



Does inflation targeting (IT) affect the macroeconomic performance of countries?

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Abstract

In recent years there has been an increase of countries that have adapted inflation targeting (IT) regimes. At the same time IT countries shifted from the traditional IT regime to a more flexible one. Previous literature has not come to a conclusive answer to the question if IT regimes were truly better at targeting inflation than other monetary frameworks. This thesis attempts to answer whether IT regimes positively influence the macroeconomic performance of countries by comparing IT and NIT countries. Furthermore this thesis will look how the flexible and traditional IT regimes performed compared to the NIT countries. The main macroeconomic variables that are used are inflation (core and headline), output growth, and interest rates. The difference in difference method is used to answer these questions for the time period of 1983-2008. The analysis shows that the differences in performance are not caused by the implementation of IT regimes, but are caused by transition factors. The results further suggest that strict regimes are better at targeting (headline) inflation than the flexible regimes. The results for the other macroeconomic indicators suggest that IT regimes do not have any influence. In conclusion, only strict regimes are able to significantly lower (headline) inflation.

Keywords: Monetary Framework, Inflation Targeting, Macroeconomic Performance

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Chapter 1: Introduction

In recent years there has been an increase of Inflation targeting (IT) being adopted by central banks as their monetary policy framework. Instead of being a set of rules, Inflation targeting is a framework for monetary policy. The adoption of inflation targeting came as a response to the failure of other monetary policy regimes, rather than in response to new economic thinking (Hammond, 2012). This new approach to monetary policy started in 1989 in New Zealand. What made this approach different to previous ones is the clear public commitment to controlling inflation as the primary policy objective, and the emphasis on policy transparency and accountability (Roger, 2010). Over the last decades the theory and practice of inflation targeting have developed together, leading to an increase in the amount of academic literature. The question of what the effect of an inflation targeting (IT) regime on the macroeconomic performance of an economy is has been a topic of interest for several of these researches. They have had a closer look at inflation targeting to see if it mattered and came up with contradicting results. Some claimed that IT does matter and that it improves economic performance, while others showed that it had no effect on macroeconomic performance. The question about the effects of IT regimes is still relevant because in 2009 27 countries had adopted inflation targeting regimes (Hammond, 2012). This number increased to 34 in 2014. Since 2014 a few more countries started using IT regimes, including India in 2015 (Ouyang and Rajan, 2016).

Several new trends have arisen for central banks in the past years. There is a progressive trend visible of more transparent and better information provision to the public. It also seems that Central banks have shifted away from a pure IT strategy and have adopted more flexible IT strategies (Roger, 2010). The inflation targeting became more flexible because all IT regime using central banks do not only aim at stabilising inflation around the inflation target, but they also want to stabilise the real economy. This makes the IT regimes looking very strict whereas in reality they are more flexible (Svensson, 2010). This thesis will go into more detail in chapter 2.

Because of these new developments it is interesting to have a new look at the performances of the IT policy these central banks implemented.

To have a better look at these countries' central banks it is important to start with an overview of what an IT framework looks like. IT regimes use a framework consisting of four main elements that need to be fulfilled for a central bank before it can be classified as a user of an IT regime. These requirements can be listed as the following:

1. 'An explicit central bank mandate to pursue price stability as the primary objective of monetary policy and a high degree of operational autonomy' (Roger, 2010, p.46)
2. 'Explicit quantitative targets for inflation' (Roger, 2010, p.46)
3. 'Central bank accountability for performance in achieving the inflation objective, mainly through high-transparency requirements for policy strategy and implementation' (Roger, 2010, p.46)
4. 'A policy approach based on a forward looking assessment of inflation pressures, taking into account a wide array of information' (Roger, 2010, p.46)

These four elements need to be fulfilled to classify a central bank of using an IT regime. These four elements/requirements suggest that a central bank cannot pursue multiple goals at the same time (Roger, 2010) (Heenan et al, 2006) (Mishkin, 2004). If a central bank uses an IT regime it can only achieve price stability. It also follows that long term monetary policy can influence nominal but not inflation-adjusted (real) variables, high inflation is harmful for growth and the equitable distribution of income, and the effectiveness of the monetary policy is influenced by expectations and credibility. Besides these requirements another important aspect is to have a central Bank that is transparent about its macroeconomic policies and accountable for price stability. This means a central bank can only have explicit quantitative targets for inflation in their mandate (Roger, 2010).

The third and fourth requirements listed are needed to deal with the interconnectedness between transparency, accountability, and credibility of the central bank (De Haan, et al., 2005). One of the most important prerequisites for a central bank is that it is transparent about the macroeconomic policies it uses and that it can be held accountable in regards to its main goal, price stability (Roger, 2010).

So what does transparency mean for the four requirements according to Roger (2010)? Transparency refers to the activities of the central bank that are concerned with providing information. Another important aspect of transparency is how understandable monetary policy is for the general public. In reality this means that the public needs transparency to execute the checks and balances and raise the credibility of an IT regime. The higher the transparency the better the public can see if the central bank is following its mandate (De Haan et al., 2005). So if the central bank does not follow or can achieve its own mandate it should be held accountable by the public. Therefore a good information provision is of the utmost importance for effectiveness of monetary policy. With the usage of an IT regime, a central bank can pursue its goal of price stability (Issing, 2001). This is the second prerequisite that a central bank needs to fulfil in order to be classified as a user of an IT regime, instead of money-growth targeting or exchange rate targeting (Svensson, 2010).

As was said previously, it seems that Central banks have shifted away from a pure IT strategy and have adopted more flexible IT strategies. They now target inflation at the medium-run instead of the short-run, which enables to central bank to pursue more than just the one objective which would be impossible otherwise. These objectives consist of smoothing output and keeping unemployment at a desired level (Roger, 2010). There are also other possible policies for central banks to follow instead of the IT regime. The central bank of the United States, the Federal Reserve (FED) has a dual mandate of price stability and full employment (Thornton, 2012). There has been an internal and public discussion between FED policy makers about whether it is desirable to adopt an IT regime (Bernanke & Mishkin, 1997).

After this introduction into the general structure of IT regimes, the question that arises is: "How do these countries with IT regimes perform?" The most common way to look at performance is by looking whether IT regimes have increased the economic performance when they were implemented. This thesis will attempt to find conclusive evidence regarding the effectiveness of an IT strategy. This will be done by comparing the macroeconomic performance of IT countries to non-inflation targeting (NIT) countries. The NIT countries will help in determining whether possible improvement or a worsening of the macroeconomic performance can be attributed to the IT regime in place. With all this in mind the research question logically follows: 'What is the effect of an inflation targeting

regime (IT) on the macroeconomic performance of a country? '. Furthermore, the shift towards flexible regimes makes it interesting to also see if flexible regimes perform better than the more traditional IT frameworks. This thesis will therefore also look at the differences between flexible and the more traditional IT frameworks.

It is important to determine the proper indicators that are needed to look at the macroeconomic performance of both IT and NIT countries. The two groups of countries (IT & NIT) are selected by using both literature and criteria for having a comparable control-group. This thesis used Hammond (2012) to determine which countries to pick. The IT countries consist of Australia, Canada, Iceland, New Zealand, Norway, Korea, and the UK. The NIT countries consist of the US, Japan, Denmark, and Switzerland. To be able to make a comparison between the two groups this thesis only looked at countries that implemented 'full-fledged inflation targeting' (FFIT). After this initial comparison, this thesis will go into more detail about countries that used flexible IT regimes in a later chapter. This will serve as a Robustness Check for whether or not IT regimes have a positive influence on economic performance.

The difference-in-differences method is used by this thesis. The difference in differences (DID or DD) is a statistical method that looks at the differential effect of a treatment by comparing groups, where one receives a 'treatment' and the other serves as a control group. The sample periods used in this thesis are chosen to include post and pre implementation of an IT regime. This paper therefore will look at 1983 till the start of a specific IT regime till 2008, the other sample will indicate the post-IT sample period. These periods are chosen to not be too much influenced by the oil crisis in '73 and the financial crisis in '08.

The indicators this thesis will inspect more closely are inflation, output growth and interest rates. To measure inflation there are two options that can be used for the targeting purposes, the headline inflation index or the core inflation index. Transparency plays an important role in determining the credibility of the IT. Using the core inflation index might indicate that central banks are out of touch with what the public cares about. The public does care about the prices of all the items they buy, it clearly does not make sense to pretend they would not. Therefore this thesis will use the headline inflation index as its main indicators for inflation since it is also used by most central banks when measuring the performance of their economy. Besides the headline inflation the core inflation will also be used because there are also some arguments on why the core inflation index should be used. An argument that can be used for both indicators is whether oil prices should be included for inflation. If a central bank does not include oil prices in its measurement of inflation, inflation is less affected by fluctuating oil prices. These oil prices however do play an important part in the life of the public, so it would make also sense to include oil price for the inflation index. This thesis therefore concluded that both measurements should be included. More details on this will follow in chapter 2.4.

The influence on output may seem a bit trickier. Although targeting inflation in prioritises price stability, it seemed that after implementing it, it seems to promote real economic growth (Mishkin, 1999). So it seems fair to say that there might be a positive relation between the implementation of IT regimes and higher growth and therefore higher output in the medium to long run.

The last indicator will be interest rates. The interest rates used will be those of government bond rates because they will serve as a proxy for the credibility of the monetary policy of the central bank. To be able to go into more detail than a general impact of IT regimes, this thesis will also look at the differences in, inflation variability and output growth variability. The method this thesis used is

similar to the one used by Ball & Sheridan (2004). This thesis however will use a different time period and will also make a distinction between different IT frameworks whereas previous literature has not done this with this method. The data will be from the early 80's till the beginning of the recent crisis. More details on the method will be presented in the method section of this thesis.

The structure of this thesis will look as follows: The second chapter of this thesis will consist of theoretical framework. Chapter 2 will start with a short historical introduction about why inflation targeting became popular in the 1990s. The chapter's next step is to go into the theoretical framework and design of IT regimes. This part will also provide more information on the communication between the central bank and the public. The third part of chapter 2 will focus on the performance of IT regimes and other monetary frameworks in the past. The final part of chapter 2 will go into the macroeconomic indicators that this thesis will use for its research. After chapter 2, the methodology is presented in chapter 3. In this chapter the approach used will be explained in more details. Chapter 3 starts by going into more details about the selection of countries and time periods. The second part of chapter 3 will explain the approach used by this paper and present the regression that will be used to generate the results. Chapter 4 naturally follows in which the results of the regression are explained in detail. The macroeconomic indicators are individually presented and discussed. In the final part of chapter 4 this thesis will present the results for the regression of both flexible and strict IT regimes. Finally in chapter 5 a conclusion with discussion will follow.

Chapter 2: Theory

Since the beginning of the 1960s, inflation appeared to be highly persistent. This led to governments experimenting with all kinds of policies such as the Gold Standard, having a form of exchange rate pegging (Bretton Woods), or the introduction of currency boards. The biggest downsides of these previous monetary policies was that they all had a high vulnerability to sustained economic shocks, were not flexible, and were easily manipulated through political pressure. Inflation targeting (IT) regimes were developed to not be affected by these downsides. So when IT regimes were being developed there was a trend going on of increasing autonomy for central banks. This was fuelled by the idea that inflation is a monetary phenomenon. This would mean that a **stable** inflation-output trade-off would not exist because the actions of economic agents are dependent on the regime that is in place at that moment, and these regimes constantly changed. So for inflation targeting to be seen as credible a rise in inflation should be seen as brief and not as a change in policy. If this is not the case, then these monetary regimes cannot be seen as adequate sources of macroeconomic discipline. It is therefore highly desirable to protect the monetary authorities of a country from any form of political influence. This can be done by aiming for independent central banks or policies that are not influenced by politics (Siklos, 1998). In the following part of this thesis there will be a closer look at the literature regarding inflation targeting that has formed since the 1990s. The first step will be to specify the relevant way of classifying IT regimes. In chapter 2.2 there will be an overview of IT regime characteristics and the conditions for an IT design are introduced. After making clear what an IT regime looks like this thesis will present some alternative framework and will compare their macroeconomic performance to that of IT regimes in previous research. The last part of chapter 2 will provide detailed information on the macroeconomic variables that are used.

