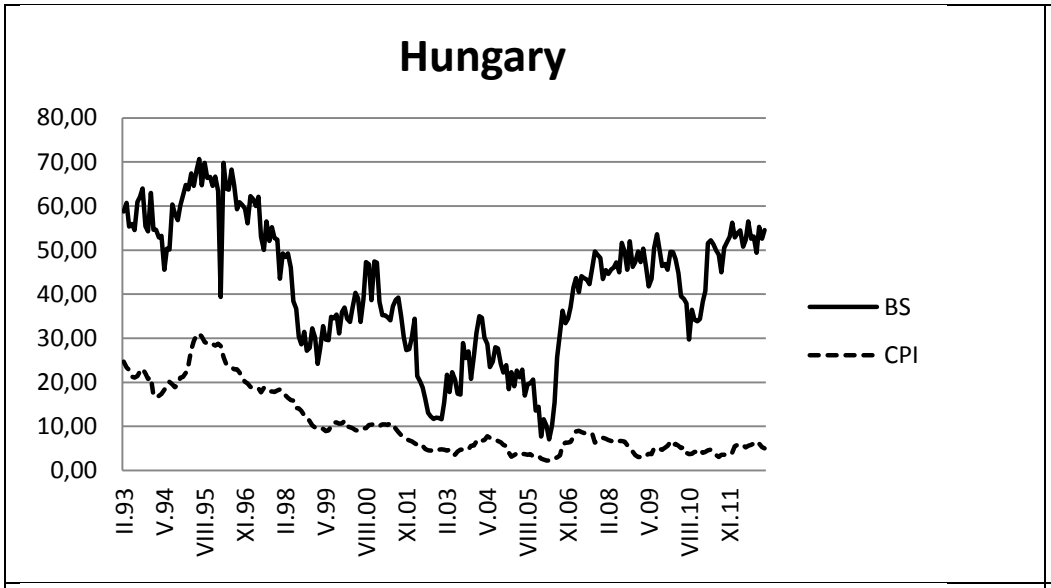
Legend: * p<0.10; ** p<0.05; *** p<0.01.
Source: Own calculation using Stata.

