ASYMMETRIC EXCHANGE RATE INTERVENTION UNDER INFLATION TARGETING REGIMES: THE CASE OF TURKEY, 2002-2008

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ABSTRACT

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Especially, after the 2000s, many developing countries let exchange rates float and began implementing inflation targeting regimes based on mainly manipulation of expectations and aggregate demand. However, most developing countries implementing inflation targeting regimes experienced considerable appreciation trends in their currencies. Might have exchange rates been utilized as implicit tools even under inflation targeting regimes in developing countries? To answer this question and investigate the determinants of inflation under an inflation targeting regime, as a case study, this thesis analyzes the Turkish experience with the inflation targeting regime by using monthly data between 2002 and 2008. There are two main findings of this study. First, the evidence from a Vector Autoregressive (VAR) model suggests that the main determinants of inflation in Turkey during this period are supply side factors such as international commodity prices and the variation in exchange rate rather than demand side factors. Second, empirical findings suggest that the appreciation of the TL is related to the deliberate asymmetric policy stance of the Bank with respect to the exchange rate. Both the econometric analysis from a VAR model and descriptive statistics indicate that appreciation of the Turkish lira was tolerated during the period under investigation whereas depreciation was responded aggressively by the central bank.

Keywords: Inflation Targeting, Central Banking, Exchange Rates

ÖZ

ENFLASYON HEDEFLEMESİ REJİMLERİNDE ASİMETRİK DÖVİZ KURU MÜDAHALESİ: TÜRKİYE ÖRNEĞİ, 2002-2008.

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Özellikle 2000'li yıllarla beraber bir dizi gelişmekte olan ülke dalgalı döviz kuru rejimini benimsedi ve beklentilerin ve toplam talebin control edilmesine dayanan enflasyon hedeflemesi rejimini uygulamaya başladı. Ancak bu dönem aynı zamanda da enflasyon hedeflemesi uygulayan gelişmekte olan ülkelerin büyük bir çoğunluğunun paralarının değerlenmesine tanıklık etti. Bu ülkelerde döviz kuru enflasyonu dizginlemek için zımni bir araç olarak kullanılıyor olabilir miydi? Bu soruyu yanıtlamak ve enflasyon hedeflemesi rejimi içerisinde enflasyonun belirleyicilerini araştırmak amacıyla bu çalışma Türkiye'nin 2002-2008 döneminde yaşadığı enflasyon hedeflemesi tecrübesini incelemektedir. Çalışmanın iki temel bulgusundan söz edilebilir. Birinci olarak, VAR modelinden çıkan sonuçlar göstermektedir ki, Türkiye'de enflasyonun bu dönemdeki temel belirleyenleri uluslararası emtia fiyatları ve döviz kurundaki değişimler gibi arz yanlı etkenlerdir. İkinci olarak ise, ampirik bulgular göstermektedir ki Türk Lirası'nın (TL) bu dönemde değerlenmesi, merkez bankasının döviz kuruna yönelik asimetrik politika duruşuyla ilişkilidir. Hem ekonometrik analizin, hem de betimleyici istatistiğin gösterdiği gibi merkez bankası bu dönemde TL'nin değerlenmesini tolere ederken, TL'nin değer kaybettiği durumlarda agresif bir şekilde hamle yapmıştır.

Anahtar Kelimeler: Enflasyon Hedeflemesi, Merkez Bankacılığı, Döviz Kuru

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ADF	Augmented Dickey Fuller
CBI	Central Bank of India
CBRT	Central Bank of the Republic of Turkey
CPI	Consumer Price Index
ERPT	Exchange Rate Pass-Through
IMF	International Monetary Fund
IRF	Impulse Response Function
IT	Inflation Targeting
ITDC	Inflation Targeting Developing Countries
MCI	Monetary Conditions Index
VAR	Vector Autoregression
VDC	Variance Decomposition
WCPI	World Commodity Price Index
WPI	Wholesale Price Index

CHAPTER 1

INTRODUCTION

Many developing countries have adopted inflation targeting (IT) as their monetary policy regime in the last two decades. The ultimate aim was to curb inflation which was seen as an impediment in the pursuit of economic growth. The apparent deficiencies of experiences with other policy regimes such as fixed exchange rate or pegged exchange rate regimes also contributed to the perception that IT may be a panacea to rein in inflation.

The assumption behind IT was that inflation is a consequence of excess demand which may be avoided through appropriate monetary policy. Manipulation of aggregate spending through interest rates was likely to have a significant impact on containing inflation. Monetary authorities could just determine their policy interest rates and affect the level of aggregate demand and hence the level of inflation. At this juncture, it is worth to mention that mainstream thinking does not presume a profound difference between developed countries and developing ones in this respect. The causes of inflation and policy tools to fight against it are assumed to be quite similar in these two groups, hence the insistence on developing countries to adopt IT as their monetary policy framework.

Proponents of IT are also welcomed by the low inflation levels recorded in developing countries in the last two decades. The evidence suggests that IT is associated with the reduction in inflation as admitted also by the critics of IT. However, the extent to which this reduction is the result of implementation of IT is open to question. Gerald Epstein and Erinc Yeldan state that "IT has not yielded inflation below the levels attained by the non-industrial targeters that have adopted other monetary regimes" (Epstein and Yeldan, 2009: 8). In this respect, the alleged

success of IT in curbing inflation is disputable. Moreover, disregarding supply side factors as sources of inflation in a conventional framework seems to be highly problematic particularly in the case of developing countries in which exchange rates and commodity prices are crucial determinants of inflation, undermining the main tenets of conventional wisdom. Hence favorable conditions in exchange rates and commodity prices rather than the active control of aggregate demand through monetary policy might have been the factors which rein in inflation.

With regards to the exchange rate, real appreciation trend is observable in many IT developing countries as can be seen from Figure 1.1. All but two of the countries' currencies exhibit an upward trend[1]. Whether or not such a trend is a characteristic feature of IT and its role in curtailing inflation is the starting point of this study. What is the role of exchange rates in determining inflation in developing countries, and if substantial, is the appreciation trend a consequence of a deliberate policy stance with respect to exchange rate favoring appreciation in an IT context? The asymmetric nature with respect to the exchange rate may arise from the positive bias between inflation targets and realized inflation in developing countries. If the direction of the bias is upward (i.e. misses from the target are usually above rather than below the target) which is evidently the case in many IT developing countries, then monetary policy may have a tendency for appreciation. After all, nominal appreciation reduces the domestic prices of imported goods thereby eases inflationary pressures coming from elsewhere within the domestic economy or from international commodity prices. Hence, where monetary policy remains insufficient to curb inflation with its control over short-term interest rates, exchange rate may emerge as a potential candidate for a policy tool. In this vein, the main aim of this thesis is to test the hypothesis that toleration of appreciation on the one hand and the fight against depreciation on the other is valid in the Turkish experience with IT.

[1] Among IT developing countries Serbia is excluded from the figure since it started IT as of late 2008. On the other hand, I have encountered with problems for obtaining real effective exchange rate data for Romania, Guatemala, Slovakia and Ghana.

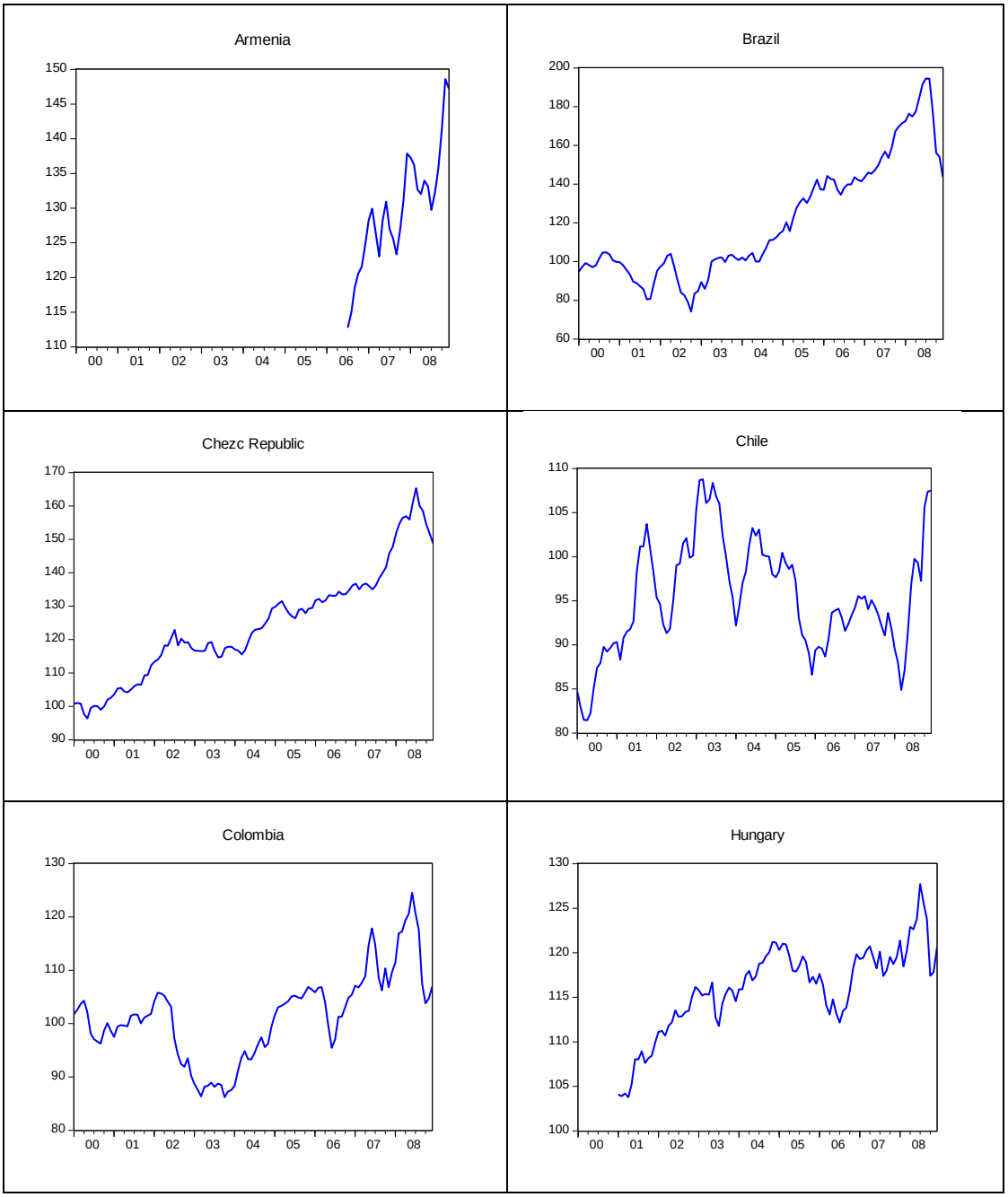

Figure 1.1 Real Effective Exchange Rates in Some of the Inflation Targeting Developing Countries, Source: National Data and JP Morgan, 2000=100[2]

[2] The data of JP Morgan is obtained from the Banco Central de Chile.

Figure 1.1 (continued)

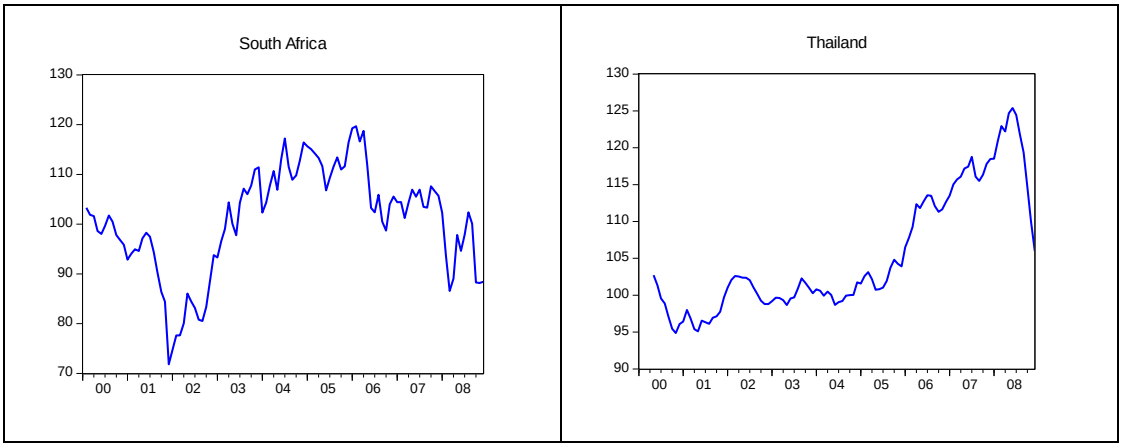

Figure 1.1 (continued)

The main findings of the study are as follows. First, using Variance Decomposition (VDC) of inflation in a Vector Autoregression (VAR) model, I find that supply side factors such as world commodity prices and exchange rate are the main determinants of inflation in Turkey between 2002 and 2008. This finding is particularly important because, then exchange rate may be used as a policy tool by the central bank to affect inflation. However, the main contribution of this study to the relevant literature is as follows. Using Impulse Response Function (IRF) of short term interest rates set by the CBRT in a VAR framework, I indicate that the CBRT exhibited an asymmetric behavior with regards to the exchange rate, i.e. the Bank did not respond to appreciation pressures through its control over interest rates whereas it aggressively responded in case of depreciation. In order to analyze the drivers of interest decisions of the CBRT, I construct a classical monetary policy reaction function incorporating the impact of exchange rate. However, my analysis differs from the rest of the literature in the sense that I define two variables one of which representing depreciation and the other representing appreciation in order to capture the asymmetry of the interest rate decisions. There is a vast literature investigating the importance of exchange rates in monetary policy reaction functions of IT developing country central banks. Nevertheless, to the best of my knowledge,

the asymmetric nature of the interest rate setting behavior of central banks in developing countries is not analyzed econometrically in the literature through a decomposition of exchange rate movements into depreciation and appreciation. One exception to that is the paper written by Galindo and Ros (2008). Yet, this paper suffers from some methodological deficiencies as I will discuss later in this study.