2.1 Inflation Targeting as a definition

Over the course of time the development of inflation targeting has led to different ways of classifying specific inflation regimes. To avoid any confusion this thesis will start to make clear what the different definitions used in the literature represent. An inflation target is being used to define their monetary framework. These classifications depend on the credibility of the central bank and the commitment of the central bank to the inflation target. These ways of classifying IT regimes can be defined into three different monetary frameworks: 'full-fledged inflation targeting' (FFIT), 'implicit price stability anchor' (IPSA), and 'Inflation targeting lite' (ITL) (Carare and Stone, 2006).

2.1.1 FFIT (full-fledged inflation targeting)

The first of these regimes, full-fledged inflation targeting (FFIT), is the best-known form of inflation targeting. Central banks that use FFIT have a medium to high level of credibility, they are clearly committed to their inflation target, and they institutionalise this commitment by using a transparent monetary framework that shows their accountability to the targets they have set. One of these first countries that used FFIT was New Zealand and since 2001 close to twenty other countries also used this regime (Carare and Stone, 2006).

2.1.2 IPSA (implicit price stability anchor)

Another type is implicit price stability anchor (IPSA). Central banks that use this type of inflation targeting have a high level of credibility that enables them to maintain low and stable inflation without full transparency and accountability about their inflation target. They earned credibility due to a record of low and stable inflation and high degree of financial stability. This allows central banks to achieve the objective of output stabilization, as well as price stability. The most well-known central banks that use this type of inflation targeting are the European Central Bank and the Board of Governors of the Federal Reserve System (Mishkin, 1999).

2.1.3 ITL (Inflation targeting lite)

The last type is Inflation targeting lite (ITL). Central banks that use this type announce that they will target a broad inflation objective but are not able to maintain inflation because of their low credibility compared to other central banks. Their low credibility is reflected by their vulnerability to large economic shocks, financial instability, and a weak institutional framework. Most central banks that use this type are active in the developing world. Inflation targeting regimes do reflect the preferences of countries for different monetary frameworks that fit with their economic structure (Carare and Stone, 2006). These different definitions make it difficult to distinguish between countries that use IT regimes and those who do not. Of these different definitions for inflation targeting the FFIT definition is used by countries using IT regimes on which this thesis focusses. Just as Hammond (2012) has done, this thesis will use only countries that use FFIT for the group of countries that use an IT regime.

2.2 Inflation targeting design

In the introduction this thesis already showed the basic requirements that an IT regime needs. It was also mentioned that in practise inflation targeting is never “strict” but always “flexible. The rules for IT regimes should be seen as guidelines, or general policy frameworks. The reason for this is that all inflation-targeting central banks not only aim at stabilising inflation but that they also try to stabilise the real economy (Svensson, 2010). Since the first implementations of IT regimes there have been a lot of developments which meant IT has changed since it was first implemented. The development led to the idea that four main elements that need to be fulfilled for a central bank before it can be classified as a user of an IT regime. The first element is an explicit mandate to pursue price stability by the central bank as its primary objective and a high degree of autonomy. The second element is that explicit quantitative targets have to be set for the inflation rate. The third requirement is that the actions of policy makers need to be forward-looking for inflation pressures, taking into account a wide array of information. The last element means that central bank has to increase its level of accountability through increased transparency of monetary policy strategies and implementation (Roger, 2010) (Heenan et al, 2006) (Mishkin, 2004).

2.2.1 Inflation targeting characteristics

An IT regime should have a well formulated design with clear characteristics. It should therefore anchor inflationary expectations. It does this by being relevant to a broad range of economic agents, signal commitment by the central bank to low inflation for the medium-run, and be easily understandable for the public.

Another important point is that it should provide a benchmark for central bank accountability. The IT regime should not be easily manipulated by the central bank, the index it uses should be timely and frequent, and it should not be subject to significant revisions.

The last point is that an IT regime should be consistent with the objectives of the central bank. The design of the regime should reflect the goal of the central bank to keep prices stable while avoiding excessive short-run output volatility (Heenan et al, 2006). A possible explanation for these characteristics can be traced back to the beginning of monetary regimes that aimed for price stability. These earlier forms of monetary policies had a high vulnerability to sustained economic shocks, were not flexible, and were easily manipulated through political pressure. As was said earlier in the beginning of chapter 2, when IT regimes were developed there was a trend going on of increasing autonomy for central banks to avoid these downsides. This trend was caused by the idea that inflation is a monetary phenomenon and that having a higher degree of autonomy for central banks means that the public sees them as more credible. Central banks became more autonomous which meant they also became more credible because they were no longer influenced by political pressure (Siklos, 1998).

Besides these points some parameters used should also be specified while designing the regime. The parameters that should be specified are the price index that is used to measure the inflation, the level of the inflation target, whether a point target or band should be used, and whether any escape clauses should be included in the specification (Heenan et al, 2006). These design characteristics are in line with the requirements of Roger (2010). These requirements are all closely linked to the transparency and accountability of the central bank, and are all needed for a clear IT regime design as is explained in the previous part.

It should furthermore be noted that there is a trade-off between having a simple design that is easy to understand or one that is technically more in line with the central bank's internal models of the inflation process but more difficult to understand for the public. In general central banks felt the need for transparency about the inflation targets was greater and have therefore adopted uncomplicated frameworks. They have also simplified their target design, moving from core inflation measures to the headline Consumer Price Index (CPI) for their inflation target. The strength of the commitment of the central bank to its own framework affects how well the policy will work. This commitment is affected by the accompanying rhetoric and other forms of communication employed by the central bank. This means for example that a relative weak framework may be strengthened through unambiguous public announcements by the management of a central bank committing it to low inflation, or that strong formal framework is undermined by unclear and contradictory policy. This clearly shows that it is of the utmost importance for an IT regime to make certain aspects of their design clear in advance of adopting an IT regime. The formal design is just one part of the design which shows the commitment. The strength of IT regimes lies just as much in the accompanying rhetoric and its forms of communication as in the formal part. The IT regime's formal framework and its communications make together the complete IT regime design.

2.2.2 Formal Inflation Targeting design

When central banks choose for IT, then the first step is to make clear which type of price index is used to measure inflation. There are mainly two options for the inflation target. Central banks can use the headline inflation index or the core inflation index. All countries that use inflation targeting regimes use the Consumer Price Index (CPI). Although inflation targeting countries calculate and report using measures of core inflation in policy formulation and communications, the headline rate is mostly used as the official target. Because transparency plays an important role in determining the credibility of the IT, not using the CPI might indicate that a central bank is out of touch with what the public cares about. The CPI generally is seen as the indicator that is the most relevant for the general public, because it is the most publicised price measure and most commonly used for indexation purposes (Heenan et al, 2006).

The second step is to determine the level of the inflation target. The primary objective of price stability has resulted in practice in setting targets as a low, positive rate of inflation (Heenan et al, 2006). Most central banks use point targets within symmetric ranges for their inflation outcomes. A small group uses a point target and some others have set a narrow target range without specifying a point target. Some countries define a target range but do not specify a mid-point of the range as the official target. In a few cases, particularly during disinflation phases, countries have specified upper but not lower bounds to target inflation (Roger & Stone, 2005). For most central banks the midpoint of their inflation targets lays around two percent, while the target for emerging market economies is more widely distributed. The optimal inflation target will differ for countries. This is because if the central bank uses targets that are too low they increase the risk of deflation, and if the target is set too high a period of financial instability may follow (Heenan et al, 2006).

The third step is specifying the target time horizon in more detail. This is the period for which the central bank holds itself accountable for meeting its inflation target (Roger & Stone, 2005). There are three time horizons that are relevant for a good framework design. The first horizon is about the central bank committing to numerical targets for inflation. This could be done by the central bank through specifying a target for the coming year or a medium-term commitment to a particular target. Secondly, there is the forecast horizon which uses the central bank's forecasted inflation (Heenan et al, 2006). Lastly there is the policy horizon which is the period in which the central bank can influence inflation to move closer to its target (Roger & Stone, 2005). While most central banks have low inflation as their long term objective, central banks with inflation targets need to specify a horizon to show their commitment to the public. The horizon should at least extend to the medium term to be able to help the general public with their economic planning horizons to serve as an anchor for inflationary expectations. There are still contradictions with the horizon of the general public and the inflation forecasts used as the operation target in an IT regime. This can be solved by adding lags to develop forecasts with meaning. This is possible since inflation forecasts serve as the operating target in an inflation targeting regime, while keeping in mind that the lags used to construct the inflation forecasts should not longer than the actual time period of the monetary policy (Heenan et al, 2006).

The fourth step focusses on whether a point or a range objective is used for the inflation target. Most IT regime users have specified a band for their target, with a few others having a point target. A reason why most countries prefer a band is because a band is able to realistically indicate what the central bank can expect to achieve with their inflation forecasts. Central banks with range target for inflation target a middle point but have a range from where it may deviate while point targets indicate a more explicit point in which the inflation needs to be nudged (Heenan et al, 2006). Having a range target allows central banks to keep their targets the same for longer periods than it would have with a point target. The range allows for both increases and decreases making it able to achieve stability for the medium run (De Haan et al, 2005). Central banks cannot perfectly forecast inflation, because of uncertainty surrounding the transmission mechanism, and possible future shocks. A band helps the central bank to be flexible and keeps it from reacting unnecessarily to noise in the measurement of inflation. It is also important to keep in mind that the credibility of the central bank is also influenced by its accountability. The accountability here refers to whether or not the central bank can be held responsible for failing to achieve its inflation target. The Bank of England, for example, has to send a letter to the government if the inflation has a deviation of 1 percentage point from their initial target. This means they have a possible range of 1 to 3 percent in which they can act without requiring additional formal accountability procedures, which will harm their credibility. This means in reality that a central bank with a 2 percent range band that has to send a letter to the government if the inflation is different from the target may be a less flexible than central bank with a point target with not such a requirement. Most countries use a band with a 2 percent range.

Emerging market economies usually have wider bands because they are less adequate in reducing the risk of a breach due shocks or errors in their modelling of inflation and the transmission mechanism than developed countries. Compared to developed economies they also have difficulties with in determining and measuring equilibrium rates for the future because they grow fast. This uncertainty means they that their policies will suffer greater errors than those of developed economies. Thus, monetary policy makers in emerging market economies prefer monetary policy rules with monetary aggregates (Taylor, 2000). Having a wider band helps them in being able to keep inflation within their range. A downside is however that it also signals that there is greater uncertainty when it comes to inflation. It therefore does not come as a surprise that having a wider range reduces the level of credibility of the central bank because it signals that it is unable to keep inflation at a stable level. This is especially true when a central bank sets the range wider than the historical volatility (Heenan et al, 2006). This thesis focusses completely on developed economies and their IT regimes. For more information on IT regimes in developing economies this thesis kindly refers to: Mishkin (2000), Mishkin (2004) and García-Solanes & Torrejón-Flores (2012).

The fifth and final step is looking at the escape clauses of the central bank. Escape clauses are events that are specified ahead of time and allow central banks to deviate from their inflation targets. The use of escape clauses is not widespread. Only a handful of countries have ever used them. The most common escape clauses are about the effect of changes in administered prices or indirect taxes. The advantage of an escape clause may have limited advantages. The one big advantage is has is that it can educate the public about possible future shocks. They can show the general public how certain shocks may influence both headline and core inflation if they do not distract the public by being too technical (Heenan et al, 2006).