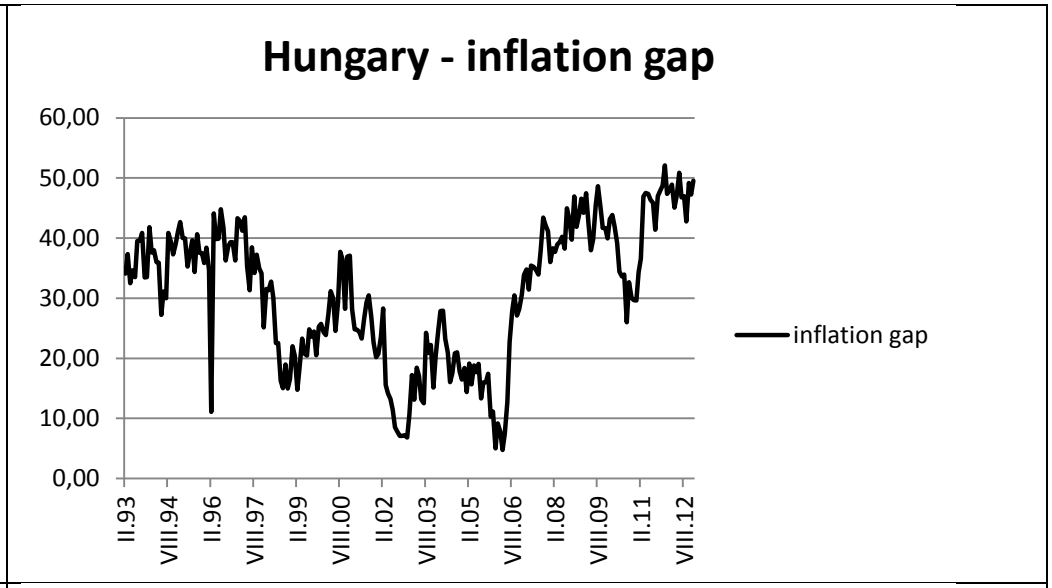
10. Appendix B

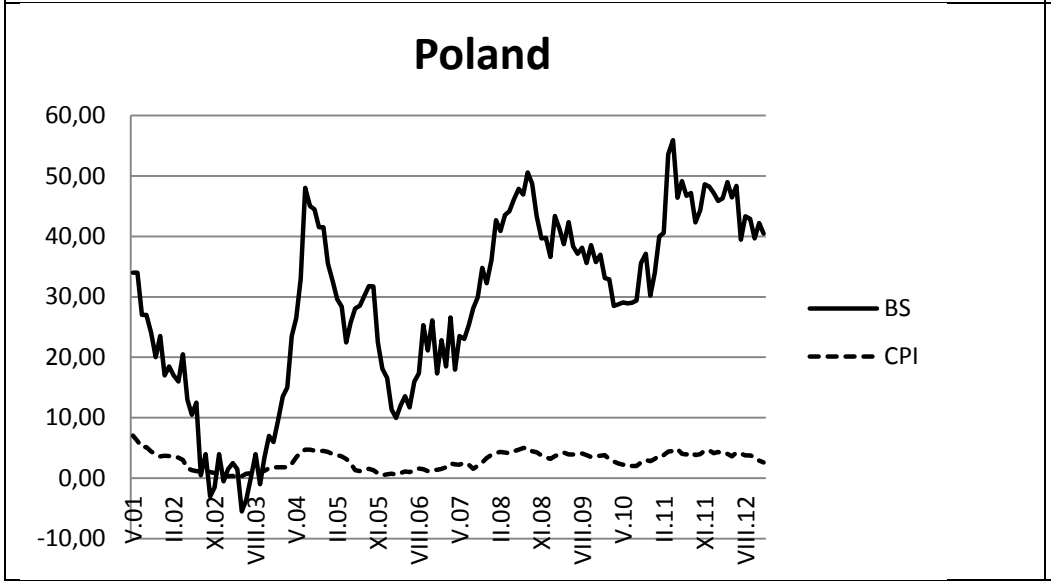
- Figure 4: Development of perceived (BS) and actual (CPI) inflation and size of the inflation gap.