The CBRT's asymmetric stance does not consist only of its decisions on the interest rate. Using descriptive statistics I also reveal that foreign exchange interventions and foreign exchange sale/purchase auctions contribute to this asymmetric nature. Given the importance of exchange rate as a determinant of inflation, then, monetary authorities in Turkey have benefited from and promoted the appreciation of the Turkish lira so as to contain inflation (see Figure 1.2).

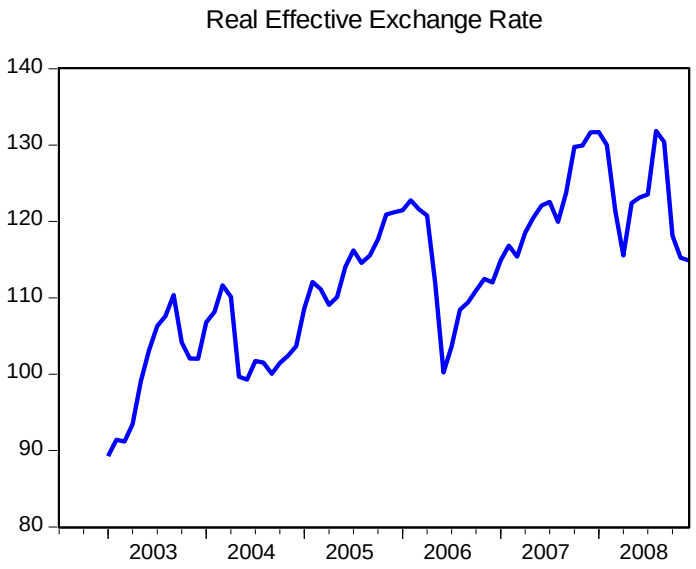

Figure 1.2. CPI Based Real Effective Exchange Rate in Turkey, 2003=100

Source: Central Bank of the Republic of Turkey.

The data of the study covers the period between the July of 2002 and the September of 2008. Given the acute reduction in inflation and interest rates in the beginning of 2002, excluding the observations in the first half of 2002 from the data set was necessary to eliminate excessive movements of these variables. The aftermath of the global crisis is excluded from the analysis because post-crisis period have witnessed a shift in the monetary policy stance into a more complex form of IT with an emphasis over financial stability. Hence, the results presented in this paper are valid only for the underlying period. The differences of monetary policy stances between these two periods, however, are subject to other researches.

The plan of the study is as follows. In the second chapter, some preliminaries with respect to IT are introduced. The arguments of the proponents of IT and those of its critics are presented briefly. This chapter provides both theoretical and practical oppositions to IT. For the purpose of this thesis, it is particularly important that supply side factors such as exchange rates and commodity prices have a major role in determining inflation in developing countries. Such perception is at odds with the main tenets of conventional wisdom promoting IT which presumes that containing aggregate demand is what is needed to achieve the desired inflation level.

The third chapter of the thesis first mentions the role of exchange rates in determining inflation in developing countries. This role exhibits variations depending on the past inflation record, composition of imports, degree of openness and the income level of different countries. This part is particularly important for the main purpose of this thesis since exchange rates are much more important in determining inflation in developing countries compared to their developed counterparts. High exchange rate pass-through in developing countries has two crucial implications. First, it implies that inflation is considerably determined by the variations in the exchange rate undermining the main tenets of IT. Second and arguably more importantly for the aim of this study, it implies that central banks can achieve their inflation targets by resorting to exchange rate movements. Then, in

this chapter, the role of exchange rates in monetary policy rules in an IT framework is discussed with reference to the literature. I try to demonstrate that the exchange rate enters into the policy reaction functions of IT central banks of developing countries. This possibility is of great importance because then, it can be argued that central banks may respond to variations in exchange rates asymmetrically, i.e. implement a tight monetary policy when the domestic currency depreciates and not loosen it when the currency appreciates.

The fourth chapter gives a brief background of the developments in Turkey prior to and during the adoption of IT; presents inflation dynamics of Turkey and the record of monetary policy between 2002 and 2008. In this part, the relationship between inflation record, policy interest rates and exchange rates are analyzed.

The fifth chapter gives econometric evidence pertaining to the first claim made in this thesis, namely that although the level of pass through might have declined in the recent period, exchange rate alongside the commodity prices is still the most significant determinant of inflation in Turkey. The sixth chapter gives econometric evidence with regards to the second claim that the monetary policy exhibits an asymmetric approach towards the exchange rate favoring appreciation. In order to test this hypothesis I construct a model for monetary policy reaction function of the CBRT.

Eventually, the seventh chapter discusses the policy implications of the findings of the study. In this part, the likely outcomes of overvaluation of currencies in developing countries are reviewed with reference to the literature on current account deficit sustainability and competitiveness of the exchange rates. In brief, this chapter elaborates discussions over the outcomes of sustaining IT in developing countries. This chapter also gives some concluding remarks.

CHAPTER 2

INFLATION TARGETING

IT is a framework by which monetary policy is conducted through the announcement of quantitative point/range targets for inflation with the explicit declaration of the monetary authority that it will pursue price stability as its primary goal, subordinating all other possible goals. Furthermore, high level of transparency of central banks emanating from increased communication with the public and the market participants is mentioned as another characteristic feature of IT. High degree of accountability of the monetary policy, allegedly, is also incorporated in an IT framework. According to Mishkin and Schmidt-Hebbel (2001) full-fledged IT is based on five main pillars: "absence of other nominal anchors, institutional commitment to price stability, absence of fiscal dominance, policy instrument independence, policy transparency and accountability" (Mishkin and Schmidt-Hebbel, 2001: 3).

2.1 The Case for IT

IT strategy emerged as a reaction to unsuccessful monetarist experiments of the 1980s. Monetarist economists, led by Milton Friedman, believed that inflation is a direct result of excess supply of money. Thus, restricting the money supply to certain pre-announced levels would eliminate inflationary pressures. However, the "velocity instability" problem implied that the link between monetary aggregates and the goal variables such as inflation was not that tight as assumed by monetarists, inducing new quests for monetary policy strategy (Bernanke and Mishkin, 2007; Mishkin,1999; Mishkin, 2000b).

As a consequence of bottlenecks of monetary targeting, a "New Consensus" has emerged in macroeconomics. Now, it is widely accepted by most central banks that inflation emerges when the overall expenditure exceeds the potential output of the economy. Hence, according to the "New Consensus", manipulation of aggregate spending through interest rates is likely to have a significant impact on containing inflation. Thus, the main policy instrument used by most central banks in conducting monetary policy is the short-term interest rates.

"New Consensus" shares major premises of monetarists such as neutrality of money in the long-run and acknowledges the vital role of price stability in monetary policy, hence the term neo-Wicksellian its proponents are ascribed to (Sapir, 2009). That the expansionary monetary policy is not capable of generating high levels of output in the long-run underscores what the monetary policy can and cannot do. The idea is that monetary policy should focus on what it can do, namely price stability in the long-run. This may be seen as the first reason why price stability became prominent in both new consensus and monetarist thinking. The second reason ensues from the monetarist idea that even low levels of inflation are costly[3] (Mishkin, 2007) which is also inherited in the new framework. Yet, whether intermediate aggregates or goal variables (inflation) are to be targeted remains the main source of divergence. In contrast with other monetary policy authorities, an IT central bank uses all available information rather than sticking only to monetary aggregates or exchange rates in order to achieve the target (Mishkin, 2000a). As presented by its proponents, this feature is a major advantage of IT framework.

The proponents of IT regime assert that inflation targeting has another major advantage of being easily understood by the public, thereby contributing to the transparency of monetary policy which is of crucial importance in shaping expectations. Moreover, since it involves a certain quantitative target, IT increases

[3] See (Bernanke, Laubach, Mishkin, Posen, 1999: 16-18).

the accountability of the monetary authority in case of any significant deviation from the target. The increase in accountability, in turn, reduces the likelihood that central bank falls into time-inconsistency trap[4] (Mishkin, 2000a).

With respect to flexibility, it is frequently asserted that IT is not a rule but a framework whereby monetary policy can be adjusted in order to respond to unexpected shocks without discarding the long-run aim of price stability. This issue is particularly important since an excessive obsession with price stability at the expense of all other concerns such as exchange rates or unemployment may jeopardize the public support for the central bank (Strachman, 2009). In this context, pioneer proponents of IT strategy assert that the well-known "rules vs discretion" dichotomy is misleading in the sense that inflation targeting may be considered as a framework "within which 'constrained discretion' can be exercised" (Bernanke, Mishkin, 2007: 216).

The actions of monetary authority are constrained in that central banks are accountable to the public and to the government whenever the realized inflation rate either overshoots or undershoots the target in a significant amount. Yet, at the same time, monetary authority has a fair degree of discretion which is very conducive to combat with unexpected circumstances on the condition that the central bank informs public about why the target may be missed in the short run and declares its commitment to long-run price stability. In this respect, proponents of IT attribute the fact that no IT country has dropped the regime even though the targets were missed

[4] Time inconsistency trap refers to the ineffectiveness of an unexpected and deceptive expansionary monetary policy in creating sustained economic growth. In an economy in which the wage and price arrangements are made on a periodic basis, economic agents made these arrangements according to their expectations which are shaped by the declarations of monetary authority concerning the future path of the monetary policy stance. If central bank chooses to deceive the public by implementing an expansionary monetary policy, it will be unsuccessful in achieving higher economic growth beyond the short run. Furthermore, under the rational expectations assumption, such a policy will result in higher inflation.

by 40 per cent, to its flexibility, transparency and accountability (Roger and Stone, 2005).

2.2 The Case Against IT

Inflation targeting has been criticized on the basis of both its theoretical foundations and recent record.

2.2.1 Theoretical arguments

"New Consensus Macroeconomics", the foundations of which constitute the basis of many IT regimes, presumes that there is no long-run trade-off between unemployment and inflation, rendering the effect of monetary policy neutral in the long-run. Hence, the advocates of IT propose that monetary authority should focus on what it can do, i.e. price stability and output stabilization. Yet, the fundamental principle underlying this perception is highly criticized by many economists, especially by Post-Keynesian economists.

Fontana and Palacio-Vera (2007) present some of the important rejections to the neutrality of monetary policy in the long-run. Taking into account the path dependency of the economy[5] yields different results with those of New-Keynesian models. In the presence of path dependency, permanent changes in aggregate demand may have long-run implications for the level of unemployment and output indicating the "long-run non-neutrality of monetary policy" (Fontana and Palacio-Vera 2007: 270). This is the case because potential output is considered as endogenous to persistent changes in aggregate demand in contrast to the New-Keynesian models which take potential output as exogenously determined by supply side factors. Hence, path dependency of natural output on aggregate demand makes

[5] Fontana and Palacio-Vera (2007) use path dependency as: "a general organizing concept to indicate that economic outcomes are the product of a specific sequence of changes and adjustments".

it likely that monetary policy may have long-run impacts on the level of output by altering the level of potential output.

Nevertheless, how path dependency brings forth changes in potential output remains to be analyzed. Demand-led growth models present an explanation for the shift of trend of potential output. The main idea is that a change in the economy which leads to the expansion of the market induces a cumulative process through which technical progress is materialized thereby contributing to the productivity growth. The existence of these cumulative linkages between aggregate demand and productivity growth by which increases in aggregate demand leads to specialization and expansion of the production, contributing to productivity growth are at odds with the neoclassical growth theory which does not presume any role attached to the aggregate demand but rather emphasizes the supply side factors as the unique source of economic growth in the long-run. Thus, given the cumulative link between investment and technological development, any factor promoting aggregate demand results in higher productivity. This approach which is generally referred as Verdoorn's law is completely different with the mainstream thinking in that it emphasizes the role of output growth on productivity growth instead of that of latter on the former. The important thing, however, is that, investment decisions are made on the basis of expectations about the market behavior. Hence, promoting aggregate demand is of vital importance in order to achieve higher productivity growth according to demand-led growth models.