2.2.3 Communication

The credibility of the central bank does not only rely on the designs of its frameworks. Another important aspect of inflation targeting is the way a central bank communicates. Central banks that use inflation targeting typically explain policy issues and decisions more, and they are more open about their bank operations and research than central banks with more traditional frameworks that do not use inflation targeting. Because central banks that use IT regimes have a high degree of operational independence they should also have a high standard of public accountability and transparency. This is in line with the idea that having an efficient IT regime is dependent on the credibility of the central bank's commitment to the inflation target and how the public perceives the actions of the central bank in regards to its declared objectives (Heenan et al, 2006).

When a central bank uses IT regimes it needs to identify the audiences for its communications, and its objectives. The bank needs to apply a strategic approach to each different audience because the most appropriate interaction or communication to achieve the particular objectives may be different. Regardless of the audience's goals, they all benefit from a high degree of transparency (Blinder et al, 2001).

The two principal objectives in an inflation targeting framework ensure broad support for the policy, and enhance its credibility and effectiveness. General public support is important because it will strengthen the effective mandate and help resist pressures to pursue other objectives, even if the central bank has a strong formal mandate for pursuing low inflation. Explaining key elements such as the accountability, transparency requirements, and the specification of the target help in maintaining public support for the framework. It helps promoting the public understanding of the benefits of low inflation and its priority over other objectives. A better educated public helps to understand how monetary policy transmission mechanism work, the limits of policy, and how the central bank deals with policy trade-offs or conflicts. The central bank demonstrates its commitment to achieving its targets by showing that it takes all relevant information into account (Heenan et al, 2006).

Effective implementations of monetary policies such as IT regimes depend heavily on the central bank's ability to influence expectations and decision making across the economy. This is done by convincing economic agents such as financial market participants, price and wage setters, and fiscal authorities, that the central bank's policy is oriented toward achieving the inflation objective. Most of the central bank's external communications is focussed on this objective. A way the central bank does this for example is by regular reporting how the actual inflation behaves compared to their initial expectations. This is important when the outcomes of inflation are significantly different from the inflation target or target range. Another way is reporting on economic developments. These include the central bank's implications for inflation pressures, and assessment of monetary policy responses. These analyses are mainly aimed at the future and therefore play an important role in informing financial market expectations. Just as important is it that the central bank reports its decisions and actions to show consistency in its policies which helps to maximize the predictability of policy adjustments to news (Heenan et al, 2006). The public that a central bank interacts with can be split into four broad external audiences for the central bank: the general public and mass media, the government and legislature, financial market participants, and expert central bank watchers. The media and bank watchers play an important role as intermediators between the central bank and audiences that have relatively a lower level of knowledge about macroeconomics and monetary

policies. It is important for the central bank's communications efforts to reach out to members of all major political parties, as well as to the independent media. It is important for the central bank's policy framework and decision making to have a nonpartisan nature and use as simple terms as possible for the underlying policy framework. Having common ground and will help understanding the framework and benefits all even if not everyone agrees with the policy they still understand how it works. This makes it important to look at the aims of different audiences and why it is in interest of all audiences to de-politicize monetary policy (Blinder et al, 2001). Frequent interactions with a wide range of audiences give the central bank the opportunity to discuss general issues to particular audiences and therefore help to increase the credibility of the bank (Heenan et al, 2006).

2.3 Performance

So how strong is the effect that IT regimes have on the economic performance of countries? Overall the effectiveness of IT regimes is dependent on other monetary policies of its central bank (Svensson, 2010). During the start of the European Monetary Union there was a debate about whether the newly formed European Central Bank should adopt inflation targeting or monetary targeting. Since the adopting of an IT regime by the Bank of England, several other European central banks had done so too in the 1990s. The German Bundesbank had been using monetary targeting since 1975. Since then the German central bank has been seen as very successful with their low-inflation monetary policy (Von Hagen, 1999). Beside these two there are other monetary regimes that are being or have been used by central banks. There are four basic types of regimes: a regime with an implicit nominal anchor, money targeting regime, exchange rate targeting, and inflation targeting. The most commonly use policy options are exchange rate targeting and money growth targeting are used the most. A central feature of all of the four basic monetary regimes is that they all use a nominal anchor (Mishkin, 1999). The effectiveness of inflation targeting cannot be seen on itself, it has to be seen relative to the performance of other monetary frameworks. The performance is therefore absolute and relative to the performance of the alternative frameworks that can be implemented by the country (Svensson, 2010). It is therefore important to have a closer look at the other regimes beside IT.

2.3.1 Alternative frameworks

I Regime with an implicit nominal anchor

There have been several countries in the past that were able to have an excellent macroeconomic performance with a low and stable inflation without using explicit nominal targets for the exchange rate, the monetary aggregate target, or the inflation rate. This does not however mean that there was no monetary policy in place. In this monetary framework, the central bank aims for an implicit, but not an explicit nominal inflation anchor in the form of an overriding concern for the long run. The monetary policy has to include forward-looking behaviour for inflation and the ability to act with pre-emptive strikes against threats to the stable inflation (Mishkin, 1999).

Monetary Policy effects have long lags. This is because monetary policy suffers from large delays that mean output and inflation are not affected immediately when policy changes take place. Countries that can respond quicker to exchange rate changes, and are therefore considered more flexible, may have short lags than countries that do not. This means that monetary policies have to be proactive in order to keep inflation stable. If the central bank is not active enough in keeping inflation stable then

the public will already have adjusted the recent inflation changes into their wage- and price setting process. If this happens, it will be much harder to return inflation to its previous level because higher inflation expectations become part of a rising inflation momentum. This is the reason why monetary policy needs to be forward looking and pre-emptive., but this is not limited to only this type of monetary framework. Policy frameworks that are less transparent and do not have nominal anchors are sometimes described as “just do it” policies. The main reason for choosing this type of monetary regime is the fact that it showed its success in the United States. The Federal Reserve was able to bring down inflation from the 1980s with double digits to a level of 3 percent in 1991, keeping it at a stable level for the next years. In the 1990s the performance of the United States on a macroeconomic level was envied by others. A big disadvantage of this type of regime is the lack of transparency. Another disadvantage is that this approach is highly dependent on the skills, and trustworthiness of the policymakers of the central bank. The Fed may now be seen as credible but there is no guarantee that this will not change when the economic or political environment will change. In the 1970s the Fed also reverted back to an inflationary monetary policy after a period of low inflation. Without an explicit anchor for inflation and a lack of transparency there is no guarantee for the general public to assume that the Fed is able to keep inflation low and stable in the future (Mishkin, 1999).

II Money growth targeting

The ECB and former German Bundesbank have been using money growth targeting. The reason that the ECB uses this as their primary monetary policy could be traced back to its willingness to inherit the high credibility of the German Bundesbank (Svensson, 2010). The German central bank was able to maintain a low and stable inflation, and had a high level of credibility. Because the public had so much confidence in the central bank’s commitment, the German Bundesbank was also able to pursue short-term objectives, such as stabilisation of output, stabilisation of the exchange rate. They could pursue these goals without increasing the inflation expectations of the public (Bernanke et al, 1999). The effects of this policy however are uncertain because the relation between money-growth and inflation seems to be weak, if there is even a relation at all (De Haan, et al, 2005). Results from this monetary framework suggest that the effectiveness of money-growth targeting in stabilising inflation is low (Bernanke et al, 1999) (Svensson, 2010).

III Exchange rate targeting

Exchange rate targeting on the other hand adopts a fixed exchange rate. This fixed rate however can be affected by speculative attacks, making it a possible cause for a possible a currency crisis. This means that a central bank will abandon the fixed exchange rate when it comes under attack. These attacks may be fuelled by weak fundamentals, increasing capital flows, or a lack of ability in defending the fixed exchange rates (Svensson, 2010). It seems that both exchange rate targeting and money growth targeting each have their limitations. The relation between inflation and money growth is weak for money-growth targeting and exchange rate targeting is considered not to be a stable form of monetary policy in the long-run.

The most commonly use monetary regimes are exchange rate targeting and money growth targeting. As was said before, the effectiveness of inflation targeting cannot be seen on itself. To say anything about the effectiveness it has to be compared to other monetary frameworks. The performance of IT

regimes is therefore absolute and relative to the performance of the alternative frameworks that can be implemented (Svensson, 2010).

2.3.2 The performance of IT

Several researchers indicate that the performance of IT regimes relative to alternative monetary frameworks can be considered a success (Svensson, 2010). There have been several papers that have looked at the pros and cons of FFIT (full-fledged inflation targeting) like Bernanke et al (1999), Mishkin and Schmidt-Hebbel (2001), and Truman (2003). According to them, the implementation of an IT regime hasn't been detrimental to growth, productivity, employment, or other indicators of macroeconomic performance. This cannot be said for the alternative frameworks this thesis has mentioned. Furthermore, IT has been even able to stabilise inflation as well as the real economy (Svensson, 2010).

The effectiveness of IT regimes in developing countries is hindered by the difficulties these countries experience for implementing monetary policy. This however has not stopped developing countries from adapting to IT regime frameworks. In South America the implementation of IT regimes can be considered as a general success story. Some researchers have found that the macro economic performance and level of inflation of those countries that implemented IT regimes has been better than countries whose central bank did not (Landerretche et al, 1999) (Garca-Solanes and Torrejon-Floris, 2012). However for Brazil the results have been less in favour of IT regime implementation. Due to high inflation rates, the central bank of Brazil has had to keep interests rates at a high level in order to be able to keep inflation under control, which meant they were not able to keep their inflation targets (Arestis et al, 2011). It seems that the differences in these results can be contributed to the differences between the countries' fundamentals. But this is of course different for developing countries than it is for the developed world where central banks have a much higher credibility. Developing countries started adopting inflation targeting when their inflation rates higher than their steady-state levels. They were using inflation targeting as mainly for increasing their credibility, lowering inflation expectations, and pursuing low levels of convergence and stationary inflation. This is opposite to most of the OECD and some other developing countries that started using IT regimes when their initial inflation close was close to their stationary inflation levels (Mishkin and Schmidt-Hebbel, 2001). The success and therefore effectiveness of IT regimes are dependent on operational details. So having a clear design that shows how the targets are defined and when they are announced plays a huge role (Bernanke et al, 1999). During the first adoptions of the system in the 1990s the development of a clear framework can be seen as a learning process. The requirements for a good design were less obvious for the first years. Early users of IT regimes perfected their framework to their own economic structures by learning from their own and other users' cumulative experiences. Around 2000 there came a broad consensus which conditions should be in place for effective full-fledged inflation targeting (Mishkin and Schmidt-Hebbel, 2001).

2.4 Macroeconomic indicators

As was mentioned before in the introduction, the indicators this thesis uses to measure macroeconomic performance are of great importance. The three main indicators are inflation, output growth and interest rates. The main goal of IT regimes is to stimulate inflation stability, it comes therefore not as a surprise that inflation is an important variable. Most Central bank with an IT regimes use the Consumer Price Index (CPI). The direction, higher or lower, depends on the starting level, the type of inflation that is being used, and the target that the central bank has set (Mishkin, 1999). As was mentioned in the introduction of this thesis there are two different ways to measure inflation: the headline inflation index or the core inflation index.

I-A Headline inflation

Most central banks with IT regimes use the headline inflation index when measuring the performance of the economy (Mishkin, 1999). The headline inflation index is used to make up the CPI. The CPI is an index that has a long history and is well known by the public. An important benefit is that the CPI gets measured monthly with little lag and is not revised. A disadvantage to the measurement is that it also includes various items that lie outside the sphere of monetary policy impact and only have a temporary effect on the inflation, such as indirect taxes and subsidies. Another big disadvantage is that short-term changes of goods that are susceptible to supply shocks may lead to misleading price trends and therefore may trigger unnecessary policy responses (Pétursson, 2000). The biggest benefit of the use of headline inflation is that it measures what the public cares about. The public cares about the price of all products they buy and will expect that a central bank does so too. So if a central bank does not, the general public may think the central bank is out of touch with them, which will harm their credibility. By making use of the headline inflation index a central bank will increase its credibility in the eyes of the general public. This helps in improving the effectiveness of the design and therefore the policy (Mishkin, 1999).