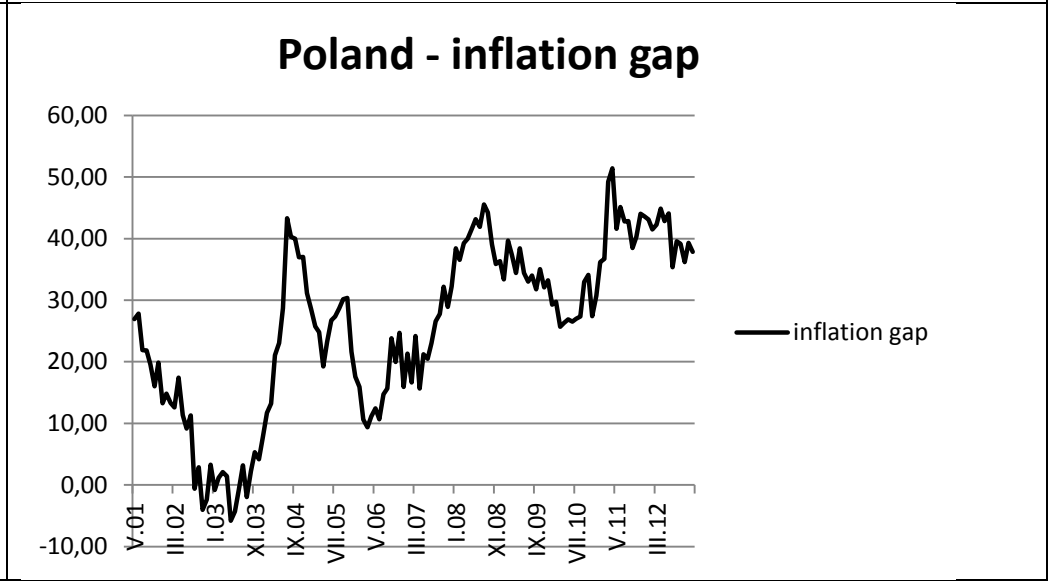


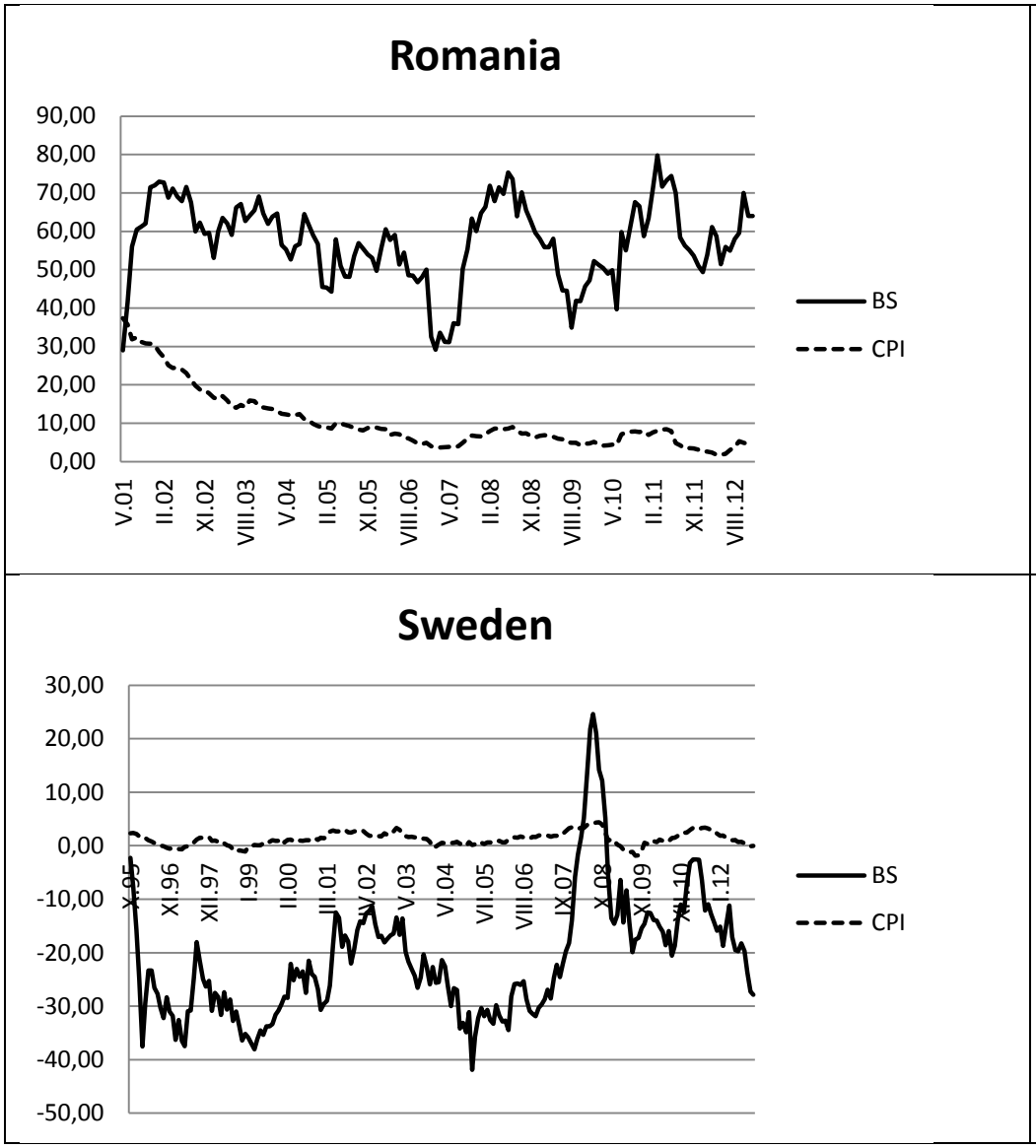


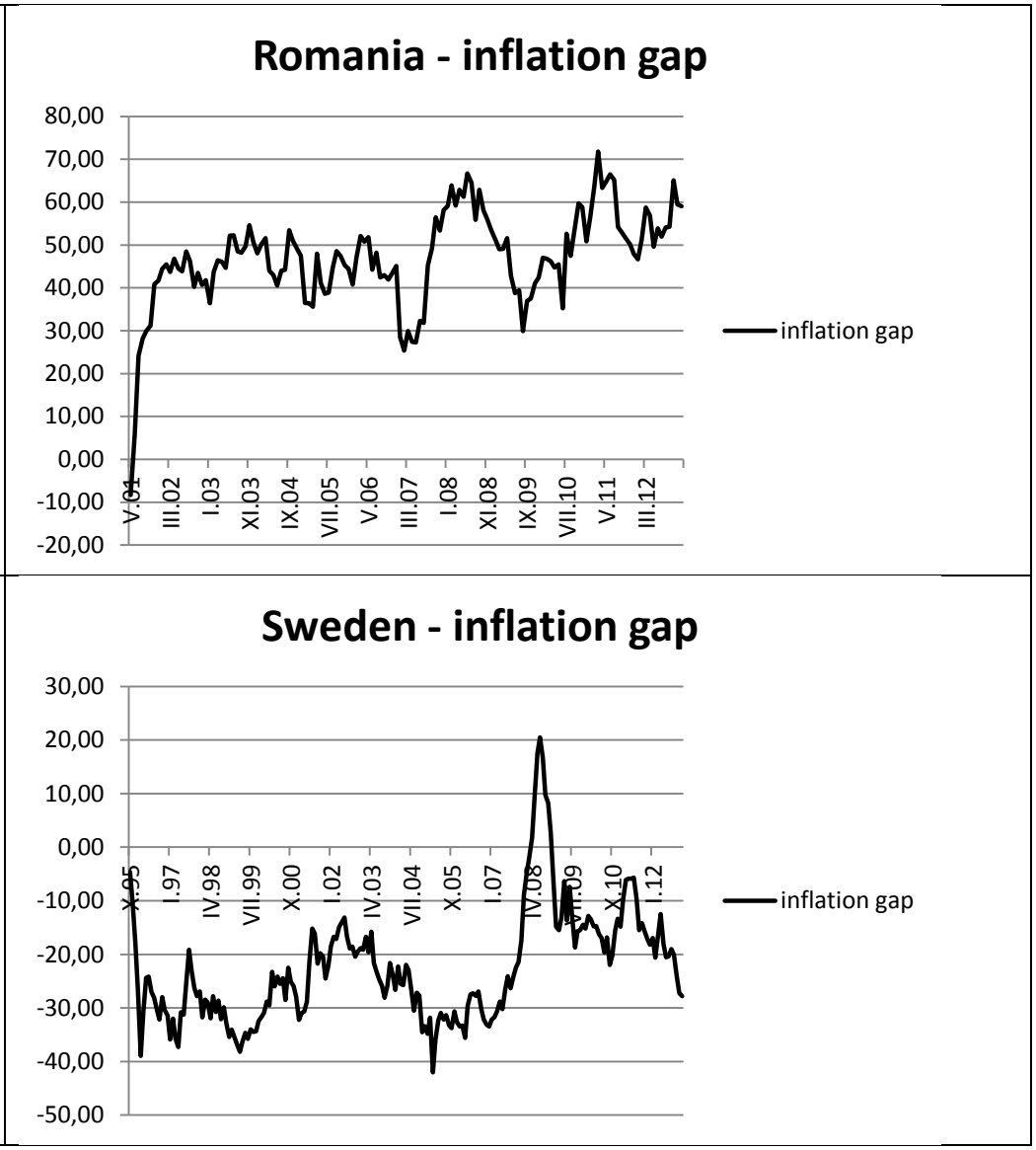

Hungary
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
II.93
V.94
VIII.95
XI.96
II.98
V.99
VIII.00
XI.01
II.03
V.04
VIII.05
XI.06
II.08
V.09
VIII.10
XI.11
BS
CPI


Hungary - inflation gap
60,00
50,00
40,00
30,00
20,00
10,00
0,00
II.93
VIII.94
II.96
VIII.97
II.99
VIII.00
II.02
VIII.03
II.05
VIII.06
II.08
VIII.09
II.11
VIII.12
inflation gap


Poland
60,00
50,00
40,00
30,00
20,00
10,00
0,00
-10,00
V.01
II.02
XI.02
VIII.03
V.04
II.05
XI.05
VIII.06
V.07
II.08
XI.08
VIII.09
V.10
II.11
XI.11
VIII.12
BS
CPI