Besides theoretical rejections of its foundations, IT is also criticized on the basis of its recent record throughout the world. We can classify those criticisms under six main titles.

2.2.2 Critics based on the recent record of IT

a) Even low inflation is harmful?

The malign effects of high inflation are admitted both by proponents of IT and its critics. Instabilities in inflation affect the economy adversely by creating an unstable economic environment in which firms, financial institutions, wage-setters and other economic actors have great difficulty in predicting the future price levels. These uncertainties, in turn, may hinder investment and financial services. On the other hand, this may not imply, in any way, that a very low level of inflation, if not zero, is required for long-run macroeconomic stability and growth.

The evidence suggests that there is a non-linear relationship between inflation and economic growth proposing that there might be a threshold for the level of inflation for its effects on the level of output growth. Anwar and Islam (2011) present a survey of both cross-country and country-level studies analyzing the impact of level of inflation on output growth. Empirical findings suggest that up to levels of approximately 11%-17%, if not it remains insignificant, inflation positively effects output growth. These findings may be taken as a validation of the argument that moderate levels –i.e. single digit- of inflation may be an indicator of how successful is the economy in terms of growth, not because inflation causes growth, but because fast growing economies tend to experience relatively high levels of inflation (Stanford, 2008). At this juncture, given its high costs in terms of foregone output and employment, the benefits of reducing inflation to very low levels is still open to debate. However, once this threshold is passed the sign of the relation turns into a negative one.

b) One-size-fits-all?

Even if one admits that monetary authority has the necessary maneuver capabilities to combat with inflation through interest rates, the degree to which the rise in interest rates contains inflation remains unclear. Stiglitz (2008) claims that, regardless of the reason of inflation, an increase in the interest rate is unlikely to have the desired impact on inflation. After all, oil and food prices constitute a larger share of the average household budget in developing countries compared to that in

advanced countries. Hence, inflation in these economies is mostly "imported" (Stiglitz, 2008).

In a similar vein, Anwar and Islam (2011) assert that the main sources of inflationary pressure in developing countries are not poor macroeconomic management of the economy but rather unexpected sudden supply shocks. They document the co-movement of inflation with food price index in least developed countries. The correlation coefficient between these two is found as 0.8. Raising interest rates in such economies, thus, may not generate the expected reduction in inflation since oil and food prices remain unchanged. What is more, supply shocks may also lead to a decrease in growth. If this is the case, a tight monetary policy stance exacerbates the situation (Anwar and Islam, 2011; Heintz and Ndikumana, 2010).

The proper policy response should depend on the root of inflation. Inflation may be the result of excess demand, namely demand-pull inflation in which case reducing demand through raising interest rates may prove successful. However, inflation may also occur as a result of increases in wages above productivity increases, or it may result from higher profits realized by producers through increased markup in which case the impact of increases in interest rates on inflation are highly contentious. In developing countries, however, the major challenge comes from imported oil and food prices which have a great influence on domestic inflation. Giving the whole burden of reducing inflation on merely one policy tool, namely interest rates does not seem to be a proper way of dealing with the problem in this context.

c) Disinflation: success of IT?

There is a significant deal of uncertainty concerning the role of IT in reducing inflation in the last two decades. The evidence suggests that IT is associated with the reduction in inflation as admitted by the critics of IT. However, the extent to which this reduction is the result of implementation of IT is open to question. Two

major factors might have played an important factor in disinflation process. First, declining commodity prices, as Stiglitz (2008) argues, lessened the inflationary effect on domestic prices in the "Greenspan years". Second, integration of low cost countries -such as China- into the global economy and consequent increases in production capacity, contributed to the disinflation process in manufacturing sector. Hence, several caveats seem to be necessary when disinflation is attributed only to the success of IT.

In their highly influential study, Ball and Sheridan (2003) present empirical findings which raise concerns over the role of IT in reducing inflation. Average inflation is reported to decrease more in countries implementing IT compared to non-IT countries. However, the key point is that IT countries start the disinflation process with a higher level of inflation before the 1990s. Therefore, if the regression is made to the mean, the alleged benefits of IT in terms of inflation reduction vanish[6]. Ball and Sheridan (2003) admit that IT regimes have witnessed reductions in inflation and a degree of output stabilization is attained however, non-IT countries have also witnessed these macroeconomic changes implying that there might be other factors at work.

Ball and Sheridan (2003) conclude that IT does not yield any significant improvement in terms of inflation, output stabilization and interest rate stabilization. IT is reported to have no impact on the level of interest rates in contrast with what is proposed by the proponents of IT on the grounds that IT reduces inflation expectations. Moreover, IT does not reduce the short term interest rate and inflation variability as evidence suggests.

[6] Ball and Sheridan (2005) make this case brilliantly: "Just as short people on average have children who are taller than they are, countries with unusually high and unstable inflation tend to see these problems diminish, regardless of whether they adopt inflation targeting. Once we control for this effect, the apparent benefits of targeting disappear"

Nevertheless, a caveat seems to be necessary when one interprets the empirical findings presented in Ball and Sheridan (2003). The sample in the study consists of 20 OECD countries excluding Iceland, Greece and Turkey. Thus the sample mainly consists of developed countries rather than developing countries. Furthermore, Ball and Sheridan (2003) claim that the indifference of IT in reducing inflation may stem from the fact that non-IT countries pursue similar monetary policies with those implemented under IT framework. Thus, the reduction in inflation may be interpreted as a consequence of successful policies of "New Consensus Macroeconomics" which emphasize the importance of low and single-digit inflation levels regardless of whether IT is implemented or not. Hence, a caveat is necessary when one makes deductions for the implications Ball and Sheridan's research for developing countries. Incorporating IT and non-IT developing countries into the sample will help to make inferences for experiences of developing countries under different monetary regimes.

d) What about promised economic growth?

Low levels of inflation have been the main tenet of monetary policy in many countries since the beginning of 1990s with the argument that long-run price stability will lead to higher economic growth through its benign effects on predictable investment environment. Yet, there is no evidence indicating that stabilization-focused monetary policy led to a higher level of output growth. In fact, theoretically, the other way around might be the case. A tight monetary policy, Barbosa-Filho (2009) argues, can in fact change the potential output by reducing the level of investment. Since most estimates of potential output of an economy are weighted average of growth rates in different years, a long-term tight monetary policy can be "self-fulfilling by keeping the economy permanently close to its supply constraints" (Barbosa-Filho, 2009). This can be seen as a natural consequence of what I have referred to as "demand-led growth models".

Most evidence validates the argument that low levels of inflation of recent decades did not generate employment and output growth. This point is in concordance with the non-linear relationship between inflation and growth as mentioned above. Very low levels of inflation, indeed, might have resulted in foregone output growth. Moreover, as Epstein (2009) argues, sacrifice ratio does not appear to decrease under IT framework contributing further to the losses in foregone output growth.

With regard to the promised economic growth of IT framework, Epstein (2009) mentions the role of orthodox policies in the recent global crisis. He argues that, these policies aggravated the disastrous impact of global crisis if not paved the way for it. Accordingly, it is suggested that central banks around the world should adopt a more developmental role incorporating both stabilization and employment generation perspectives (Epstein, 2009).

e) Independent central banks?

The formal independency of central banks from political sphere is frequently praised by the proponents of IT strategy on the grounds that it eases political pressure on the central bank to pursue expansionary policies, the absence of which is necessary to refrain from time-inconsistency trap. However, independency of central bank from all layers of the society is highly problematic. Whereas, central banks became less accountable to the government, as Epstein and Yeldan (2009) argue, they became more accountable to financial industry and international financial institutions. Moreover, Stanford (2008) claims that exclusion of public evaluation and control from monetary policy which is a very important component of economic policy is contentious with respect to democratic standards.

f) Overvaluation of domestic currencies: is it sustainable?

Epstein and Yeldan (2009) provide evidence that many of the IT developing countries have witnessed overvaluation of their currency during IT implementation. Sustainability of such a steady overvaluation poses a major challenge for IT

developing economies (Barbosa-Filho, 2009). In the fourth chapter, I will analyze the overvaluation process of Turkish lira, and its relevance in IT context. Later, in the sixth chapter I will mention policy implications of this phenomenon. So, this issue will be discussed in detail in the later chapter.

Nonetheless, an important argument regarding the overvaluation trend of currencies of developing countries which is made by Heintz and Ndikumana (2010) deserves a special emphasis. The authors emphasize the importance of appreciation in allocating resources between different sectors. Most notably, appreciation allocates resources out of tradable goods sectors into non-tradable goods sectors. If average productivity level is higher in tradable goods sectors, then an appreciation will adversely affect output growth (Heintz and Ndikumana, 2010).

CHAPTER 3

THE ROLE OF EXCHANGE RATES IN AN INFLATION TARGETING FRAMEWORK

In this chapter, I will analyze the role of exchange rates in IT developing countries (ITDC). First, I will analyze the relationship between inflation and exchange rates in a developing country context. The critical role of exchange rates in determining inflation makes it indispensable for central banks to intervene in the foreign exchange market. The impact of exchange rates on inflation differs on the basis of the past inflationary environment, degree of openness, composition of imports and income level of the country. Then, in the second section, prominent theoretical arguments about the role of exchange rates in monetary policy rules will be revised. This section concludes with the possibility of existence of exchange rates in monetary policy rules which implies that central banks respond to variations in the exchange rates.

Later in the third section, I will summarize the main rationales for exchange rate interventions in developing countries in general. These are typically gathered around three main issues. First, high exchange rate pass-through poses a major thread to desired inflation level whenever depreciation is observed. This is actually the main consideration in ITDC. Second, central banks try to establish financial stability which is largely affected by the level of exchange rates in developing countries. Third, non-IT central banks may have concerns over competitiveness of their industrial sector; thereby render exchange rates as important policy tools. In the final section, the results of the recent researches on exchange rate policies of developing countries will be presented. There is a remarkable literature underlining

that interest rates and interventions are used excessively in case of significant changes in the exchange rate in developing countries.

3.1 The Relationship between Inflation and Exchange Rates in Developing Countries

The impact of exchange rate variations on the level of domestic inflation is generally referred as the exchange rate pass-through (ERPT) in a developing country context. Kara et. al (2005) define ERPT as the "percentage change in domestic prices resulting from a one-percentage change in the nominal exchange rate". Hence, depreciation in the nominal exchange rates, by raising the import prices in local currency, may cause domestic inflation soaring, whereas appreciation has the opposite effect.

Analyzing the determinants of ERPT is important because such an analysis, as the rest of the section indicates, is needed to understand why ERPT tends to be higher in developing countries. High level of ERPT, in turn, implies two very important inferences for the purpose of this study. First, high level of ERPT implies that exchange rates are very important in determining inflation thereby undermining the main rationale of IT which emphasizes demand-led factors in determining inflation. However, the second implication gives ITDC central banks a powerful tool to hit their inflation targets. Since the exchange rate is one of the leading, if not the most important, sources of variations in inflation, then ITDC central banks can achieve the desired level of inflation by using exchange rates. The rest of the section tries to discover main determinants of ERPT. In the literature, four major components are mentioned to have profound impact on the level of pass-through in a developing country.

3.1.1 The role of inflationary environment

The level of ERPT is likely to increase when economic agents make their daily arrangements (transactions, financial contracts) in foreign currencies due to high

and unstable inflation in the country (Kara et al, 2005). This situation is often called "dollarization" in many developing countries where instabilities in the value of domestic currency induce increased circulation of foreign currency within the economy. This indexation mechanism, in turn, increases the effect of exchange rates on the level of inflation. When exchange rate depreciates, the value of goods and services which are indexed to the foreign currency increases in terms of domestic currency, hence creating an inflationary pressure.

Besides the direct channel, indexation also occurs through "expectations channel" by which economic agents perceive the changes in the exchange rate as permanent and make their wage/price-setting decisions accordingly. Kara and Öğünç (2008) argue that in fixed exchange rate and crawling peg regimes, expectations channel is likely to lead higher ERPT since economic agents perceive the changes in the exchange rate as a reference. However, it is likely that ERPT declines when exchange rate can move in both directions, making it difficult for economic actors to decide whether the change in exchange rate is permanent or transitory (Kara and Öğünç, 2008).

Recent decline in the ERPT in developing countries is usually attributed to the low inflation environment materialized throughout the last two decades. The major contribution to this approach comes from Taylor (2000). In this paper, Taylor argues that low inflation environment brings along a decrease in ERPT. The order of implications is such that low and stable inflation leads to a less persistent inflation as documented by Taylor (2000) for the case of United States. The decrease in persistency, in turn, is taken into account in wage setting and price setting decisions. Using a model of staggered price setting, Taylor (2000) shows that the degree to which firms respond to increases in costs by raising the prices of their products

depends on the expected level of persistency of the cost increase. If this persistency is expected to be low, firms will tend to overlook such a trend in costs[7].