I-B Core inflation

The second way to measure inflation is the core inflation index. One of the most well-known users of this type of inflation measurement is the Federal Reserve (Fed). The difference between headline inflation and core influence is simply that the later excludes changes in food and energy prices. The idea behind this is that by being able to distinguish the inflation signal from the transitory noise, expected inflation becomes much more stable. So when there is a shock in the oil industry, core inflation may remain the same whereas headline inflation would increase. If the central bank can clearly communicate this to the public then there will be no changes in their expected inflation patterns. If the public understands that the central bank is using core inflation in formulating monetary policy and they trust the central bank then there will be no need to actively bring inflation down as it is believed to only be brief (Mishkin, 2007).

Both ways of measuring inflation have their advantages and disadvantages. Core inflation has the benefit of taking out transitory shocks in oil and food prices, but it does not take out all types of shocks and may therefore provide misleading information about the actual overall inflation for an economy. Using the core inflation measure is however not the same as good analyses of the forces influence the economy and the inflation process. Overall price stability does depend on headline inflation because this is what is the easiest to understand for the general public (Mishkin, 2007). This

is the main reason for why this thesis uses headline inflation as its main measurement of inflation. Central banks however should pay attention to both headline inflation and core inflation measures. Because both measurements of inflation have arguments on why they should be used and both are used by central banks, this thesis will also make use of the core inflation index which will serve as a robustness check.

II Output growth

The relation with output on the other hand is less obvious. The main goal of inflation targeting should be that it aims for price stability as its primary goal it also seems to promote real economic growth, as was seen in New Zealand (Mishkin, 1999). So far, implementing IT regimes has been a success as measured by the stability of inflation and the stability of the real economy for New Zealand, Canada, the U.K., and Sweden. The view that IT regimes has a positive effect on the economy were supported by several researchers, for example Bernanke, Laubach, Mishkin, and Truman. Other researchers point out that the relation between output and IT regimes may also be different. They argue that an FFIT regime is too much focussed on inflation and that attempts to control inflation by such a regime will generate instability in the real economy and possibly also lower macroeconomic growth. There however is no evidence that inflation targeting has a negative effect on growth, productivity, employment, or other measures of economic performance in both developed and developing economies (Svensson, 2010).

III Interest rates

For the last indicator of interest this thesis will use government bond rates because they can serve as a proxy for the central bank's credibility. Credibility is an important aspect of IT regimes, because it is one of the cornerstones of the IT regime design (Carare and Stones, 2006). When the governments bonds will increase this might be an indication that inflation expectations may be on the rise. This in turn may indicate that the central bank is not able to maintain its target, which means that its credibility is very low. When the opposite is true, a central bank shows that it receives high levels of credibility. This makes using government bonds a good proxy for the credibility of the central bank (de Haan et al, 2005).

Looking at the dual mandate of the Federal Reserve of price stability and full employment there are a lot of similarities with the macroeconomic indicators that are affected by FFIT regimes. The Fed acknowledges that price stability is critical to achieving maximum employment and moderate long-term interest rates. Maximum employment refers here to having the highest possible output under normal economic conditions. So the Fed focusses on the macroeconomic indicators of output, interest rates, and inflation (Thornton, 2012). This makes these indicators the perfect indicators to compare the monetary frameworks with. When looking at the results from previous researchers this thesis expects that implementing an IT regime in line with the requirements listed in this thesis will have a positive effect on the credibility of the central bank. Because of this, this thesis expects that there is a positive effect on the macroeconomic performance of countries that use IT regimes. In the next chapter this thesis will introduce the method that is being used to test this.

Chapter 3: Methodology

In this part of the thesis the approach used will be explained in detail. The method this paper used is similar to the one used by Ball & Sheridan (2004). The approach used by this thesis will be a difference in differences analysis where the IT countries can be compared to the NIT countries. For this comparison the macroeconomic indicators from chapter 2.4 will be used. These macroeconomic indicators improved on average for most countries since the introduction of inflation targeting. To see how IT regimes truly affect the macro economic performance, one would have to compare improvements in targeting countries to improvements in non-targeting countries. This thesis will show the method used to do just this after which the results will be presented in chapter 4. Chapter 3 will start by taking a closer look at the selection criteria used by this paper. The second step will be to introduce the approach with the help of Ball & Sheridan (2004). In the final part of this chapter the variables that will be used for the research are introduced.

3.1 Selection

3.1.1 Selection of countries

It is important to make a selection of two groups of countries that use Inflation targeting (IT) and those that do not (NIT). The two groups of countries are selected by using both literature and criteria for having a comparable control-group. When looking at which countries to select, Hammond (2012) was used. This means that all IT countries used FFIT (full-fledged inflation targeting). An important aspect of the selection is that both IT and NIT countries are comparable. For this reason this thesis did not choose all countries used by Hammond (2012) but limited itself to two groups that were comparable. This thesis will look at major developed, moderate-inflation economies, which means that all countries used are part of the OECD. It also deliberately does not include countries that have joined the European Monetary union, so that data is available for all dates. The NIT countries serve as the control group. The group of countries that this thesis uses is the same as Ball and Sheridan (2004). This is done because their group of NIT countries fitted the demands listed above for the IT countries, which makes the groups better comparable. The one big difference is that this thesis moves Norway to the IT countries. This is done because Norway has started using IT since 2001, which means they fall under the IT countries for the time period used by this thesis. The next two tables show the lists of IT and NIT countries with the start, the target, and the target type for the IT regimes.

Table 1: IT countries			
IT countries	Start of IT	Target	Target type
Australia	June 1993	2%-3%	Range
Canada	February 1991	2% (mid-point of 1%-3%)	P + T
Iceland	March 2001	2.5%	Point
New Zealand	December 1989	1%-3%	Range
Norway	March 2001	2.5%	Point
Korea, Rep.	April 1998	3% ± 1 pp	P + T
Sweden	January 1995	2%	point
United Kingdom	October 1992	2%	Point

Table 2: NIT countries
NIT Countries
United States
Japan
Denmark
Switzerland

In the theory part this thesis mentioned that all IT regimes are not completely strict but are flexible in a way. Some central banks consider themselves to be using flexible IT regimes: the Swedish, Norwegian, English, Australia, and Canadian central bank. The Swedish central bank (Riksbank) had announced that it would conduct flexible inflation targeting and aims at stabilising inflation and resource utilisation around a normal level. A similar trend took place at other central banks; they have stopped referring to a fixed horizon and instead refer a medium, leading to more flexible IT regimes (Svensson, 2010). After comparing the group of IT with the NIT countries, this thesis will split the IT countries into a flexible and a strict group. According to Svensson (2010) all central banks use a flexible IT regime. However, the choice between strict and flexible inflation targeting comes down to whether inflation should be targeted at the shortest possible horizon or a somewhat longer horizon. For this reason this thesis will split up the group of IT countries into a group that targets inflation at a very short term called the flexible group and one that targets over a longer period and therefore is called the strict regime. With the help of Hammond (2012) and Kuttner (2004) data was collected on the target horizon for the IT countries, which can be seen in table 3.

Countries	Target horizon
Australia	One year
Canada	Inflation-control target agreement with government renewed for five years until December 2016, however before 2008 the horizon was one year.
Iceland	Two years
New Zealand	Two years
Norway	Three years or more
Korea	Three years
Sweden	Normally over two years, but in some circumstances it may be extended.
United Kingdom	all the time

3.1.2 Sample selection

After having chosen the countries to inspect, the next step is to determine the time period to look at. This thesis runs several versions of this regression corresponding to different start dates for the pre-targeting period. The sample periods used in this thesis are chosen to include post and pre implementation of an IT regime. This paper therefore will look at 1983 from till the start of a specific IT regime till 2008, the other sample will indicate the post-IT sample period. These periods are chosen to not be too much influenced by the oil crisis in '73 and the financial crisis in '08.

IT countries	Sample 1	Sample 2
Australia	1983 1993	1993 2008
Canada	1983 1991	1991 2008
Iceland	1983 2001	2001 2008
Korea, Rep.	1983 1998	1998 2008
New Zealand	1983 1989	1989 2008
Norway	1983 2001	2001 2008
Sweden	1983 1995	1995 2008
United Kingdom	1983 1992	1992 2008
NIT countries		
Denmark, Japan, Switzerland, United States	1983 1995	1995 2008

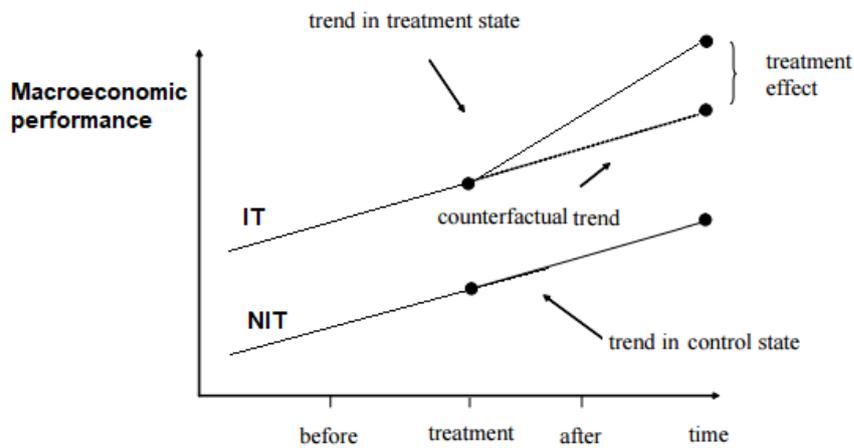
3.2 Approach

As was said in the beginning of this chapter, this thesis will compare the improvements in macroeconomic indicators between IT and NIT countries. This will help in determining whether IT regimes have a positive effect on macroeconomic indicators. This thesis will use the difference-in-differences method to determine the true effects of the implementation of an IT monetary policy. The difference in differences (DID or DD) is a statistical method that looks at the differential effect of a treatment by comparing groups, where one receives a 'treatment' and the other serves as a control group. The method was pioneered by the **physician** John Snow in 1855 when he wanted to establish that contaminated water was the cause of cholera. He compared two groups with different water suppliers. He used the approach to estimate the treatment effects comparing the pre- and post-treatment differences in the outcome of a treatment and a control group. One of the water supply companies had changed its water source to an area that was relatively free of sewage. Death rates in this district fell sharply compared to the control group.

Over the years several authors such as Pischke in 2007 and Card & Krueger in 1994 and 2000 used the method to test the effectiveness of treatments making it a popular method in the field of **econometrics** to estimate a causal effect. In 1994 Card and Krueger wanted to investigate whether a higher minimum wage affected employment in a negative way. They used an increase in the New Jersey state's minimum wage to see if employment was negatively affected by the increase. In their example the increase in wage is considered to be the treatment. They collected data from two groups of employees at fast food restaurants in New Jersey and Pennsylvania. They used the differences in differences (DiD) to estimate the effects. Their results showed a slight decline in employment in Pennsylvania and little change in New Jersey for the same period (Angrist and Pischke, 2008).