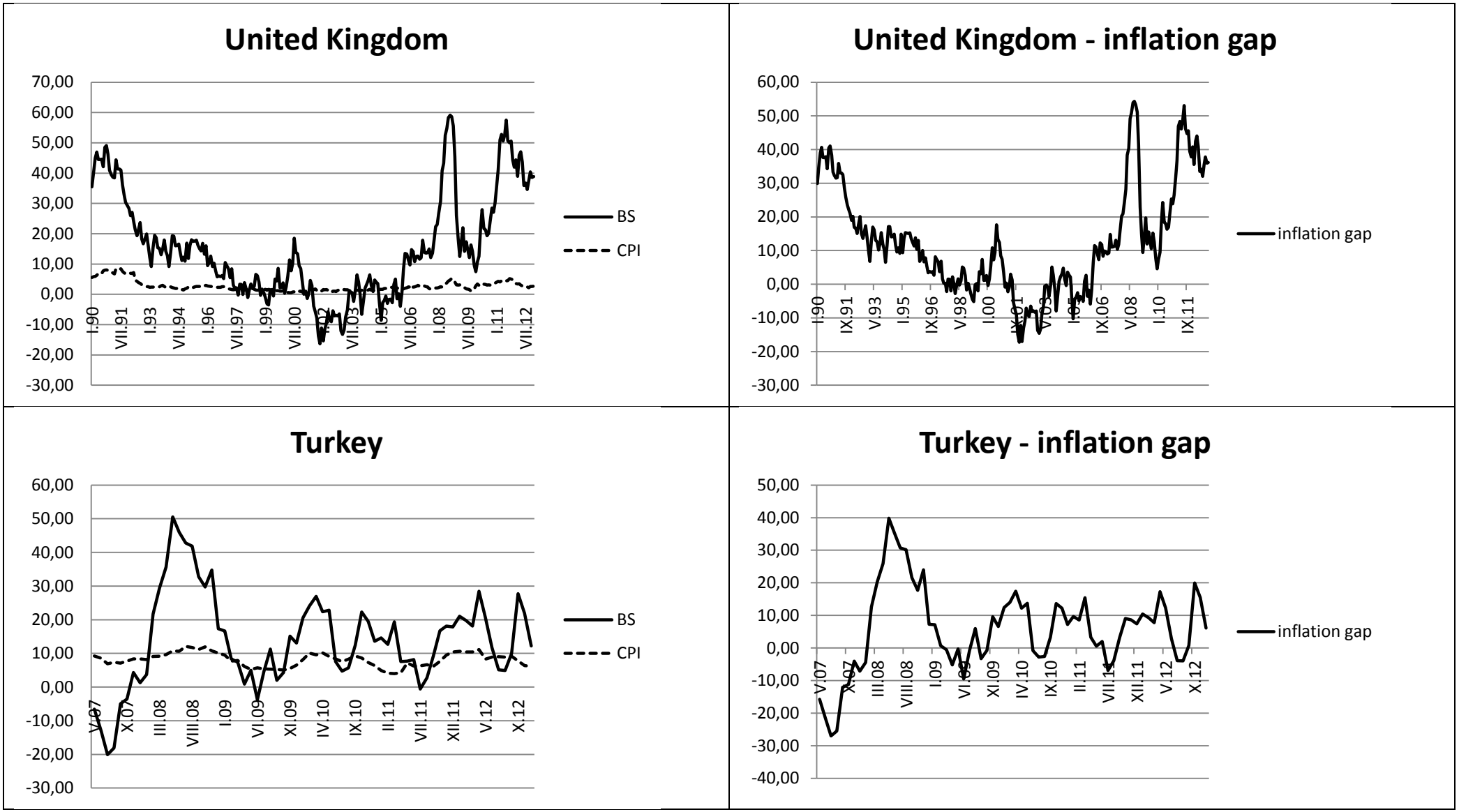

Poland - inflation gap
60,00
50,00
40,00
30,00
20,00
10,00
0,00
-10,00
V.01
III.02
I.03
XI.03
IX.04
VII.05
V.06
III.07
I.08
XI.08
IX.09
VII.10
V.11
III.12
inflation gap


Romania
90,00
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
V.01
II.02
XI.02
VIII.03
V.04
II.05
XI.05
VIII.06
V.07
II.08
XI.08
VIII.09
V.10
II.11
XI.11
VIII.12
BS
CPI


Romania - inflation gap
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
-10,00
-20,00
V.01
III.02
I.03
XI.03
IX.04
VII.05
V.06
III.07
I.08
XI.08
IX.09
VII.10
V.11
III.12
inflation gap

Sweden
30,00
20,00
10,00
0,00
-10,00
-20,00
-30,00
-40,00
-50,00
X.95
XI.96
XII.97
I.99
II.00
III.01
V.02
V.03
VI.04
VII.05
VIII.06
IX.07
X.08
XI.09
XII.10
I.12
BS
CPI

Sweden - inflation gap
30,00
20,00
10,00
0,00
-10,00
-20,00
-30,00
-40,00
-50,00
X.95
I.97
IV.98
VII.99
X.00
I.02
IV.03
VII.04
X.05
I.07
IV.08
X.10
I.12
inflation gap



Source: Own work using BS and CPI data.