The unresponsiveness of firms may be due to the concerns over whether an increase in prices by the firm will be accompanied with price increases by other firms. It is much likely that, given the low persistency of cost shocks, other firms will stick to previous prices, jeopardizing the competitive power of the firm which increases its prices. Thus seen, less persistency of inflationary pressures which is a result of low and stable inflation tend to decrease, through its impact on expectations, the pricing power of firms. The reduction in pricing power, in turn, leads to a decrease in the pass through of changes in costs into prices.

Although the focus of Taylor (2000) was changing inflationary environment of the United States, his arguments were tested in the context of developing country experiences. One of the main contributions in the literature is made by Choudri and Hakura (2006). They test the hypothesis of Taylor (2000) for developing countries with respect to ERPT using data for 71 countries between 1979 and 2000. An application of arguments made by Taylor (2000) is that lower and more stable inflation environment reduces ERPT in developing countries through its impact on the expectations of persistency of cost changes. If the impact of a change in the exchange rate is perceived to be transitory and not permanent, then firms do not match changes in the costs they face by changing the prices.

Choudri and Hakura (2006) estimate the ERPT into Consumer Price Index (CPI) for the sample and find a positive relation between the average level of inflation and ERPT. Controlling for other variables, they conclude that the level of average inflation is the dominant factor in determining variations in the ERPT. Hence, their study validates the hypothesis posed by Taylor (2000) for developing country case.

[7] Taylor (2000) refers to this approach as the “expectations theory of pass-through”.

3.1.2 Composition of imports

Another prominent work in the literature is by Campa and Goldberg (2002) who investigate the role of macro and micro factors in determining the pass through into import prices in OECD countries. They find that, although inflation rates and exchange rate volatility are positively correlated with the level of pass through, this association seems to be weak suggesting for other factors in order to explain changes in the pass through. This finding is at odds with what Taylor (2000) hypothesized.

Campa and Goldberg (2002) emphasize microeconomic factors such as the composition of import bundles of the countries as the dominant determinant of ERPT into import prices. They suggest that when there is a move in the import bundle away from what is assumed to have a higher pass through elasticity such as energy or raw materials, into lower pass through elasticity goods such as manufactured goods, the pass through is likely to decline as a result of the shift in the composition of imports. This move in the import composition is offered by the authors as the main contributor of recent decline in the pass through in OECD countries. However, it is again important to remind that the sample consists of advanced countries. Hence, the relevance of this line of argument in a developing country context needs more research.

3.1.3 The degree of openness

As dependence on imports for both consumption and production increases, so does the ERPT into CPI. This happens for two reasons. First channel is the direct channel through which depreciation of the currency raises domestic currency prices of imported consumption goods. The second channel is the indirect channel through which depreciation of the currency raises domestic currency prices of imported intermediate goods, thereby raising the cost of production which in turn increases

the prices of domestically produced goods. The more open the economy is, the more the EPRT is likely to be.

The indirect channel is particularly important in developing countries given their higher level of dependence on imported capital goods for production compared to advanced economies. With respect to the relationship between inflation and the degree of openness, a cautionary note seems to be necessary. Developing countries depend substantially not only on imported capital goods, but also on imported commodities such as oil and raw materials, the prices of which are generally subject to sharp fluctuations. Thus, the pass-through from foreign prices is also an important determinant of domestic inflation (Kara and Öğünç, 2011). Hence, the degree of openness may have two destabilizing effects on domestic prices, the first with nominal exchange rate fluctuations (ERPT) and the second with foreign price fluctuations.

3.1.4 The income level

In low income countries tradable goods such as food constitute a larger body of CPI whereas non-tradable goods such as services typically have smaller share in CPI compared to high income countries. Thus any movement in the exchange rate has a significant impact on domestic inflation via its effect on tradable goods prices.

The relative effects of these three factors on ERPT may vary between countries according to their characteristics. As an example, using a VAR analysis, Sohrabji (2011) concludes that openness is the dominant factor in determining ERPT in India. On the other hand, using data for 19 developing and developed countries, Ho and McCauley (2003) find that among the four possible candidates for ERPT determination including dollarization and openness, inflation record and income level stand out as dominant variables.

Given the low income level, preponderance of energy and raw materials in the import bundle, high degree of openness and high inflation inertia, ERPT is higher in

developing countries compared to advanced countries. Then, this implies that exchange rates are much more important in determining the level of inflation in developing countries. Hence, exchange rate emerges as a effective policy tool to curb inflation.

3.2 Theoretical Arguments: Is There a Room for Exchange Rate in Monetary Policy Reaction Functions under an IT Framework?

Having seen the significant impact the exchange rate has on inflation in developing countries, now I can discuss whether or not exchange rates enter into monetary policy reaction functions of ITDC' central banks. This issue is important because once exchange rates are assumed to enter into the reaction function, it is quite likely that central banks may respond to variations in the exchange rate asymmetrically.

Domaç and Mendoza (2004) asserts that in practice, ITDC central banks try to keep the exchange rate under control either by adjusting interest rates or conducting foreign exchange intervention whereas advanced countries' central banks occasionally implemented such measures. Similarly, Edwards (2006) conclude that IT economies with a high inflationary past are likely to adjust their monetary policy in line with variations in the exchange rate. However, given that an inflation targeting framework requires that inflation is the only nominal anchor, interventions concerning the exchange rate raised questions about whether ITDC' central banks target exchange rate or not.

The arguments about how to set monetary policy rules is a highly contentious issue in macroeconomics. Pertaining to the United States economy, Taylor (1993) contends that central bank cares for inflation and the level of real output while setting the interest rate. In the new Keynesian models the concerns about the level of output may arise due to two reasons. First, if the central bank perceives output fluctuations as undesirable for the benefit of the society, it certainly tries to

minimize deviations of real output from its long term trend[8]. Second, even if the coefficient of the output gap in the loss function of the central bank is zero – i.e. central bank does not care for output fluctuations, a hypothetic situation in which the central bank is generally referred to as "inflation nutter" – output gap is still there in the central bank's reaction function. This is because current output gap carries information about the forecasts for future inflation. According to these models, variations in the output gap affect future inflation through the aggregate supply relation. Following Svensson (1997) these relations can be seen through three equations:

$$\pi_{t+1} = \alpha_1 y_t + \alpha_2 x_t + \epsilon_{t+1} \quad (3.1)$$

$$y_{t+1} = \beta_1 y_t - \beta_2 (i_t - \pi_t) + \beta_3 x_t + \varepsilon_{t+1} \quad (3.2)$$

$$x_{t+1} = \gamma x_t + \theta_{t+1} \quad (3.3)$$

Where π_t is the inflation rate, y_t is the log output relative to potential output, x_t is an exogenous variable, i_t is the monetary policy instrument and ϵ_t, ε_t, θ_t are i.i.d. shocks. The output gap in year t affects inflation rate in year t+1 through the first equation. Central banks set their policy instrument i_t so as to affect aggregate demand through the second equation. Interest rate is set at which the bank minimizes the intertemporal loss function:

$$E_t \sum_{\tau=t}^{\infty} \delta^{\tau-t} L(\pi_\tau, y_\tau) \quad (3.4)$$

where the loss function is,

$$L(\pi_\tau, y_\tau) = \frac{1}{2} [(\pi_t - \pi^*)^2 + \sigma y_t^2] \quad (3.5)$$

[8] Mishkin (2002) emphasizes dangers created by an extensive focus on output fluctuations for it can reduce communication skills and credibility of the central bank. Moreover, he asserts that the fact that output gap is hard to measure engenders problems in conducting monetary policy.

The above equations imply that there is a two-period lag between central bank's policy setting and inflation which is the main reason why IT is usually referred to as inflation forecast targeting. According to Svensson (1997), central bank's inflation forecast, rather than current inflation becomes an intermediate target in order to affect future inflation.

In an open economy, monetary policy rule might differ in that exchange rate considerations now exist regardless of whether the exchange rate is attached a special importance in the loss function or not. The movements in the exchange rate directly affects the level of inflation hence making it indispensable for the central bank to take into account the impact of these variations on the level of inflation in an IT context. Following Taylor (2001) the role of exchange rate considerations in monetary policy can be formulated as follows:

$$i_t = f\pi_t + gy_t + h_0 e_t + h_1 e_{t-1} \quad (3.6)$$

where i_t is the short term interest rate, y_t is the output gap, π_t is the deviation of inflation from the target, and e_t is the logarithm of the real exchange rate. Edwards (2006) argue that, even if $h_0, h_1 \neq 0$ this equation does not imply that a certain level of exchange rate is targeted. There is no reason for monetary authority to target a certain exchange rate. On the other hand, the role of exchange rate in monetary policy formulation depends on the specific values of coefficients h_0 and h_1. If h_0 and h_1 are both equal to zero in terms of equation 3.6, then the monetary policy rule is the same with that under closed economy. If $h_0 = h_1 \neq 0$, then central bank cares only about the change in the exchange rate and not with its value. This may be the case since variations in the exchange rate affects the level of inflation in line with what is outlined in section 3.1. In practice, IT central banks adhere to this argument; they frequently claim that they do not have any target for the exchange rate and that interventions are made only to contain temporal excessive fluctuations.

Edwards (2006) contends that whether a central bank responds to variations in exchange rate or not and the degree of intervention depends on the specific circumstance the central bank face. To make it more concrete, consider the loss function of the central bank

$$L = (\pi_t - \pi^*)^2 + \beta(y_t - y^*)^2, \text{ with } \beta > 0 \quad (3.7)$$

Edwards (2006) articulate that if the real exchange rate plays a role in monetary policy, this materializes only through its effect on output gap and inflation. Thus, monetary policy reacts to movements in the real exchange rate as long as it affects the level of output gap and inflation. However, whether there is a room for an independent role of the exchange rate in loss minimization is still questionable. If monetary authorities constructed the model carefully so that possible effects of exchange rates on y_t and π_t are included in the model, then exchange rate variations are out of consideration in the monetary policy rule. If, however, Edwards (2006) states: "there is a lagged response of both inflation and output to exchange rate changes, the central bank may want to preempt their effect by adjusting the policy stance when the exchange rate change occurs, rather than when its effects on y_t and p_t are manifested" (Edwards, 2006: 22-23). Moreover, whether or not a pre-emptive strategy is chosen depends on the characteristics of the country under discussion. Consequently, whether $h_0, h_1 = 0$ or not is a "country-specific empirical question" (Edwards, 2006: 25).

Similar remarks are made by other studies as well. Chang (2007) emphasizes that exchange rates are likely to have impact on the level of inflation in conventional IT regimes. If there is a correlation between the changes in exchange rate and forecasted inflation, then monetary policy may have to respond in order to keep inflation in check in line with the target. This result clearly contradicts with what is proposed by the advocates of IT who contend that one of the preconditions of IT is

to have a flexible exchange rate regime under open capital markets. Yet, again, this does not mean, in any way that exchange rate is the target for monetary policy.

What is argued by Edwards (2006) is in line with what is proposed by Taylor (2001). Taylor (2001) mentions that incorporating the exchange rate in the monetary policy does not yield a greater performance in terms of inflation and output variation. Furthermore, the performance may be deteriorated when $h_0, h_1 \neq 0$. This may occur, Taylor (2001) contends, because exchange rate considerations are already present in a monetary policy rule even if h parameters are set to zero due to the impact of exchange rate variation on output and inflation. Hence, even if h parameters are zero, central bank reacts to the consequences of exchange rate fluctuations on inflation and output gap.

The implicit assumption behind Taylor (2001) as well as Edwards (2006), however, is that monetary authority is capable of influencing inflation and output gap to a great extent through its decisions in interest rate setting. Although still very controversial, this assumption may work in developed countries. Yet, what if monetary transmission mechanism does not operate properly which is indeed the case in most developing countries? What if changes in exchange rates and international commodity prices very important in affecting inflation?

Weak financial and institutional structure along with the deficiencies in the credibility of the central bank may undermine the ability of transmission channels to shape expectations and influence the level of inflation. What is more, external factors such as fluctuations in energy and food prices the weight of which in CPI is particularly high in developing countries and which are out of control of the monetary authority may undermine the efficiency of the monetary policy. If that is the case, exchange rate may appear as a panacea for the central bank to hit its inflation target. The upward trend in the real exchange rate may compensate for the deficiencies in monetary transmission mechanism. In brief, exchange rate performs its role in influencing the level of inflation on the behalf of the central bank! Once

the implicit assumption that by setting the interest rates central bank is able to influence inflation and output gap to a great extent is challenged on well-founded arguments, the existence of e_t and e_{t-1} in the monetary policy reaction function becomes totally plausible.