In figure 1 the difference in differences method is graphically modelled to fit the description of this research with the help of Angrist and Pischke (2008). The y-axis represents the overall performance of the macroeconomic indicators. The x-axis represents the time. The figure shows how the trend for both groups IT and NIT is expected to run parallel until the treatment, so in this case until the implementation of an IT regime takes place. After the implementation it is expected that the IT countries will perform better than the trend that both groups had before. The previous trend for the IT countries is now the counterfactual trend, whereas the trend that is expected, if IT regimes positively influence macroeconomic performance, is steeper. The positive effect is represented by the treatment effect in figure 1. As can be seen in the figure, it is expected that the NIT countries will follow their previous trend. This is the basic idea behind the difference in differences method.

Figure 1: Graphical explanation of the DiD approach



The basic idea behind the method has now been described. There is also a mathematical regression behind the approach. According to Ball & Sheridan (2004) the basic difference in differences method can be written down as the following regression:

$$X_{post} - X_{pre} = a_0 + a_1D + \varepsilon$$

In this regression the variable X_{post} stands for the average value of a macroeconomic country variable in the post (and during) IT regime period, in other words after the treatment. The variable X_{pre} stands for the average value of a macroeconomic country variable in the pre-IT regime period, in other words before the treatment. D indicates a dummy which is equal to 1 if the country is an IT country and zero if it is not. The coefficient a_1 supposedly measures the effect of the implementation of an IT regime on the variable X (Ball & Sheridan, 2004).

This regression however is misleading since it does not take into account that for some countries the initial variable of X_{pre} is substantially different for both IT and NIT countries. The idea that the initial variable is different is not very strange. A lot of the IT adopters, choose IT regimes because their previous monetary framework performed poorly. This could mean that average inflation in the period before the treatment was higher for IT countries. A problem arises because of this. Countries that performed poorly before the implementation of an IT regime will tend to improve more than good performers simply because the initial performance depends for some parts on transition factors (Ball and Sheridan, 2004). These transition factors could be the reason that IT countries improve more than NIT countries, if targeting does not affect performance. Not including these transition factors can lead to misleading conclusions on whether or not IT regimes benefit macroeconomic performance. When this argument is put into a more mathematical approach it looks as follows: It is assumed that variable X depends on a country effect, a period effect, a country-period effect, and possibly on an IT-dummy. The presence of the country-period effect generates regression to the mean. This means that if X_{pre} is correlated with the IT-dummy the original regression will produce a biased estimate of the dummy coefficient. This bias can be simply eliminated by adding the initial

value of X to the DiD regression (Ball & Sheridan, 2004). This leads to the following regression used by Ball and Sheridan (2004):

$$X_{post} - X_{pre} = a_0 + a_1D + a_2X_{pre} + \varepsilon$$

The value of X_{pre} is included to serve as a control variable to deal with the issue of a biased estimate of the dummy coefficient. This is done by adding a_2X_{pre} to the right part of the regression. When X_{pre} is included as a control variable, it is possible to estimate an unbiased coefficient. In this new regression the coefficient of the dummy variable (D) then shows to what extent IT has an influence on the relevant macroeconomic variable. A significant coefficient a_1 indicates that the IT country improves more relative to a country with the same initial starting position, in other words there is an indication that the IT regime causes the differences. However when a_2 is significant there is an indication that the differences are caused by the transition factors and not by the IT regime (Ball and Sheridan, 2004). With this information it is possible to see what the real effect of IT is relative to other countries with the same initial starting position.

3.3 Variables and Description

In this part of the method the macroeconomic variables from chapter 2.4 are introduced again. In table 4 it is visible what variables are used and where the data was gathered from.

Table 4: Macroeconomic variables	
Macroeconomic variable	Description
Inflation, consumer prices (annual %) and core inflation consumer prices (annual %) without food and energy	Consumer prices (annual %) Inflation. This is obtained from the World Bank and OECD
Gross Domestic Product Growth	A measure of GDP growth retrieved from the GDP data from the OECD
Interest rates, Government Securities, Government Bonds, Percent per annum (Maturity of 10 years)	These yearly data are gathered from the IFS database from the IMF.
IT-dummy	This is a dummy variable to indicate whether the specific country implemented an IT regime or not. The dummy has a value of 1 when an IT regime has been implemented. This is the independent variable

Chapter 4: Results

Following the method section of this thesis is the part where the results are presented. The results obtained from the DiD approach are split into three different parts. These parts focus on headline and core inflation, GDP output, and interest rates respectively.

4.1 Inflation

In the following tables the results obtained for inflation are presented. The first thing that is shown is the average inflation of the countries for the samples. The averages for the two groups of IT and NIT are also shown. The second thing that is visible is the results from the regression that was mentioned in the method section of this thesis. Both the headline inflation and core inflation are presented. The main results of this regression can be seen in the tables.

I-A Headline inflation

The inflation rates used in table 5 is the headline inflation. It can be seen that there is some variation between with respect to the averages of inflation. It seems that the IT countries have a higher average inflation for both samples. The difference in average inflation between the pre-treatment and post-treatment averages is also the biggest for the IT countries. Japan and Iceland seem to be the most notable countries because of their inflation rates. Japan scores relatively low and Iceland scores relatively high during the periods. The fact that there is considerable cross-country variation cannot be seen as a surprise since all countries have different fundamental backgrounds. Together with the theory it comes as no surprise that this thesis expects that the IT-dummy will have a negative effect on inflation. This is of course only so if the theory presented in chapter 2 is correct. To demonstrate the effect of eliminating the bias mentioned in 3.2 an extra regression is run in the appendix.

Table 5: Mean CPI inflation rate (annualised)		
CPI inflation	Sample 1	Sample 2
Australia	6,03	2,71
Canada	4,68	2,11
Denmark	3,64	2,18
Iceland	15,14	5,65
Japan	1,52	0,06
Korea, Rep.	5,21	3,34
New Zealand	10,00	2,58
Norway	4,11	1,95
Sweden	5,89	1,36
Switzerland	2,91	1,00
United Kingdom	5,12	2,05
United States	3,58	2,70
Averages		
IT	7,02	2,72
NIT	2,91	1,49
Dependent variable:	Regression results	
Change in CPI inflation rate between samples	(2)-(1)	
Constant	0.560498 (1.16)	
IT-dummy	-0.072289 (-0.12)	
Initial Value	-0.6823318*** (-15.27)	
Adjusted R²	0.8980	
Observations	12	

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

The regression shows that the IT-dummy does not have a significant coefficient. The direction of the IT-dummy however is in line with the theory that an IT regime lowers inflation, but there is no significant difference between the groups of countries. The initial value, in other words X_{pre} however has a significant results. This means that the positive results the IT countries have experienced is not due to the IT regime, but that it is caused due to by the transitions factors as this thesis mentioned in chapter 3.2. These results therefore do not give any support to the idea that an IT regime is effective in lowering the inflation rate towards the inflation target set by the central bank. Looking at the regression without the initial value in the appendix, it can be seen that without taking this bias into account the results from the regression would be quite different. There it can be seen that the IT-dummy would have generated a coefficient of -2.88* which would have produced a spurious conclusion. However according to the regression used in the table 5 the decrease in inflation is only caused by the transition factors IT countries experienced.

I-B Core inflation

The inflation rates used in table 5 is the core inflation. It can be seen that there is some variation between with respect to the averages of inflation. It seems that the IT countries have a higher average inflation for both periods. Japan and New Zealand seem to be the most notable countries because of their inflation rates. Where Iceland scored high for the headline inflation, they score here more similar than the other countries. They are however the only country that has experienced an increase for sample 2. This may have been cause by the crisis that happened in 2008. Because of the theoretic background provided in chapter 2 it follows logically that, just as for the headline inflation, this thesis expects that the IT-dummy will have a negative effect on inflation.

Core inflation	Sample 1	Sample 2
Australia	6,15	2,48
Canada	4,97	2,11
Denmark	4,06	1,91
Iceland	3,01	6,04
Japan	1,91	-0.01
Korea, Rep.	6,11	2,64
New Zealand	10,51	2,42
Norway	4,17	1,66
Sweden	6,03	0,80
Switzerland	3,38	0,84
United Kingdom	5,93	1,69
United States	4,08	2,32
Averages		
IT	5,86	2,45
NIT	3,36	1,26
Dependent variable: Change in mean inflation rate between samples	Regression results	
	(2)-(1)	
Constant	1.794791 (1.63)	
IT-dummy	1.585837 (1.46)	
Initial value	-1.158087*** (-15.27)	
Adjusted R²	0.6747	
Observations	12	

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

The regression results show no differences with the regression of the headline inflation when it comes to the significance of the variables. There however is one big difference: the direction of the IT-dummy is not negative as was expected but is actually positive. This would suggest that when it comes to core inflation that the theory about IT framework would be completely wrong. However, this variable is not significant and the big difference might also have been caused by the outlier Iceland. The regression, without Iceland can be found in the appendix. In this regression the coefficient of the variable decreases towards a value of 0.05 but its direction remains positive. The initial value is again similar and therefore supports the idea that the differences are caused by transition factors. The results from both regressions for inflation show that an IT regime is not effective in lowering the inflation rate towards the inflation target set by the central bank for both headline and core inflation. The results for core inflation seem to suggest that an IT regime increases inflation compared to NIT countries. But without Iceland this suggested relation becomes very small so this thesis assumes that this was caused by the crisis that hit the world in 2008.

4.2 Inflation variability

In the next part of this thesis the results regarding the standard deviation of the inflation rate are presented. It is said in the theory that IT regimes are better able than other monetary frameworks in stabilising the inflation variable over time. This thesis looks at this by using the standard deviation for both headline and core inflation. The outline of the tables used for this variable is similar to the tables previously shown. In the first part of the tables the averages are shown. In the bottom part the results of the regressions can be seen.

II-A Headline inflation

Similar to the observations of the standard inflation indicators there is some variation between countries in their initial value regarding inflation variability. Once again Iceland is a big outlier with a much higher variability relative to the rest for the change in standard deviation for headline inflation. Overall it can be seen that the averages of the IT and NIT countries indicate that inflation variability is higher in the IT countries. The IT countries clearly have less deviation in the second time period. So in line with chapter 2, it would follow that IT regimes decrease the amount of deviation of inflation. IT regimes should lead to more stable inflation. The coefficient is therefore expected to be negative.

Table 7: Standard deviation of the CPI inflation rate		
Standard Deviation	Sample 1	Sample 2
Australia	3,05	1,33
Canada	0,69	0,64
Denmark	1,75	0,57
Iceland	19,71	3,48
Japan	1,08	0,79
Korea, Rep.	2,18	1,09
New Zealand	4,58	1,35
Norway	3,53	0,89
Sweden	2,80	1,07
Switzerland	1,58	0,57
United Kingdom	1,34	4,06
United States	0,97	0,60
Averages		
IT	4,74	1,74
NIT	1,35	0,63
Dependent variable: Change in standard deviation of the CPI inflation rate between samples	Regression results	
	(2)-(1)	
Constant	0.495862 (0.99)	
IT-dummy	0.7599614 (1.19)	
Initial value	-0.8980818*** (-14.86)	
Adjusted R²	0.9549	
Observations	12	

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

The first thing that seems odd is that the direction of the IT-dummy is positive instead of negative. This goes against the idea that IT regimes stabilise inflation. However the IT-dummy is not significant. The value that is significant again is the initial value, also known as X_{pre} . This suggests that IT countries have a larger decrease in deviation but that this was caused by transition factors. The regression results therefore show that there is no sign of an impact from the implementation of an IT regime because of a lack of significant results for the IT-dummy. There is no significant result for this variable which indicates that the real effect of IT implementation seems to be absent.

II-B Core inflation

When using the headline inflation it can be seen that there are quite some differences between the countries. When switching to core inflation all previous outliers perform now more in line with the other countries as can be seen in table 8. There are however still some differences but no longer are these enormous. Similarly as with headline inflation, the expectation is that the IT-dummy will have a negative effect on the deviation since according to the theory, IT regimes should stabilise inflation rates.