The importance of exchange rates in policy reaction function is also evident when equations 3.1 and 3.2 are considered. Two-period lag between interest rate setting and inflation undermines monetary authorities' ability to fight with sudden inflationary pressures. Given the much shorter lag between exchange rate and inflation[9] (Svensson, 1999), an IT central bank may resort to exchange rate intervention in order not to miss the target if exogenous shocks are found to happen regularly and are likely to impinge upon CPI considerably which is again the case in most developing countries.

In this respect, Ball (1999) derives the optimal policy rule for the open economy case. His findings indicate that if the monetary authority wishes to minimize output gap and deviations of inflation from the target, optimal policy instrument is a weighted sum of the interest rate and the exchange rate. This finding is compatible with the implementation of Monetary Conditions Index (MCI) which is used in some IT countries most prominently in Canada and New Zealand.

An important note seems to be necessary here. The above arguments make the case for the existence of exchange rates in the monetary policy reaction functions of the ITDC central banks. However, they do not mention the asymmetric nature of the central banks' exchange rate policy. Yet, since realized inflation tends to be higher than target inflation in ITDC, a natural consequence of above discussion is that ITDC central banks may tend to have an asymmetric policy stance favoring

[9] After all, any change in the exchange rate may immediately alter the prices of imported goods denominated in domestic currency.

appreciation. I will emphasize this issue later in Chapter 6 when I analyze the CBRT's interest rate setting decisions.

Albeit this propitious theoretical background for exchange rate intervention in IT regimes -exclusively in ITDC-, the conventional literature is riddled with malign consequences of interfering the asset prices, most exclusively the exchange rate. Bernanke and Gertler (1999, 2001) argue that in an IT regime monetary authority should respond to fluctuations in the asset prices only if they signal changes in the inflation forecast. Efforts to stabilize asset prices seem to be problematic regarding their impact on the market psychology (Bernanke and Gertler, 2001). Moreover, Bernanke and Gertler (1999) argue that distinguishing what is fundamental in asset prices from what is not is nearly impossible, undermining the rationale for the intervention. Hence, monetary policy should not respond to changes in asset prices unless they affect future inflation.

Other studies focus on interventions with respect to the exchange rate. Mishkin and Savastano (2001) contend that focusing too much on exchange rate considerations in ITDCs endanger that the level of exchange rate rather than the inflation target may turn into the nominal anchor. Hence, both direct and indirect intervention to the exchange rate should be constrained. In a similar vein, Obstfeld and Rogoff (1995) articulate that interventions in asset prices including the exchange rate are highly problematic since they can be very sensitive to expectations. Thus, exchange rate can only be used as an indicator of the forecasted inflation. These lines of argument seem to be inconsonant with what is happening in the real world given challenging problems developing countries face with. Then, the rationale behind exchange rate interventions in developing countries is discussed in the next section.

3.3 The Rationale Behind Exchange Rate Intervention in Developing Countries

Having seen that monetary policy reaction functions are likely to incorporate exchange rate fluctuations in an IT regime, now I can analyze the underlying reasons of exchange rate intervention in developing countries both in the form of interest rate adjustments and of interventions in the foreign exchange market. Following Mishkin (2004), differences between developing countries and their developed counterparts with respect to monetary policy issues can be classified under five main topics: weak fiscal institutions; "weak financial institutions including government prudential regulation and supervision; low credibility of monetary institutions; currency substitution and liability dollarization; vulnerability to sudden stops of capital inflows" (Mishkin, 2004: 3). These differences, in turn, provide developing countries with challenging problems concerning the effect of exchange rate fluctuations on the economy. Therefore, monetary authorities are obliged to respond to variations in the exchange rate due to several reasons. In this section, I analyze the rationale behind exchange rate intervention for developing countries, both IT and non-IT. Three major rationales are underscored in the literature.

3.3.1 High Exchange Rate Pass-Through into Domestic Prices

Given the relatively high exchange rate pass-through into domestic prices in developing countries, a likely consequence of the relatively high degree of openness and small size of the economy, the movements in the exchange rate have a significant impact on inflation. Thus, IT central banks in developing countries are more willing to fight with inflationary pressures of exchange rate movements compared to their counterparts in advanced countries. In a recent work, using Granger causality test, Abdullah, Achsani and Fauzi (2010) find a strong relationship between inflation and real exchange rates in Asian countries. However, evidence does not suggest the same for EU and North America. The bottomline is

that inflation rate in Asian countries are more sensitive to exchange rate movements compared to advanced countries.

As I have outlined in 3.1.1, it is widely argued that recent disinflation process in developing world led to a decline in the level of ERPT. Even though such a conclusion still needs more robust evidence, the degree to which the ERPT declined seems to be far away than what could substantially ease the inflationary pressures of the movements in the exchange rate. Hence, monetary policymakers in developing world still have greater concerns about the impacts of exchange rate on inflation than their industrial country counterparts.

One of the arguments of the critics of IT was that, IT is associated with overvaluation of domestic currencies in developing countries. In the Brazilian context, Barbosa-Filho (2006) takes this argument one step forward by claiming that reductions in inflation in Brazil was achieved mainly through appreciation of the real. Because other monetary transmission mechanisms do not operate properly, exchange rate variations constituted the main monetary transmission channel. Whenever forecasted inflation tended to surpass the target, monetary authority raised interest rates in order to attract foreign capital into the country, thereby leading to appreciation of the currency. Currency appreciation, in turn, decreased domestic prices as a result of pass-through[10]. Very high real-interest rates in Brazil, is presented by Barbosa-Filho (2006) as a result of this process. Moreover, Barbosa-Filho (2006) asserts that Banco Central do Brazil responded to exchange rate movements asymmetrically, asymmetric in the sense that it has stood out against depreciation while tended to tolerate appreciation of the *real*. Indeed, as Barbosa-Filho (2009) documents, inflation targets were hit only when *real* appreciated.

[10] This line of reasoning is compatible with what I propose in section 3.2 i.e. IT central banks in developing countries may resort to exchange rate intervention to hit their target in the absence of robust monetary transmission channels.

In a similar vein, using a vector autoregressive model Galindo and Ros (2009) discover that policy reactions of Banco de Mexico is asymmetric in that, central bank responded depreciation with raising the interest rate but did not do the same when peso appreciated. Overall, the evidence suggests that ITDC central banks consider variations in exchange rates as important indicators of forecasted inflation hence take monetary policy measures accordingly. Also they may be eager to appreciate the exchange rate in order to benefit from the positive consequences of appreciation with respect to the inflation.

The concerns over the impact of high ERPT on inflation are much more severe in ITDCs compared to that in non-IT developing countries. On the other hand, concerns over financial stability and international competitiveness are likely to be more relevant in the case of non-IT developing countries. In what follows I mention these two factors in a developing country context.

3.3.2 Financial Stability

In developing countries where the banking system is troubled with major deficiencies, acute fluctuations of exchange rate may have disastrous effects on the entire economy. For instance, when the bulk of banks in a developing country have short term liabilities in foreign currency whereas their assets are mainly denominated in domestic currency, a sharp depreciation may deteriorate balance sheets of banks acutely, leading to a contraction in credit. Hence the consequence is likely to be a decline in demand which in turn leads to a contraction.

The malfunctioning of the credit system may occur even if banks do not have a currency mismatch problem. If the firms to which financial institutions extended credit have currency mismatch problems, then a sharp depreciation of the currency will lead to insolvency of the corporate sector ultimately deteriorating balance sheets of the banking sector (Mishkin, 2004; Ho and McCauley, 2003). Such

currency mismatch problems may emanate from several reasons in developing countries.

First, the existence of either explicit or implicit guarantees that are provided by monetary authorities or government (i.e. exchange rate peg or government bailout) will induce financial intermediaries to incur liabilities denominated in foreign currency (Ho and McCauley, 2003). Second, low level of domestic savings may prompt banks to seek for external financial resources. Third, the low level of interest rates in developed countries renders external finance desirable.

The malign impacts of depreciation can also exacerbate credit market frictions via credit channel. In an unstable financial environment where lenders do not have the sufficient information about the financial position of the borrower, deterioration in the balance sheets of both firms and banks hinders well-functioning of the credit mechanism. As a result, adverse selection and moral hazard induces a decline in the investment in line with Mishkin and Schmidt-Hebbel (2001).

Monetary authorities in developing countries tend to abstain from acute depreciations in the exchange rate for another reason as well. The relatively more vulnerability of exchange rates to speculative attacks make it indispensable for the central bank to respond to excessive exchange rate fluctuations to affect market expectations. Concerns over financial stability may exist in ITDC as well; however, they are typically more important in non-IT developing countries or in more complex IT countries.

3.3.3 International Competitiveness

In order to illustrate the difference between ITDC and non-ITDC in their approach to exchange rate movements, their concerns over international competitiveness may be illuminative. Typically, concerns over inflation are the major of focus of IT central banks whereas non-IT central banks may put more emphasis on financial stability and international competitiveness.

A case study illustrates the concerns over competitiveness in shaping monetary policy in a non-IT developing country. Ramachandran and Srinivasan (2007) use an ARDL approach to reveal the asymmetric nature of central bank intervention in foreign exchange market in India. The empirical results suggest that the volatility of external factors is not adequate to explain huge accumulated foreign exchange reserves of Central Bank of India (CBI). The authors point out that the possible motive for such accumulation may be concerns about competitiveness of Indian firms rather than prudential measures. The manifestation of this concern may be seen from the asymmetric position of monetary authority which purchases foreign exchange aggressively in case of appreciation of rupee, but giving an insignificant response in case of depreciation resulting in excessive reserves Ramachandran and Srinivasan (2007: 264).

The case of India may be informative since it is not an IT economy. It is much more likely for the case of India that CBI gives much more weight to factors other than inflation in its policy agenda. In fact, the head of CBI makes an account for this argument[1112].

[11] "Inflation targeting is neither feasible nor advisable in India, and for several reasons. First, in an emerging economy like ours, it is not practical for the central bank to focus exclusively on inflation oblivious of the larger development context. The Reserve Bank cannot escape from the difficult challenge of weighing the growth-inflation trade off in determining its monetary policy stance. Second, the drivers of inflation in India often emanate from the supply side which are normally beyond the pale of monetary policy. In particular, given the low income levels, food items have a relatively larger weight in the consumption basket in India compared to advanced economies and even many emerging market economies… …finally, a necessary condition for inflation targeting to work is efficient monetary transmission. In India, monetary transmission has been improving but is still a fair bit away from best practice…" (Subbarao, 2011: 4).

[12] Before concluding this section, another possible candidate for exchange rate interventions deserves a special attention. Substantial depreciations in the exchange rate may jeopardize the ability of governments of developing countries in their effort to pay their debt which may largely be denominated in foreign currency. Hence, fiscal considerations may also exist in developing countries.

3.4 Some Literature Review on Exchange Rate Intervention in Developing Countries

Having already analyzed theoretical arguments about the role of exchange rates in monetary policy reaction functions and rationale behind exchange rate interventions in developing countries now I can present some research over recent experiences as to why and how exchange rate intervention is conducted.

Most research verifies that exchange rate is an important concern in monetary policy both for its effects on inflation and financial stability. In their highly influential paper, Calvo and Reinhart (2000) find that monetary authorities in floating exchange rate regimes exhibit "fear of floating" due to their credibility shortcomings and concerns over financial system. Using data for thirty nine countries, Calvo and Reinhart (2000) document that variability in nominal exchange rate is low and fluctuations in interest rates and level of reserves is high in developing countries relative to developed countries. They claim that, given their higher levels of exposure to external shocks, relative stability of exchange rates in developing countries must stem from deliberate interventions to stabilize the exchange rate. Moreover, high volatility of both nominal interest rates and the level of foreign currency reserves indicate that both direct and indirect intervention is conducted. Besides transactions in the foreign exchange market, central banks in developing countries also set interest rates in order to stabilize the exchange rate. Calvo and Reinhart (2000) claim that even though interest rates are mainly set according to domestic policy considerations in advanced countries, it is unlikely to be the case in developing countries where external factors play a more important role. An indicator of this is the co-movement of interest rates and nominal exchange rate. Another indicator is the negative relationship (in two thirds of the cases) between reserves and the nominal exchange rate revealing that "leaning against the wind" is the case (Calvo and Reinhart, 2000).

Similarly other studies also reveal that monetary authorities respond to exchange rate fluctuations in developing countries. For instance, using a model estimated for Argentina, Brazil, Mexico, Indonesia, Korea and Thailand, Filosa (2001) concludes that monetary authorities strongly responded to exchange rate variations. Accordingly, Mohanty and Klau (2004) report that in most developing countries interest rates are used strongly as a reaction to fluctuations in the exchange rate. Moreover, in some countries the interest rate reaction to exchange rates is higher than to inflation and output gap. Central banks raise interest rate when currency starts to depreciate. This situation seems to be most evident in Brazil and South Africa (Mohanty and Klau, 2004). Other cases of monetary tightening when exchange rates move upward (depreciation) can be seen in Indonesia (2000) and Israel (2002) (Ho and McCauley, 2003).