Standard deviation	Sample 1	Sample 2
Australia	3,19	1,36
Canada	0,86	0,59
Denmark	1,90	0,45
Iceland	1,74	2,81
Japan	0,82	0,69
Korea, Rep.	2,12	1,11
New Zealand	4,94	1,33
Norway	2,48	0,48
Sweden	2,46	1,14
Switzerland	3,15	0,32
United Kingdom	1,84	0,72
United States	0,70	0,29
Averages		
IT	2,45	1,19
NIT	1,64	0,44
Dependent variable: Change in standard deviation of the Core inflation rate between samples	Regression results	
	(2)-(1)	
Constant	0.3969391 (0.91)	
IT-dummy	0.7346314 (1.73)	
Initial Value	-0.9753115*** (-5.61)	
Adjusted R²	0.7285	
Observations	12	

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

The regression results show similar results than they did for the headline inflation indicator. The direction of the IT-dummy is again not in line with what was expected. It however is also again not significant. The initial value however is negative and significant, this is in line with the idea that the differences are caused by the transition factors. This indicates that also for core inflation there is no real effect of IT implementation.

Similarly as was done for core inflation this thesis did another regression without Iceland to see if there were big changes in the regression. Removing Iceland from the regression did not change the results of the regression as can be seen in the appendix. Both the direction and significance of the macroeconomic indicators did not change. It seems therefore fair to say that with these regressions there is no sign that IT regimes caused the positive effect on the inflation rate.

4.3 Output growth

So far the results have shown that there is no significant relation between IT regimes and an improvement for the macroeconomic indicators used for inflation. There are several authors mentioned in chapter 2 who assume that IT regimes will also positively influence output. To test this assumptions this thesis will take a closer look at both output growth and output variability in the next part of chapter 4. In this part of chapter 4, the averages over the different samples will be discussed, as well as, the regression results.

4.3.1 GDP growth

The results regarding the growth for output are presented by using the average GDP growth. The growth rates vary across countries with the slightly higher rates being in sample 1. Overall IT countries maintain higher growth for both samples. GDP growth is lower for all countries in the second time period, except for Iceland and New Zealand. Since the theory suggested that IT regimes could have a positive effect on output, this thesis assumes that the coefficient for the IT-dummy should be positive.

Table 9: Mean annual GDP growth rates		
GDP growth rates	Sample 1	Sample 2
Australia	4,45	3,59
Canada	2,70	2,64
Denmark	2,29	2,07
Iceland	2,72	4,65
Japan	3,6	1,16
Korea, Rep.	8,37	4,71
New Zealand	1,54	2,85
Norway	3,32	2,09
Sweden	1,86	3,04
Switzerland	1,76	2,11
United Kingdom	2,77	2,57
United States	3,52	2,94
Averages		
IT	3,34	3,26
NIT	2,79	2,07
Dependent variable:	Regression results	
Change in output between samples	(2)-(1)	
Constant	1.863467 (2.65)	
IT-dummy	0.1939597 (0.31)	
Initial Value	-0.7232711*** (-15.27)	
Adjusted R²	0.5919	
Observations	12	

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

It can be seen in table 9 that the IT-dummy has a positive coefficient, but it is not significant. The initial value however is significant. The direction of this coefficient however is negative, which would mean that the NIT countries perform better due to the transition factors the IT countries experience. These results suggest that GDP has increased less in IT countries, going against the theory. However these results suggest that this is not caused by the IT regime, but simply by the transition. Removing Iceland and New Zealand from the regression, as was done for table 23 in the appendix, did not change the results of the regression much. The direction of the coefficients stayed the same and the significance did so too. With these results it seems therefore fair to say that IT regimes do not positively influence output. However it is important to keep in mind that this is not what IT regimes aim to do. IT regimes aim for a stable inflation rate making growth more predictable. So it would make more sense to look at how growth has fluctuated over the years, and whether IT regimes have stabilised this.

4.3.2 GDP growth variability

As was mentioned in the previous part, IT regimes aim for stabilisation of growth. In table 10 the standard deviation of the GDP growth rates as a measure of output variability are being presented. Contradictory to earlier results, the averages for both groups decline not as rapidly as before. For some countries, it even increases in the second sample period. When comparing the IT with the NIT countries it can be seen that the averages for the IT countries decreased much more. So when looking back at chapter 2 it does not come as a surprise that this thesis expects that the direction of the IT-dummy will be negative. A negative coefficient means that the smaller standard deviation has decreased, in other words that the output growth becomes more stable.

Standard deviation	Sample 1	Sample 2
Australia	1,90	0,85
Canada	2,47	1,34
Denmark	1,87	1,42
Iceland	3,1	3,48
Japan	2,17	1,36
Korea, Rep.	4,34	2,71
New Zealand	2,92	2,19
Norway	2,54	0,97
Sweden	2,13	1,57
Switzerland	1,70	1,61
United Kingdom	2,25	1,00
United States	3,52	2,94
Averages		
IT	2,71	1,77
NIT	1,85	1,42
Dependent variable: Change in standard deviation of GDP growth	Regression results	
	(2)-(1)	
Constant	-0.1927782 (-0.94)	
IT-dummy	-0.4043951 (-0.45)	
Initial Value	-0.1277063 (-0.32)	
Adjusted R²	0.0245	
Observations	12	

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

Looking at the results of the regression in table 10, it can be seen that the IT-dummy has the expected direction. This supports the idea that an IT regime stabilises output, however this variable is not significant. The initial value however is significant, meaning that the differences between the groups are caused by transition factors. The idea that IT regimes positively affected output became a source of interest after Mishkin (1999) and others saw that GDP rose in New Zealand after implementing the IT regime. However this data suggest that this was not the case for most IT countries. When removing Iceland and New Zealand the regression becomes slightly different as can be seen in the appendix at table 24. Without these two countries, the IT-dummy becomes -0.52^{**} and the initial value changes to -0.32^* . These results suggest that both the IT regimes and the transition factors influenced the stability of GDP growth. This supports the idea that IT regimes stabilise output.

4.4 Interest rates

The last macroeconomic indicator that this paper looks at is the interest rate. The long term interest rates serve as a proxy for the credibility of the central as was explained in chapter 2.4. When looking at the averages it can be seen that the interest rates have dropped for all countries except Iceland. The average interest rates differ substantially for the countries. There are several countries that experienced rates of double digits in the first sample period. Iceland seems to be an outlier again because it is the only country that experienced an increase. This may have been caused by missing data for the beginning years of the sample or by the crisis in 2008 which increased the long term interest rates in that year to 11.40%. Iceland was kept in the regression however another regression without Iceland has been included in the appendix.

In chapter 2 this thesis showed that credibility is a vital part for implementing IT strategies. Having low interest rates was therefore an indication of a credible central bank. Looking at the interest rate averages it can be clearly seen that IT countries have higher rates. This would suggest that rather than performing better, IT countries perform worse than NIT countries. To be more specific, credibility, as indicated in the theory section can be considered vital for implementing IT strategies. Having low interest rates might therefore indicate that the CB is more credible. Countries with IT regimes might thus have a less credible CB. Interest rates however did drop more for IT countries than for NIT countries which might suggest that macroeconomic performance with respect to interest rates has improved. Keeping this all in mind together with the theory from chapter 2, this thesis expects that with the implementation of an IT regime the central bank's credibility has increased. Lower interest rates would mean a higher level of credibility. This thesis therefore expects that the direction of the coefficient is negative.

Table 11: Long-term interest rates		
Interest rates	Sample 1	Sample 2
Australia	12,17	6,48
Canada	10,64	6,29
Denmark	10,28	5,12
Iceland (1992 start)	3,01	6,04
Japan	5,21	1,60
Korea, Rep.	13,22	6,68
New Zealand	14,51	7,44
Norway	9,15	4,64
Sweden	11,12	5,35
Switzerland	4,87	2,94
United Kingdom	10,346	5,97
United States	8,50	5,11
Averages		
IT	10,52	6,11
NIT	7,22	3,69
Dependent variable:	Regression results	
Interest rates	(2)-(1)	
Constant	2.198164** (2.47)	
IT-dummy	1.730976 (0.26)	
Initial Value	-0.7927805*** (-7.89)	
Adjusted R²	0.7536	
Observations	12	

*Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

Looking at the regression the results show similar results to the previous tables. It can be seen that the IT-dummy has the opposite direction of what was expected. It seems that the direction of the coefficient is positive. The IT-dummy is however not significant, indicating that the differences are not caused by the IT-dummy. The initial value is significant and has a negative direction. This is similar to previous regression run in this paper. As was said previously, this thesis also ran the regression without Iceland. In this regression that can be seen in the appendix table 25, the IT-dummy remains positive and not significant. However the coefficient decreases in size to 0.15. The initial value also slightly decreases but remains negative and significant. These results therefore do not support the idea that an IT regime reduces interest rates, but they suggest that the decreases are caused by transition factors.

4.5 Flexible Regimes

In chapter 2 this thesis mentioned that there is a difference between strict and flexible IT regimes. As Svensson (2010) argues all IT regimes are flexible in way. However there are differences in the degree of flexibility. In the following table this thesis has split up the IT group into a flexible and strict group. Strict inflation targeting is only concerned with keeping inflation as close to a given inflation target as possible. Flexible inflation targeting on the other hand is also focussed on other things matter such as the stability of interest rates, exchange rates, output and employment. A flexible regime will not try to take back inflation as quickly as possible if there are shocks. They will bring inflation gradually back towards the target, extending the target further into the future. Strict regimes will try to keep inflation as close to the target as possible, they will do everything they can to get inflation back to their target as soon as possible. This means that the length of the target horizon plays a big role in determining whether or not a central bank follows a strict or flexible regime (Svensson, 1997).

With information from Svensson (2010), Kuttner (2004), and Hammond (2012) table 12 was constructed. Several countries stated in their frameworks that they used a flexible or strict framework. This thesis uses the length of the target horizon to split the IT countries into two groups. The strict group has a target horizon of less than 2 years and/or has an explicit statement that they use a strict IT framework. The flexible group has a target of more than two years and/or has an explicit statement that they use a flexible framework. Over the years some regimes changed their degree of flexibility. Most of the central banks of the IT countries started to refer to a medium target horizon instead of a fixed horizon between the years 2007 and 2010. The United Kingdom and Canada did so quite recently around 2008 however Australia switched to a more flexible regime in 1999 (Svensson, 2010). This switch might influence the results since this was within the periods this thesis looks at. Therefore this thesis chose to include the regressions between the flexible and strict regimes without Australia in the appendix to see if this makes a difference for the results.

Table 12: Flexible and strict IT regimes
Flexible Regimes:
Iceland
New Zealand
Norway
Sweden
Korea
Strict Regimes :
Australia
Canada
United Kingdom

In the following part of this thesis the results from the regressions will be shown. The regressions are identical to the ones used in the previous part of the thesis. In the tables it can be seen that there are now two groups of IT regimes who both get compared to the NIT countries. This makes it possible to see the real effect of flexible and strict IT regimes compared to NIT countries, which enable us to see if there are differences between the two types of IT regimes.

4.5.1 Inflation for strict and flexible regimes

In this part of the results the regression for the flexible and strict IT regimes are presented. Similarly to before, both headline inflation and core inflation are shown.

I-A Headline inflation for strict and flexible regimes

The regressions shown in this part of the thesis are not so different from the ones shown before. The expectation is still that IT regimes should influence the macroeconomic indicators of inflation in a negative way, in other words this thesis expects that the coefficient will be negative.

Table 13: Headline inflation for strict and flexible regimes		
Dependent variable: Change in mean CPI inflation rate	Regression results	
	<i>Strict</i>	<i>Flexible</i>
<i>Constant</i>	-1.346948 (-1.89)	-0.2046331 (-0.23)
<i>IT-dummy</i>	-1.492477* (-2.30)	-0.2046331 (-0.23)
<i>Initial Value</i>	.0274128 (0.12)	-0.6715872*** (-6.73)
<i>Adjusted R²</i>	0.7503	0.9197
<i>Observations</i>	7	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

Looking at table 13 it can be clearly seen that the direction of the coefficient is similar for both flexible and strict IT regimes. The IT-dummy is negative as was expected. The IT -dummy for the group with flexible regimes is not significant, while the one for the strict group is significant. This is different for the results for all previous regression where the inflation variables seemed to be not affected by IT regimes. The flexible group's initial value is negative and significant, suggesting that the differences are caused not by the implementation of IT regimes, but transition factors. This is similar to the results from comparing the IT to the NIT countries. The results from the regression clearly show that there is a big difference between the two types of IT regimes. These differences support the theory from Svensson (2010) that there are differences in the flexibility of IT regimes.

Also when leaving out Australia, as can be seen in the appendix in table 26, the IT-dummy remains negative and significant. These regression results suggest that inflation targeting is quite different for strict and flexible regimes, as the results for the flexible IT regimes suggest that the differences are caused by transition factors. The results of these regressions therefore support the idea that strict IT regimes are able to reduce headline inflation. The results however also show that this is not the case for the flexible IT regimes. Those results do not support the idea that IT regimes reduce inflation better than the frameworks used by the NIT countries.

I-B Core inflation for strict and flexible regimes

In this part this thesis will look at the core inflation. Similar to the expectations for headline inflation, this thesis expects that the IT-dummy will be negative. This is because according to the theory provided, IT regimes should lower inflation. In the previous regression for IT and NIT countries, Iceland was left out in the regression for the appendix since its values were most likely caused by the recent crisis. For this reason this thesis included a regression without Iceland and Australia for the flexible IT regimes.

Dependent variable: Change in mean core inflation rate	Regression results	
	Strict	Flexible
Constant	-1.533592 (-1.78)	1.863079 (1.43)
IT-dummy	-1.178367 (-1.73)	1.91214 (1.38)
Initial Value	-0.1662485 (-0.68)	-1.178437*** (-4.06)
Adjusted R²	0.7299	0.6591
Observations	7	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

The results from the regression show some conflicting results. The coefficient of the IT-dummy is positive for the flexible IT group, but it is negative for the strict IT group. Both groups' IT-dummy is not significant however the direction of the coefficient is still remarkable. For the strict regimes the initial value is also not significant, meaning there is probable cause for the difference between the strict IT regime countries and the NIT countries. For the flexible countries it can be seen that the initial value is significant, suggesting that the difference are caused by transition factors. When removing Australia and Iceland, as can be seen in the appendix table27, the direction and significance of the IT-dummy and the initial value did not change. One could argue that the results of the regressions for the strict regime slightly support the idea that an IT regime decreases inflation even if the IT-dummy is not significant. The flexible regimes suggest however that the differences are not caused by IT regimes. The IT-dummy is not significant when comparing the regimes to the NIT countries. The results therefore suggest that IT regimes do not influence core inflation.

The results for the regressions for both headline and core inflation suggest that it might be interesting to compare the regimes with each other since their coefficients are so different. This thesis chose to see how IT regimes performed compared to countries with other monetary frameworks. This was done because according to the theory mentioned in chapter 2 IT countries should perform better. The differences between the flexible and strict regimes for both types of inflation suggest that there are quite some differences between these IT countries. This holds especially true for the core inflation where the direction of the IT-dummy is the complete opposite. This suggests that that there are clearly distinctions between IT regimes that are worth researching in a more detailed manner. One of the few authors who looked closer at the differences in flexibility for IT regimes has been Svennson. These results suggest that this is an interesting field for monetary frameworks that deserves further research by multiple researchers.

4.5.2 Inflation variability for strict and flexible regimes

Similarly again this thesis will also look at the standard deviation for both core inflation and headline inflation. The reason is that IT regimes according to the theory in chapter 2 stabilise the inflation rate. This means that this thesis expects that having an IT regime will have a negative effect on the standard deviation for both headline and core inflation.

II-A Headline inflation for strict and flexible regimes

As was said in the previous part, this thesis expects that the standard deviation of headline inflation will decrease when countries have implemented an IT regime. The idea is that an IT regime is able to stabilise inflation. The only goal of a strict regime is keeping inflation at the target. Flexible regimes aim for more, as was explained at the beginning of chapter 4.5. The expectation of this thesis is therefore that a strict regime would be better at keeping stable, since this is their only target while for a flexible regime other aspects may also play a role.

Table 15: Standard deviation of the CPI inflation rate for strict and flexible regimes		
Dependent variable: Change in standard deviation of the CPI inflation rate between samples	Regression results	
	Strict	Flexible
Constant	0.7637537 (0.68)	0.4402508*** (5.44)
IT-dummy	1.414195 (1.41)	0.1937746 (1.61)
Initial Value	-1.1097211 (-1.58)	-0.8567448*** (-79.82)
Adjusted R²	0.2125	0.9990
Observations	7	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

When looking at the results there are no differences in the direction of the coefficients. There is however a big difference between the size of the IT-dummy coefficients between the strict and flexible regimes. It seems that these coefficients suggest that the opposite from what was expected is actually happening. The results from the regression show that CPI inflation is less stable for countries with strict IT regimes. The initial value for strict regimes suggests that there however is a decrease over time. But there are no significant results for the strict regime. The flexible regimes however do have a significant coefficient for the initial value. This suggest that IT regimes do not cause the difference between flexible It regimes and NIT countries, but that they are caused by transition factors. The results without Australia in the appendix table 28 also do not suggest any other relation for the IT-dummy. The initial value however changes direction without Australia. This may seem odd, but is most likely caused by the small group of countries that was left in the strict IT group. Overall, it seems that these results do not support the idea that IT regimes decrease inflation deviation.

II-B Standard deviation of core inflation for strict and flexible regimes

Similar to the headline inflation, this thesis expects that the standard deviation of core inflation will decrease when countries have implemented an IT regime. According to the theory part of this thesis IT regimes should stabilise inflation, in other words they should reduce the deviation.

Table 16: Standard deviation of the core inflation rate for strict and flexible regimes

Dependent variable: Change in standard deviation of the core inflation rate between samples	Regression results	
	<i>Strict</i>	<i>Flexible</i>
<i>Constant</i>	1.717217* (2.41)	1.143686 (0.40)
<i>IT-dummy</i>	0.6934554 (1.32)	0.7914719 (0.53)
<i>Initial Value</i>	-1.019628*** (-7.93)	-0.9061211*** (-1.69)
<i>Adjusted R²</i>	0.9234	0.2891
<i>Observations</i>	7	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

When looking at the results from the regression it can immediately be seen that the standard deviation for core inflation generates no big difference between the two types of IT regimes. This is different to what could be observed for the headline inflation. These regression results suggest that the two types of IT regimes have roughly the same effect since all coefficients have a similar size and direction. For both types of regimes, the IT-dummy is positive, suggesting that instead of lowering the deviation, IT regime increase the standard deviation for core inflation. The significant initial value suggests that the difference between the two IT-regimes and the NIT countries are caused by transition factors. The regression results without Australia in the appendix, table 29, do not show any big differences. The results show no significant IT-dummy, leading to the suggestion that IT regimes do not decrease inflation more than other monetary framework.

4.5.3 Output growth for strict and flexible regimes

So far the results for flexible and strict regime shave shown some interesting results for some indicators. Similarly to the approach for the IT and NIT countries, the next step is to look at whether IT regimes positively influence other macroeconomic indicators. In chapter 2 it was mentioned that several authors assume that IT regimes will also positively influence output. In the next part of this thesis there will be a closer look at the GDP growth rate. Similarly to before, both GDP growth and the standard deviation of GDP growth will be looked at.

4.5.3.1 GDP growth for strict and flexible regimes

In the table 17 the regressions for the GDP growth rates of both strict and flexible regimes are presented. Similar to before, this thesis expects that IT regimes have a positive effect on GDP growth. According to theory, flexible regimes should be better in promoting growth than strict ones. According to Mishkin (1997) all IT regimes promote GDP growth. Svensson (2010) however argues that flexible regimes would be better at this, as was explained in details in chapter 2. Svensson is however one of the few authors who looked at the differences between flexible and strict IT regimes making this disputable. So when this thesis follows Mishkin (1997) the expectation would be that both regimes would perform better than the NIT countries. Following Svensson (2010) this thesis would expect that the flexible regimes would perform better than the strict regimes.

Table 17: Mean annual GDP growth rates for strict and flexible regimes

Dependent variable: Change GDP growth rates	Regression results	
	<i>Strict</i>	<i>Flexible</i>
Constant	2.505939 ** (3.03)	1.787594* (2.08)
IT-dummy	0.384609 (0.96)	0.0151632 (0.02)
Initial Value	-0.1662485** (-3.46)	-0.6968244** (-3.22)
Adjusted R²	0.6833	0.5279
Observations	7	9

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

When looking at the regression results, this thesis sees that the IT-dummy is positive for both strict and flexible regimes. The coefficient for the flexible regime however is not larger than the one for the strict regimes as this thesis expected. This suggests that strict regimes are better at promoting growth. However the IT-dummy is not significant. The initial value however shows that for both regimes, there is a negative significant coefficient. So it seems that there was a decrease over time, but this was caused by transition factors. Removing Australia, as can be seen in the appendix table 30, changes the direction of the IT coefficient for the strict regime to -0.10. This would suggest that a flexible IT regime has a positive influence on GDP growth while the strict regimes have a small negative effect. This result would support the transition from strict to flexible regimes over time. However these results are not significant. So looking at the results from this regression it can be concluded that these regressions do not support the idea that IT regimes, both strict and flexible, influence GDP growth.

4.5.3.2 Standard deviation of the annual GDP growth rate for strict and flexible regimes

Similarly to before this thesis will also look at the standard deviation of GDP growth. The expectations are similar to the previous expectations about standard deviations. This thesis expects that, according to the theory in chapter 2, IT regimes will be able to reduce the size of the fluctuations. A more stable inflation trend would keep expected inflation constant, making it easier to achieve the inflation target.

Table 18: Standard deviation of the annual GDP growth rate for strict and flexible regimes		
Dependent variable: Change in standard deviation of GDP growth rate between samples	Regression results	
	<i>Strict</i>	<i>Flexible</i>
<i>Constant</i>	0.7993589 (1.28)	0.2014726 (0.26)
<i>IT-dummy</i>	-0.4770843 (-2.58)	-0.0014266 (0.00)
<i>Initial Value</i>	-0.6629698 (-2.00)	-0.3404068 (-0.89)
<i>Adjusted R²</i>	0.8179	-0.0537
<i>Observations</i>	7	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

It can be immediately seen that the direction is similar for both strict and flexible IT regimes. The size of the coefficients however does differ as can be clearly seen in table 18. For the flexible regimes the impact of the IT-dummy is very small, suggesting that strict regimes are better than at keeping inflation stable. For both regimes the dummy is however not significant. Also the initial value is not significant. When removing Australia, as was done for table 31 in the appendix, the results of the regressions do not change. The direction and significance of the coefficients remains the same. It is therefore fair to say that these regression results do not support the idea that IT regimes stabilise GDP growth.

4.5.4 Interest rates for strict and flexible regimes

The last macroeconomic indicator that this paper looks at for both strict and flexible IT regimes is the interest rate. Interest rates play a vital part for the credibility of a central bank. This thesis therefore uses the long term interest rates as a proxy for the credibility of a central bank. In chapter 2 it is argued that the credibility of a central bank should increase after implementing an IT regime. Having a central bank with a higher credibility will lead to lower interest rates. This thesis therefore expects that for both types the implementation of an IT regime will have a negative effect on the interest rates.