Considering the relationship between exchange rates and inflation in an IT context, a preliminary glance at misses of inflation target and real exchange rate trends may be intuitive. Ho and McCauley (2003) find a stronger association between missed inflation targets and exchange rate movements in developing countries compared to developed countries. They report that: "of the 22 target misses by emerging market economies, 10 (45%) were associated with exchange rate moves of over 10% in the aggravating direction" (Ho and McCauley, 2003: 22). Similar results were found by Roger and Stone (2005). It is reported that largest deviations from the inflation target reflect impact of exchange rate shocks mostly in the form of shifts in capital inflows. They conclude that "all of the large misses reflected wide exchange rate fluctuations" (Roger and Stone, 2005: 29).

The relative importance of concerns over inflation, financial stability and competitiveness are also mentioned in the literature. Ho and McCauley (2003) contend that there is no empirical evidence supporting the argument that IT developing countries try to stabilize exchange rate at the expense of missing the inflation targets. There seems to be no case in which a change in the interest rates

are aimed to affect the exchange rate and contradicts with the inflation target (Ho and McCauley, 2003). This case is also made by Schmidt-Hebbel and Werner (2002). Using a model for Brazil, Chile and Mexico they conclude that there is no evidence supporting the view that central banks responded to fluctuations in exchange rates beyond their implications for inflation[13]. Hence, the main reason why central banks in developing countries strive to stabilize exchange rate is to contain its adverse effects on inflation. Nevertheless, this is not to say that concerns over financial stability and competitiveness do not exist in these economies. Such concerns may be prevalent and responses can be made as long as reactions of the central bank assure that inflation remains in the target range (Ho and McCauley, 2003). Once the inflation needs immediate treatment, however, concerns over inflation subordinate other concerns as IT necessitates.

In a similar vein, Aizenman, Hutchinson and Noy (2008) conduct research using data from 17 developing countries both IT and non-IT. Their results suggest that external factors play a role in shaping IT central bank's monetary policy. Thus, IT central banks take into account the changes in exchange rate although this does not imply that they have a certain target level for the real exchange rate. Aizenman, Hutchinson and Noy (2008) attribute systematic policy responses of central bank to exchange rates to the possibility that changes in real exchange rate may be an indicator of future inflation.

In line with what Barbosa-Filho (2006) claimed for the case of Brazil as outlined in 3.3.1, Heintz and Ndikumana (2010) assert that monetary policymakers in South Africa had to resort to exchange rates in order not to miss the inflation target. They claim that given considerable ERPT, monetary authorities will have to target exchange rates in order to achieve the target. One of the most important findings of

[13] Though, Schmidt-Hebbel and Werner (2002) find that the impact of exchange rate depreciations on real interest rates is not significant contradicting with what is offered by Calvo and Reinhart (2000), Mohanty and Klau (2004), Filosa (2001), Galindo and Ros (2008) and Barbosa-Filho (2006).

their work is that between 2003 and beginning of 2007 during which IT proved successful in terms of achieving targets, real exchange rate exhibited an appreciation trend. Yet, concluding whether this trend owes to implementation of IT or not still needs further research. However, intuition appears to be straightforward. Similar to Heintz and Ndikumana (2010), Cömert and Epstein (2011) indicate that when commodity prices increased and exchange rate depreciated inflation targets were missed and inflation remained high in South Africa.

So far, all the studies under investigation reveal that monetary authorities in developing countries take into account the movements in the exchange rate when conducting monetary policy. Nevertheless, they do not mention about the asymmetric nature of the policy stance of ITDC. Yet, as argued in the introduction, ITDC may have to resort to appreciation of their currency due to the positive bias between actual inflation and inflation targets. Later in the following sections I will analyze the asymmetric policy stance with respect to the exchange rate in the Turkish context. However, before getting into a more detailed discussion over inflation dynamics and interest rate decisions in Turkey, now in the next chapter I will briefly present the developments during the IT experience of Turkey between 2002 and 2008.

CHAPTER 4

IMPLEMENTATION OF INFLATION TARGETING IN TURKEY

In this chapter, I will briefly present the period during which Turkey implemented IT, both implicitly and then explicitly. Turkey switched into IT beginning with 2002. However the CBRT did not announce an official adherence to IT until 2006 when full-fledged instead of implicit IT is implemented. Yet, the principles of formal IT marked the period between 2002 and 2006. Hence, the main principles underlining the monetary policy remained the same between 2002 and 2008.

In this chapter, first, I will briefly summarize the post-crisis environment in which the CBRT adopted IT informally. Then I will mention the components of transition to a full-fledged IT and concomitant developments with emphasis on the changes in exchange rate, inflation and interest rates in Turkey.

4.1 Post-Crisis Environment, Implicit Inflation Targeting and Transition Into Full-fledged IT

Having noticed the impossibility of defending the exchange rate regime during the crisis of 2001, the CBRT allowed the Turkish lira to float in February 2001. Accordingly, at the beginning of 2002, the CBRT declared that it will target inflation and monetary aggregates. Monetary aggregates were to be used as anchors to complement inflation targets. The CBRT also conducted liquidity management strategy besides the price stability goal (Civcir and Akcaglayan, 2010).

The framework incorporated the essence of formal IT in that, the CBRT was already given formal independence by Central Bank Law in 2001 which explicitly states that price stability was the main aim for the CBRT. Moreover, the CBRT announced

its forecasts for inflation to affect expectations with regards to inflation and changed interest rates in line with its expectations on inflation. It also explained the reasons of policy changes to the public (Ersel and Özatay, 2008). However, although the core of IT framework existed, the framework can be defined as implicit as long as the regime is not formalized[14]. The CBRT retained a considerable level of discretion in conducting monetary policy. Although a monetary policy committee was established, it did not take the final decisions concerning the monetary policy, nor was the meeting dates of committee announced (Ersel and Özatay, 2008). Furthermore, communication policy of the CBRT was to be enhanced given the irregularity of its explanations about the inflation outlook.

On the macroeconomic front, Turkish economy after 2001 crisis posed significant challenges to monetary policy due to deficiencies in fiscal front, high ERPT, inflation inertia and financial fragilities[15]. In such an environment, CBRT claimed that possible deviations from the target, if stated in a formalized and rigid manner, might have reduced central bank credibility jeopardizing the long-run aim of price stability. Hence, these obstacles were presented as the main reason behind the CBRT'S selection of implicit IT rather than a formal one.

During implicit IT, Turkish economy has undergone a transformation by which improvements were made in all of the four problems. Nevertheless, the improvements in all of the four fronts were far away from being adequate to ensure a proper functioning of the monetary transmission mechanism. Although fiscal stance is perceived as the most benign aspect of Turkish economy after 2002, problems in financial system was still present and ERPT was still very high even compared to other developing countries. Besides the ERPT, problems with the

[14] "Implicit inflation targeting can be defined as a period under which inflation targets are announced to the public, but not the regime and its details as such. It involves country acting as if inflation targeting were in place without a formal adoption of the regime" (Kara, 2006: 3).

[15] The same classification is made by Ersel and Özatay (2008).

operation of monetary transmission restrained CBRT in its effort to rein in inflation with its control over short-term interest rates. Hence, when CBRT announced that it will pursue a full-fledged IT beginning with 2006, it was still too far away from having a direct control over inflation through manipulating the interest rates.

At the end of 2005, the CBRT announced that monetary policy will be conducted through a formal IT regime beginning with 2006. It set a three-year path for inflation targets for 2006, 2007 and 2008, 5 percent, 4 percent and 4 percent respectively (CBRT, 2005). It constructed an "uncertainty band" allowing the inflation rate deviate from target by 2 percent in both directions. In case of what can be seen as a failure when actual inflation goes beyond this interval, the CBRT would explain the reasons of deviation and the envisaged policy response to it. In the new period, the CBRT declared that it will have a medium term perspective in conformity with the flexibility principle of IT framework through which it will not respond deviations from the target due to temporary exogenous shocks but instead explains the reasons of this deviation and stick into the medium term target. The CBRT announced that the economy will now move towards price stability having already attained a considerable level of disinflation.

With respect to the exchange rate, the CBRT declared that although the level of exchange rate will be determined by market forces which implies that CBRT has no target regarding the level of exchange rate, it reserved the right to take actions in case of excessive volatility. Moreover, the CBRT announced that it will try to establish a strong foreign exchange reserve position in order to foster confidence in the economy and due to foreign debt payments of Treasury (CBRT, 2005). Costly deposits of workers abroad and debt repayments to IMF were also other factors behind the need for building up of reserves (Kara and Öğünç, 2008). Building up of reserves would be eased by the reverse-dollarization process through which foreign exchange supply may exceed foreign exchange demand. Furthermore, the CBRT announced that, in line with its commitment to the role of market forces in

determining the exchange rate, it will make purchases of foreign exchange through auctions, the terms of which are announced in advance in order not to affect market conditions substantially (CBRT, 2005).

The alleged neutrality of the CBRT in the level of exchange rate, however, seems to be far away from what is observed in the period under discussion. This will be my main consideration in Chapter 6 where I will present evidence indicating that the CBRT set interest rates asymmetrically with respect to the exchange rate and also that it conducted foreign exchange interventions in the same asymmetric manner. However, before moving into a deeper discussion in this subject, it is worth to present a brief macroeconomic outlook of the Turkish economy between 2002 and 2008 in order to illustrate the relationship between inflation, exchange rate and interest rates.

4.2 The Relationship Between Inflation, Exchange Rate and Interest Rates in Turkey in the IT Framework

It is widely argued that, with the transformation into a flexible exchange rate regime and the success in reducing inflation from very high levels through implementation of IT, ERPT has declined substantially as a result of the decline in indexation behavior and reverse-dollarization in Turkey[16]. However, as the next section suggests, the decline in the ERPT was far away from being sufficient to subordinate the exchange rate in determining inflation. Exchange rate still remains as one of the most important factors in explaining inflation in Turkey in this period[17]. In fact, whether the inflation targets are achieved or missed is closely related with what trend exchange rate and commodity prices exhibit as Table 4.1 indicates.

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[16] See among others Kara and Öğünç (2008), Kara et. al (2005). For an argument about the decline of dollarization within the Turkish economy, see Akıncı et al (2005a).

[17] Actually, this point was made by the CBRT itself in many of its reports. For instance, see CBRT (2003, 2004)

Table 4.1. Success and failure in hitting inflation targets and the average nominal exchange rate.

Year	Realized Inflation (annual)	Target Inflation	Average Nominal Exchange Rate[18] ($/TL)	World Commodity Price Inflation (annual)
2003	18.4	20✓	1.486 (appreciation: 1.7%)	10
2004	9.3	12✓	1.420 (appreciation: 4.4%)	18.2
2005	7.7	8✓	1.339 (appreciation: 5.7%)	29.7
2006	9.7	5 X	1.429 (depreciation: 6.7%)	14.3
2007	8.4	4 X	1.306 (appreciation: 8.6%)	29.5
2008	10.1	4 X	1.297 (appreciation: 0.6%)	-37.2

Source: Central Bank of the Republic of Turkey, IMF.

Three success cases (given by ✓) in hitting the inflation target is associated with appreciation of the lira. The miss of the target in 2006 is associated with depreciation. The claim that the exchange rate movements due to international liquidity shocks are important for the rise of inflation in 2006 is also made by the CBRT in its annual report for 2006 (CBRT, 2007). On the other hand, although appreciation of the lira in average was observable during 2007 and 2008, inflation targets were missed. The reason is closely related with the acute upward trend of international commodity prices in these years as can be seen from Figure 4.1. During the second half of 2007 and the first half of 2008 international commodity prices increased excessively, putting a pressure on domestic inflation in Turkey through imports.

[18] Average nominal exchange rate at a given year is calculated as the mean of end-month indicative exchange rate released by the CBRT.

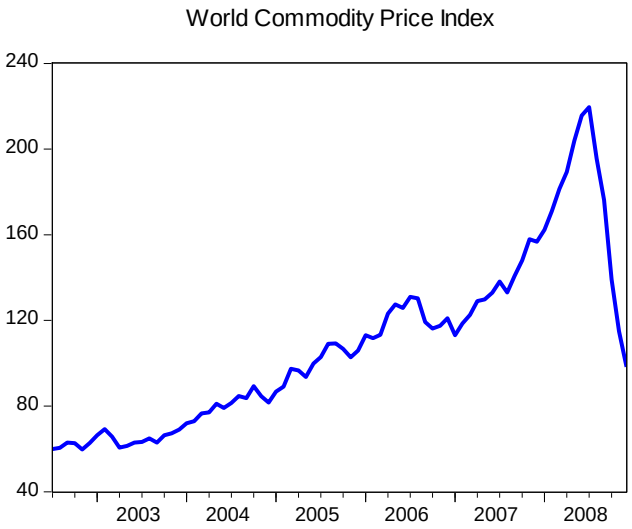

Figure 4.1. World Commodity Price Index, Source: IMF

In 2002, the CBRT decreased overnight interest rates six times due to expectations about a downward movement in inflation. Moreover, it conducted foreign exchange purchase auctions beginning with April as a result of reverse dollarization process which creates an excess supply of foreign exchange. A caveat made by the CBRT deserves special attention at this point. The CBRT states that exchange rate is still one of the most important determinants of inflation in Turkey (CBRT, 2003).