Table 19: long term interest rates for strict and flexible regimes		
Dependent variable: Interest Rates	Regression results	
	Strict	Flexible
Constant	2.400704 (2.01)	2.829496 (1.49)
IT-dummy	0.6869343 (1.53)	-0.1783378 (0.02)
Initial Value	-0.7068806*** (-5.86)	-0.7507344*** (-4.23)
Adjusted R²	0.8863	0.6972
Observations	7	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*

Looking at the results of the regression it can be seen that there are some big differences between the strict and flexible regimes. The IT-dummy for the flexible regimes is in line with the expectations, but the IT-dummy for the strict regimes has a positive coefficient. It seems that flexible regimes are better capable at lowering interest rates. When leaving out Australia, as can be seen in the appendix table 32, the coefficients do not change direction. However for none of the regimes the IT-dummy is significant meaning that no conclusion can be made in favour of the IT regime. The initial value is negative and significant for both IT regimes supporting the idea that the differences between the regimes are caused by transition factors.

Chapter 5: Conclusion

The main question this thesis tried to answer was: Does inflation targeting affect the economic performance of countries? The variables used to answer this question were inflation, output growth and interest rates. The research question used was: 'What is the effect of an inflation targeting regime (IT) on the macroeconomic performance of a country?' The difference in differences approach was used to answer this question. In the approach a group of targeting countries was compared to a group of non-targeting countries and Flexible IT regimes compared to strict IT regimes. The results from this approach show that the macroeconomic performance of countries is not influenced by having an IT regime. The results suggest that the differences between the IT and NIT countries are caused by transition factors. Both groups improve their performance with respect to inflation, inflation variability and interest rates as can be seen in the top parts of the tables. Looking at the regression results shows how the countries actually performed compared to each other. The results for the headline inflation suggest that IT countries are performing better than NIT countries. The results for the standard deviation and core inflation on the other hand suggest that NIT countries perform better. When looking at the macroeconomic indicator of output growth it can be seen that IT countries seem to perform better when it comes to GDP growth and keeping inflation stable. For interest rates the results show that NIT countries are able to keep interest lower than IT countries. The results for almost all indicators are significant for the initial value suggesting that the differences between the countries are caused by transition factors. Overall it seems that the results for the IT-dummy are not significant leading to the conclusion that IT regimes do not affect the economic performance of countries for the given time span of this thesis.

The next question this thesis tried to answer was: 'Is there any difference between the performance of strict and flexible IT regimes?' This thesis looked at the same macroeconomic indicators to see if there were any differences as is claimed by Svensson (2010). The difference in differences approach was also used to answer this question. The results show that when it comes to both types of inflation, strict regimes are better at lowering inflation than flexible regimes. Flexible regimes even seem to increase inflation for this time period. These results were not all significant. For the headline inflation strict regimes however, significantly lowered inflation compared to the non-targeting countries. For the flexible countries the difference was caused by transition factors. For the standard deviation the results showed that both IT regimes had a positive influence instead of the negative influence that was expected. This result was however not significant. When looking at the other macroeconomic indicator of output growth there were no big differences. Both regimes seemed to have a positive effect on GDP growth and stabilisation. For the interest rate indicators it seemed that flexible regimes lowered interest rates, whereas strict regimes had the opposite effect. These results were however not significant and therefore neither of them show a specific impact of the implementation of IT regimes. So when comparing the two regimes it can be seen that strict regimes are better capable at keeping inflation low compared to both the flexible IT countries and the NIT countries. Besides this there was no variable that was significantly affected by the IT-dummy. So looking back at the research question it can be said that having an IT regime is neither beneficial nor harmful for a country for the economic indicators except for inflation. These results do not support the theory from Svensson (2010) that flexible regimes would be better at positively influencing the other macroeconomic indicators. However it does show that there are clear differences between IT regimes that deserve more research. Overall the conclusion for the effect of IT regimes on inflation is

debatable since only headline inflation for strict regimes has a significant coefficient while the others do not. This makes it difficult to approve or disprove of having an IT regime to effectively lower inflation.

There are several drawbacks that this thesis suffered from. In the last part of this thesis these will be highlighted.

One of the major drawbacks is that it is difficult to compare IT countries and NIT countries because there are a lot of differences between the NIT countries. These NIT countries have been using all different monetary policies such as money-growth targeting, exchange-rate targeting, or some other framework. Comparing IT countries that use one specific framework with some many different frameworks may lead to distorted conclusions. A way to avoid this would be by splitting the NIT countries into specific frameworks and see how these perform compared to IT regime countries. This however also suffers from some problems similar to the ones this thesis experienced when it comes to the selection of countries.

The second drawback is related to the selection process. This thesis chose to only use developed countries for its analysis. This meant that the number of countries was limited. This resulted in a small group of NIT countries compared to the IT countries. This meant that some results were heavily influenced outliers, as can be seen in the appendix. Choosing more countries might show clearer distinctions between the performance of the IT and NIT countries. Having more countries in both groups will however lower the comparability between the IT and NIT groups. This comparability is however important to really say anything about the difference in performance between the two groups. Lowering the amount of countries even further makes the two groups better comparable. The downside to this is that with the selection of the countries the results rely on the performance of one country. This makes the research unreliable since changing one country might change the results completely.

The third drawback has to do with the time periods chosen. The periods were deliberately chosen to not include some major shocks the world economy had suffered over the last years such as the oil crisis and the financial crisis in 2008. Choosing this time period meant however that the shift towards flexible regimes was still ongoing. This means that pure strict IT regimes changed over the course of the time period that was used, therefore influencing the results.

The fourth drawback can be found in the approach used by this thesis. The data used consisted of yearly data. However to properly compare the periods before and after the treatment it may have been better to use quarterly or even monthly data. This data is however harder to find for countries and may therefore push the time period even further up.

The fifth drawback can be found in the results. The regressions show that the differences are mostly caused by transition factors. The improvement for the IT countries may have been caused because the IT countries might have been more inclined to structural reforms for their economy since they were not performing as good as other countries. These structural reforms were most likely not limited to inflation. However, what these transition factors are and how they influenced the countries is not something this thesis elaborates and is something other researchers can expand on. The final drawback is that singling out that the macroeconomic performance would be influenced by only an IT regime seems unlikely. The approach chosen already tried to limited this, it is however not unlikely that these differences have different causes than the ones assumed in this thesis.

This thesis' recommendation would be to take all these drawbacks into account for further research. Given the results from the regressions a further recommendation would be to further investigate the differences between flexible and strict regimes and see how these affect economic performance.

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Appendix:

Table 20: CPI inflation without the elimination of the bias	
Dependent variable: Change in CPI inflation rate between samples	Regression results
	(2)-(1)
Constant	-1.426787 (-1.24)
IT-dummy	-2.876209* (-2.04)
Adjusted R ²	0.2222
Observations	12

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

Table 21: Core inflation regression without Iceland	
Dependent variable: Change in mean inflation rate between samples	Regression results
	(2)-(1)
Constant	0.5464138 (0.89)
IT-dummy	0.0546359 (0.09)
Initial Value	-0.7860783*** (-5.48)
Adjusted R ²	0.8347
Observations	11

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

Table 22: Stand deviation of core inflation without Iceland	
Dependent variable: Change in standard deviation of the Core inflation rate between samples	Regression results
	(2)-(1)
Constant	1.443347 (0.99)
IT-dummy	0.7086088 (0.67)
Initial Value	-0.9654266*** (-4.14)
Adjusted R ²	0.6070
Observations	11

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

Table 23: GDP growth without Iceland and New Zealand

Dependent variable: Change in GDP growth	Regression results
	(2)-(1)
Constant	1.894718 (3.53)
IT-dummy	0.6194645 (1.25)
Initial Value	-0.7341642*** (-5.37)
Adjusted R ²	0.7648
Observations	10

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

Table 24: Standard deviation of GDP growth without Iceland and New Zealand

Dependent variable: Change in standard deviation of GDP growth	Regression results
	(2)-(1)
Constant	-0.1647337 (0.53)
IT-dummy	-0.5245792** (-2.4)
Initial Value	-0.3205859* (-2.19)
Adjusted R ²	0.6809
Observations	10

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively.

Table 25: Long-term interest rates without Iceland

Dependent variable: Interest rates	Regression results
	(2)-(1)
Constant	-0.0589855 (2.47)
IT-dummy	0.150109 (0.26)
Initial Value	-0.480006 *** (-7.89)
Adjusted R ²	0.7536
Observations	12

Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Table 26: Headline inflation for strict and flexible regimes without Australia		
Dependent variable: Change in mean CPI inflation rate	Regression results	
	Strict	Flexible
Constant	-1.691276 (-2.09)	-0.2046331 (-0.23)
IT-dummy	-1.569875* (-2.37)	-0.2046331 (-0.23)
Initial Value	.0908119 (0.34)	-0.6715872*** (-6.73)
Adjusted R²	0.6708	0.9197
Observations	6	9

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Table 27: Core inflation for strict and flexible regimes without Australia and Iceland		
Dependent variable: Change in mean core inflation rate	Regression results	
	Strict	Flexible
Constant	- 1.492645 (-1.45)	0.9273149 (1.12)
IT-dummy	-1.183758 (-1.51)	0.1705269 (0.16)
Initial Value	-0.1784505 (-0.60)	-0.8082779** (-3.66)
Adjusted R²	0.6346	0.7687
Observations	6	8

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Table 28: Standard deviation change for CPI inflation for strict and flexible regimes without Australia		
Dependent variable: Change in standard deviation of the CPI inflation rate between samples	Regression results	
	Strict	Flexible
Constant	-1.549518 (-0.75)	0.4402508 (5.44)
IT-dummy	2.250169 (1.99)	0.1937746 (1.61)
Initial Value	0.622293 (0.42)	-0.8567448*** (-79.82)
Adjusted R²	0.3028	0.9990
Observations	6	9

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Dependent variable: Change in standard deviation of the core inflation rate between samples	Regression results	
	<i>Strict</i>	<i>Flexible</i>
Constant	1.635812 (1.96)	1.143686 (0.40)
IT-dummy	0.554467 (0.79)	0.7914719 (0.53)
Initial Value	-1.003517*** (-6.62)	-0.9061211*** (-1.69)
Adjusted R²	0.9181	0.2891
Observations	6	9

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Dependent variable: Change GDP growth rates	Regression results	
	<i>Strict</i>	<i>Flexible</i>
Constant	3.3570595** (4.53)	1.787594* (2.08)
IT-dummy	-0.0977345 (-0.26)	0.0151632 (0.02)
Initial Value	-1.243883** (-4.98)	-0.6968244** (-3.22)
Adjusted R²	0.8535	0.5279
Observations	6	9

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Dependent variable: Change in standard deviation of GDP growth rate between samples	Regression results	
	<i>Strict</i>	<i>Flexible</i>
Constant	1.328105 (1.59)	0.2014726 (0.26)
IT-dummy	-0.2776743 (-0.99)	-0.0014266 (0.00)
Initial Value	-0.9482313 (-2.11)	-0.3404068 (-0.89)
Adjusted R²	0.8277	-0.0537
Observations	6	9

Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively

Table 32: long term interest rates for strict and flexible regimes without Australia		
Dependent variable: Interest rates	Regression results	
	<i>Strict</i>	<i>Flexible</i>
<i>Constant</i>	2.461064 (1.44)	2.829496 (1.49)
<i>IT-dummy</i>	0.7921541 (1.44)	-0.1783378 (0.02)
<i>Initial Value</i>	-0.7130537** (-5.28)	-0.7507344*** (-4.23)
<i>Adjusted R²</i>	0.8752	0.6972
<i>Observations</i>	6	9

*Note: Note: T-values between the brackets, significance for 10, 5, 1 levels for *, **, ***, respectively*