In 2003, the CBRT decreased overnight interest rates six times due to decreases in inflation. The achievements in disinflation is presented by the CBRT as a consequence of stability, appreciation of the lira, productivity increases, decreases in real wages, accordance of wages and prices in public sector with the targeted inflation, the absence of domestic demand pressures and increasing competitiveness within the economy (CBRT, 2004). Yet, the CBRT (2004) still states that is still one of the most important determinants of inflation in Turkey. The CBRT maintained

foreign exchange purchases as a result of excess foreign exchange supply due to shifts from deposits denominated in foreign currency into lira denominated assets.

The relationship between the movements in the exchange rate and inflation in Turkey becomes clearer after the disinflation was achieved considerably. Large reductions in inflation until the second quarter of 2004 make it difficult to draw inferences about this relationship. Relatively small changes in nominal exchange rates are accompanied by large changes in the level of inflation which are seemingly due to changes in inertial component. Yet, after 2004, the relationship becomes much clearer.

In 2006, the tight relationship between exchange rate and inflation in Turkey became most apparent. The uncertainties in global financial markets made a profound impact on the Turkish economy. The difficulties in the access to global liquidity were mostly felt in May and June. The hikes in interest rates in developed countries and increased risk perception of international investors about developing countries resulted in capital outflows in this period. As a result, lira has lost 20% of its value against American dollar. Sharp depreciation of the lira, in turn, triggered inflationary pressures making the actual end year inflation 9.7 percent, too high compared to the inflation target for 2006, i.e. 5 percent. The CBRT responded to capital outflows by increasing the policy interest rates 175 and 225 basis points on June 7 and 25, respectively. These decisions were made in extraordinary meetings revealing the acuteness of the situation. Moreover, the CBRT decided to conduct foreign exchange sale to fight against depreciation of the lira. Three interventions were made in June 15, 23 and 26 in which 2.2 billion $ in total were sold by the Bank. Besides, foreign exchange purchase auctions were suspended temporarily beginning with May 16.

Between 2002 and 2008, the CBRT usually emphasized the role played by price rigidities in services sector and increases in oil and food prices as the causes of hikes in the inflation in its annual reports. For instance, the CBRT explained that the

hikes in administered prices and unprocessed food prices which are beyond the control of monetary policy are the main reasons why actual inflation (8.4 percent) exceeded target inflation (4 percent) in 2007 (CBRT, 2008). It is also reported that, upward trend of lira eased such inflationary pressures. In a similar vein, the CBRT explained the reason of miss of the inflation target in 2008 (realized inflation: 10.1 percent, target inflation: 4 percent) as the substantial increases in food and energy prices and their implications for prices in the service sector (CBRT, 2009).

That the CBRT has a tendency to present the reasons behind misses of targets as increases in the food and energy prices and nominal rigidities in services sector uncovers the contradictory nature of IT in developing countries which are highly exposed to external shocks such as changes in commodity prices and which have generally sticky prices for non-tradable goods. While commodity prices are beyond the control of monetary policy price stickiness in non-tradable sector is also evidently beyond what monetary policy can affect due to credibility problems. Hence, as can be readily seen from the Turkish experience, IT seems to be not effective in achieving inflation targets as realized inflation is largely determined by external shocks. With or without IT, inflation is likely to exceed single digit values due to external factors. At this juncture a new question arises: what lies behind the movements in inflation in Turkey? To shed more light on this issue, I now use econometric analysis in the following chapter to investigate the sources of inflation in Turkey between 2002 and 2008.

CHAPTER 5

ECONOMETRIC EVIDENCE FOR THE SOURCES OF INFLATION IN TURKEY

In this chapter, sources of inflation in Turkey are analyzed. In the first section, I give a brief overview of the literature over the level of ERPT in Turkey. The level of ERPT is particularly important because there is a vast literature suggesting that ERPT has declined considerably in Turkey. A byproduct of such perception is that exchange rate is no longer an important determinant of inflation in Turkey. However, evidence in this chapter asserts that the situation is quite different. In the second section, some selected studies on the determinants of inflation in developing countries and in Turkey in particular is presented. Then in the third section I construct a model incorporating the most notable determinants of inflation in Turkey and find the relative contributions of each variable in explaining changes in inflation.

5.1 Selected Literature Review on ERPT in Turkey

The literature on the level of ERPT in Turkey has grown after adopting a floating exchange rate regime. It is argued that with the decline in the indexation behavior, ERPT to domestic prices has declined substantially. For instance, Kara et. al (2005) find that ERPT to inflation declined from %68 for tradable goods and %45 for non-tradable goods to %15 and %8 after having adopted floating exchange rate. The sharper decline of ERPT in non-tradable sector compared to that in the tradable sector is offered by the authors as the evidence of the decline in the indexation behavior.

Similar suggestions were made by Kara and Öğünç (2008). Having showed that ERPT has declined in the post-float period, they present two aspects as the main reason in the process. First, they argue that under managed or crawling peg exchange rate regimes changes in the exchange rate are much likely to be perceived as permanent. A depreciation may induce expectations for further depreciations and consequently for higher inflation. Adopting a floating exchange rate regime on the other hand makes such predictions difficult thereby weakening the indexation behavior of economic agents through expectations. Second, when the inflation is high and unstable, there is a tendency for the formation of prices and contracts in terms of foreign currency. Low inflationary environment, on the other hand, is argued to enable domestic currency to regain its role as a store of value and as a unit of account hence reducing the ERPT.

In addition to the two aforementioned factors, in a pioneering work Leigh and Rossi (1999) count the oligopolistic nature of the industrial structure as a factor increasing the level of ERPT by which it is easier for firms to pass the shocks in the exchange rate into retailers. This line of reasoning seems to be consonant with what is argued by Taylor (2000) outlined in the third chapter. The evidence presented in Arbatlı (2003), on the other hand, suggests that ERPT is smaller during economic contractions, depreciations and lower inflationary periods.

Albeit the vast literature on how ERPT declined over time as a result of floating exchange rate regime and disinflation, some research found that exchange rate remains still the most important indicator of inflation. Civcir and Akçağlayan (2010), for instance, find that ERPT has declined during the implementation of IT, however evidence suggests that "main channel in feeding the inflation in Turkey is still the depreciation of the domestic currency" (Civcir and Akcaglayan, 2010: 351). Moreover, their findings indicate that exchange rate was the main variable to which the CBRT reacted. Short term interest rates are used strongly to react to changes in

the exchange rate implying the existence of MCI or a managed float (Civcir and Akcaglayan, 2010).

The high level of ERPT seems to be associated with the substantial dependence of the production on imported goods. Başçı et. al (2007) report that capital and intermediate goods constitute the 90 per cent of total imports in Turkey. Moreover, they note that indexation is most apparent in sectors in which raw materials are processed intensively. This example typically shows the dependence of domestic inflation on external shocks such as the exchange rate and commodity prices. They conclude that the dominance of exchange rate in the economy leaves a smaller scope for the monetary policy to operate through the decisions over short term interest rates.

What is argued by Başçı et. al (2007) clearly demonstrates the important role of supply side factors in determining inflation in developing countries. Accordingly, the next section reviews explanations on the inflation dynamics in developing countries and Turkey in particular.

5.2 Sources of Inflation in Developing Countries

The literature on sources of inflation is generally divided into two views one of which attaches much more importance to demand side factors such as output gap and monetization of the fiscal deficits whereas the other emphasizes supply side factors such as exchange rates and international commodity prices as the crux of inflation dynamics in developing countries. While the first view propounds that even if supply shocks may induce inflationary pressures in the short run, demand side factors are the ultimate reasons of inflation in the long run, the second view asserts that given the high level of dependency in external resources in the

production process in developing countries, supply side factors overweight demand side factors[19].

There are also integrative approaches as to the relative importance of supply side and demand side factors in determining inflation. For instance, Mohanty and Klau (2000) analyze inflation dynamics in 14 developing countries in 1980s and 1990s. They adopt an eclectic approach whereby both the demand side and supply side factors are found to be important in determining inflation. The empirical evidence shows that although conventional sources of inflation such as excess money supply, wages and output gap plays an important role, movements in food prices is the dominant determinant of inflation in most of the countries under investigation. It is also reported that, irrespective of the exchange rate regime, exchange rates emerge as a significant contributor to inflation in most of the countries (10 out of 14). Overall, they state that "shocks to food prices emerge as the most common inflation determinant in almost all emerging market economies, followed by the exchange rate" (Mohanty and Klau, 2000: 2).

In another pioneering study, focusing on the experience of 53 developing countries, Loungani and Swagel (2001) present evidence suggesting that money growth and exchange rate movements, the relative impact of which depend on the exchange rate regime, explain two-thirds of changes in inflation in these countries. They count four determinants of inflation, namely fiscal deficits (through either triggering higher money growth or trigger balance of payments crisis thereby depreciation of the domestic currency), output gap, cost shocks and inflation inertia. They categorize the relative importance of these four factors in explaining inflation according to different regions. In Latin America, for instance, exchange rates and monetization of fiscal deficits stand out as the predominant factors in explaining inflation. On the other hand, in African and Asian countries, inflation inertia is the

[19] An elaborated presentation of literature review on the sources of inflation can be found in Mohanty and Klau (2000).

most important factor subordinating all other three factors. In contrast with Mohanty and Klau (2000) they attribute significant differences in the relative importance of these factors in determining inflation across regions to differences in exchange rate regimes.

In another study, Domaç and Yücel (2004) analyze factors behind start of 24 inflation episodes between 1980 and 2001 in 15 emerging market economies. They use a pooled probit analysis to discover the relative importance of different factors explaining inflation. They find that output gap, agricultural shocks and expansionary fiscal policy raise the probability of inflation starts in these countries. Besides, democratic environment and increase in the capital inflows are found to reduce this probability.

In the Turkish context, using a VAR analysis, Us (2004) reports that there are two major sources of inflation in Turkey: public sector prices and exchange rate depreciation. She concludes that inertial component of inflation is largely due to increases in prices in public sector. Moreover, Us (2004) presents evidence suggesting that the ERPT in Turkey has an asymmetric nature in that the impact of depreciation on inflation is greater than that of appreciation of the same amount. In another study, Kibritçioğlu (2002) analyzes the importance of different factors in explaining inflation with reference to the literature on the causes of inflation. He concludes that the demand side or monetary factors, supply side factors, inertial factors and institutional factors together determine the level of inflation in Turkey.

Hence, both demand and supply factors may play role in explaining inflation in developing countries. Given this background, now I will construct a model including both factors to explain determinants of inflation in Turkey.

5.3 A VAR Model for the Sources of Inflation in Turkey

In this subsection, I first investigate the sources of inflation in Turkey, taking into account both the demand side and supply side factors in my model in line with what

is argued by Mohanty and Klau (2000). I use VAR econometrics in this work since it has two conducive tools to interpret changes in inflation and interest rate, namely IRF and VDC. IRF enables us to trace the response of one endogenous variable to a one unit shock in another endogenous variable in the model. On the other hand, VDC analysis is used to answer how much of the variance in one variable is explained by others. In this section, I will analyze the IRF and VDC of inflation through a VAR framework to assess the relative importance of determinants of inflation. In the VAR model, monthly inflation measured as the percentage change in domestic Consumer Price Index (π_t), monthly inflation measured as the percentage change in World Commodity Price Index (π_t^w)[20], output gap (y_t^g), budget balance to output ratio (b_t), nominal exchange rate (e_t), and interest rate (i_t) are treated as endogenous variables. Hence, the general inflation model is of the form:

$$\pi_t = \propto_0 + E_{t-1}[\pi_t] + \propto_1 \pi_t^w + \propto_2 e_t + \propto_3 y_t^g + \propto_4 i_t + \propto_5 b_t \quad (5.1)$$

where E_{t-1} stands for the expected inflation at time t depending on the information available at time $t-1$. In this study, with the assumption of adaptive expectations, expectations are simply treated as the linear projections of the lag of the variable, i.e. $E_{t-1}[\pi_t] = \pi_{t-1}$. Using this general inflation model, then, I will analyze determinants of inflation in a VAR framework.

At this juncture it is important to note that the model implicitly incorporates the impact of changes in nominal wages on inflation. This is because the appearance of the lagged inflation term in the model (i. e. $E_{t-1}[\pi_t]$) is closely related with the

[20] World Commodity Price Index is a price index released by the IMF incorporating all commodities (both fuel and non-fuel).

nominal wage inflation at time t. In fact, it can be assumed that wage inflation in Turkey is characterized by the following equation (Ekinci, 2013: 43)[21]:

$$\Delta lnw_t = \beta\pi_{t-1}, 0 < \beta < 1 \qquad (5.2)^{22}$$

The model is similar to that developed by Loungani and Swagel (2001) who analyze sources of inflation in developing countries through a VDC in their model. In this paper, Loungani and Swagel include oil price growth, non-oil price growth, output gap, exchange rate growth, domestic inflation and money growth as endogenous variables of the VAR model. Instead of separate indices for oil and non-oil commodity price inflation I choose to use a composite index of commodity prices[23]. Furthermore, in order to capture the effect of monetary policy on inflation I include interest rate in the model instead of money growth since the main policy tool of the CBRT is the short term interest rate. Similarly, Sohrabji (2011) constructs a VAR model including world oil prices, world food prices, output gap, exchange rate, domestic prices and short term interest rate to comprehend the impact of these variables on inflation and evaluate the exchange rate pass through in India. The

[21] "More to the point a recent study based on a survey covering wage negotiations in selected unionized companies quoted in Istanbul Stock Exchange argues that ".... employers' unions and labour unions agreed for the most part on using "actual" inflation in Turkey. This is largely because the rate of increase in the past is known, while the future rates are a matter of personal judgment and prediction which may be affected subsequently by a wide range of factors. Generally actual inflation is reflected to the wage in order to recover possible loss in the workers' real income." (Sarıca 2008, p. 220). There is therefore reason to suppose that the assumption reflected in (5.2) is a reasonable approximation to the wage determination process in Turkey" (Ekinci, 2013: 43).

[22] In order to test the relevance of this assumption, I present the relation between annual inflation in consumer prices and nominal wage inflation in Turkey during the period 2002-2008 in Table A.1. Since the nominal wage data released by Turkish Statistical Institute is available only in quarterly form, I am not able to analyze correlation between the consumer price inflation and nominal wage inflation. This is also the main reason why I cannot have nominal wage inflation explicitly within the model.

[23] I have also estimated another model having fuel and food price inflation as its explanatory variables. The results are similar with separate indices. Yet, I choose the model with general commodity price inflation in order not to consume unnecessary degrees of freedom.

order of VAR differs from that in my analysis; however, different specifications for the order do not change our results.

On the other hand, other studies include different variables in their VAR models in order to explain the determinants of inflation in Turkey. For instance, in their influential paper, Leigh and Rossi (1999) incorporates oil prices, real output, nominal exchange rate, wholesale prices and consumer prices as the endogenous variables in their VAR framework to examine the impact of exchange rate shocks on both WPI (wholesale price index) and CPI inflation through VDC. Following Leigh and Rossi (1999), Arbatlı (2003) uses a VAR framework to analyze ERPT in Turkey. In addition to the variables in Leigh and Rossi (1999), Arbatlı (2003) includes interest rate in the model so as to capture the impact of monetary policy on the economy. However, since my focus is on variations of the CPI inflation, I do not incorporate WPI inflation in the model. In addition to those variables presented above, I also include budget balance output ratio within the model in order to capture the impact of fiscal policy on the domestic inflation. The intuition behind this is the possible positive effects of acute reductions in the budget deficit in Turkey (until 2006) on reducing inflation.

5.3.1 Data

The data for domestic inflation (monthly change) is obtained from the CBRT. World Commodity Price Index (WCPI) is obtained from the IMF and I calculate monthly WCPI inflation from this index. In order to eliminate seasonal fluctuations, I used X-12 method for both variables. The output gap is calculated as a proxy to the difference between the seasonally adjusted (through X-12 method) monthly industrial production index (1997=100) released by the Turkish Statistical Institute and the trend industrial production calculated through Hodrick-Prescott filter. Applying the Hodrick-Prescott filter, I used the commonly used smoothing parameter (14400 for monthly data).

Nominal exchange rates are the CBRT's end month indicative exchange rates ($/TL) at 15.30. In this study I take the exchange rate as the $/TL since the bulk of reserves of the CBRT is denominated in dollars and the CBRT conducts foreign exchange interventions through its dollar reserves. Moreover most of the commodity prices such as oil prices which are crucial in determining inflation are calculated in terms of dollars which further increases the importance of $/TL exchange rate.

Monthly budget balance (primary balance) data is obtained from the Undersecreteriat of Treasury. Quarterly GDP data released by the Turkish Statistical Institute is used to find an approximation of the monthly data. For this approximation, I assumed a linear relationship between any two quarters. Then I found the budget balance to output ratio and seasonally adjusted it with the X-12 method. Finally, the mean of overnight borrowing and lending interest rate declared by the CBRT is used as the policy instrument influencing the inflation rate in the economy. All of the data are given in the Appendix A, Table A.2.

5.3.2 Estimation Results

The general inflation model consists of π_t, π_t^w, y_t^g, e_t, b_t and i_t. Stationarity properties of all the variables are tested. The results of Augmented Dickey Fuller (ADF) unit root tests are given in Table A.3 in the Appendix. The lags for ADF are chosen automatically according to Schwarz Criterion. Interest rate is reported to be stationary under the hypothesis that it is random walk with intercept only. On the other hand, CPI inflation, WCPI inflation, budget balance to output ratio and output gap are stationary no matter what the specification of the random walk is. Under the hypothesis that it follows random walk with intercept, exchange rate is found to be non-stationary. Hence, according to unit root tests all endogenous variables but

exchange rates are stationary. Thus, I will use a reduced form VAR for the estimation taking the first difference of the exchange rate[24].

Since VDC will be used to unveil the separate contributions of the variables to the variations in inflation, the ordering of VAR is important. Using pairwise Granger Causality tests yield mostly ambiguous results[25]. Yet, following the literature and economic theory I make a few assumptions as to the degree of exogeneity of the variables. First, I assume that π_t^w is the most exogenous variable in the model which seems quite reasonable since the domestic factors in Turkey are unlikely to affect world commodity prices in a significant way. Second, following the literature I assume that output gap and exchange rate are more exogenous than monthly inflation. Under these assumptions the estimation results indicate that specification of the ordering of variables does not significantly alter the results. Hence the results given below are robust to different specifications of the ordering. Besides I restricted the model to use a maximum of 6 lags of each variable in order not to consume degrees of freedom given the small size of the sample[26]. In Table A.4 in the Appendix, I give the estimation results of the VAR. The IRF of inflation is given in the Appendix Figure A.1. Below I depict the VDC of domestic inflation for the following order: $\pi_t^w, e_t, b_t, i_t, y_t^g, \pi_t$. The lag length 2 is chosen automatically according to the Akaike Information Criteria[27]. Moreover, diagnostic tests reveal

[24] I also checked for the situation where interest rate follows random walk with trend and intercept and exchange rate is stationary since the p-value is relatively low (0.09). These specifications do not alter the main findings in a considerable way.

[25] In most lags, variables are reported not to Granger cause each other.

[26] For 7 lags, we are left with only 26 degrees of freedom which are not adequate for a meaningful econometric analysis.

[27] The estimation results do not change in a considerable manner when we include more than two lags in the model. As we include more lags, the contribution of WCPI inflation increases whereas that of CPI inflation decreases.

that estimation results are free from heteroscedasticity and autocorrelation problems as can be seen from Table A.5 and A.6 in the Appendix.

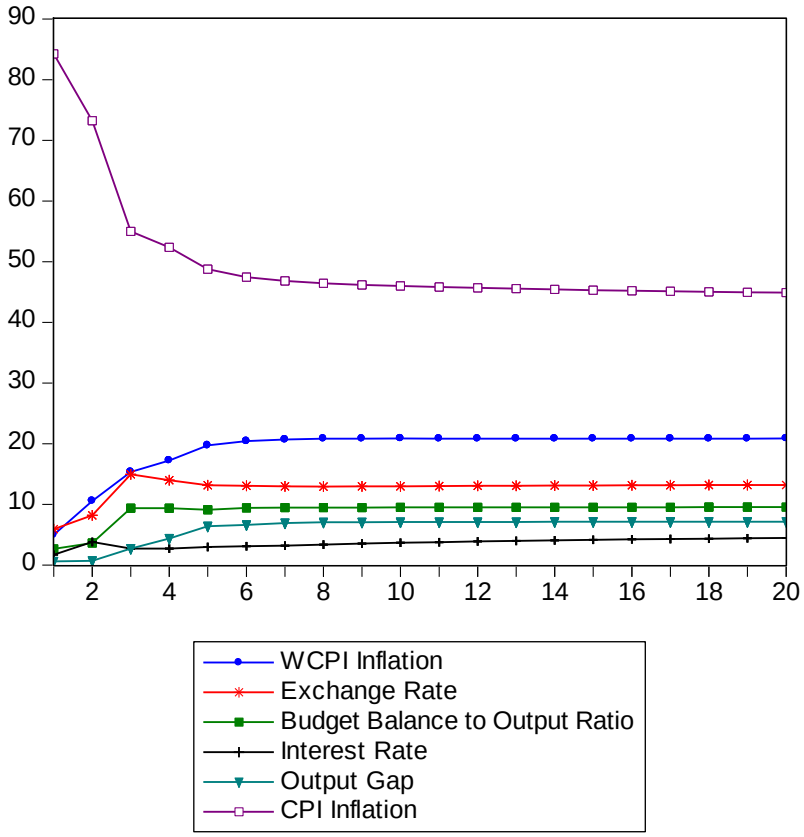

Figure 5.1. Variance Decomposition of CPI Inflation

Using VDC for inflation, I find the relative contribution of different variables to changes in inflation. According to the evidence, WCPI inflation explains up to 20% of the variations in domestic inflation, while innovations in exchange rate explain up to 13% of fluctuations in inflation. The contribution of budget balance to output ratio is found as approximately 9.5%. On the other hand, output gap explains approximately 7% of the variations in inflation. The contribution of interest rate is

quite low: approximately 4%. The rest of the variations is explained by the variations of CPI inflation itself[28].

Hence, VDC of CPI inflation yields that innovations in the exchange rate and commodity prices are the most important factors in explaining variations in CPI inflation (approximately 33 percent in total) whereas the contribution of the changes in output gap and interest rates play only a subordinate role (nearly 10 percent in total). On the other hand, fiscal side seems to have explanatory power in explaining changes in inflation. Hence the conventional wisdom attaching a major role to demand side factors in determining inflation seems to be irrelevant in the Turkish case where supply side factors such as exchange rate and world commodity prices explain much of the variance in CPI inflation. This analysis is in line with what the CBRT claims in its annual reports with regards to the reasons of overshooting the inflation target as mentioned in the previous section. Given that, however, the idea behind the implementation of IT is undermined considerably. If it is the supply side factors that determine changes in inflation which are typically behind the scope of monetary policy, the reasons behind the implementation of IT which tries to control inflation through measures related with demand side factors remain unclear.

As argued before, the role of exchange rates as an important source of changes in CPI inflation (seemingly more important than the output gap and interest rates) has two crucial implications. First, it implies that inflation is considerably determined by the variations in the exchange rate which undermines the main principles of IT. Second and arguably more important for the aim of this study, it endows the monetary authority with a conducive tool to curb inflation pressures. A sustained appreciation of the domestic currency may decrease the import prices thereby helps

[28] Most of the variation of CPI inflation is explained by itself as expected. This also reflects the fact that the changes in nominal wages is of great importance in determining inflation. However as we include more lags in the model, the contribution of CPI inflation in explaining variations in itself decreases.

the CBRT to achieve its inflation target. Hence, along the lines with what is argued above with regards to developing countries, monetary authorities in Turkey have benefited from the appreciation of the Turkish lira to contain inflation. What is more, a considerable part of the success for achieving the targets is very likely to be associated with favorable movements in exchange rates. Yet, whether such trend is policy-induced or not still needs further research. Did the CBRT favor appreciation trend of the lira or has it just treated depreciation and appreciation pressures equally? To shed more light on this issue I now analyze interest rate setting behavior of the CBRT through constructing a classical monetary policy reaction function.

CHAPTER 6

ASYMMETRIC MONETARY POLICY STANCE WITH RESPECT TO THE EXCHANGE RATE

6.1 Asymmetric Behavior in Interest Rate Setting

Many researches verify that exchange rate is an important concern in monetary policy both for its effects on inflation and on financial stability[29]. The studies reviewed in Section 3.4 are typical examples. However, asymmetric nature of the exchange rate policy in ITDC is not analyzed considerably in the literature. In what follows I test the hypothesis that appreciation is tolerated whereas depreciation was responded aggressively on the basis of the Turkish experience.

6.1.1 A VAR model for the asymmetric policy stance of the CBRT

In this section, I test the hypothesis that the monetary policy stance in Turkey is asymmetric with respect to the exchange rate, tolerating appreciation and fighting against depreciation. For this aim, I hypothesize that the monetary policy reaction function is of the form:

[29] Besides its impact on inflation and financial system, the importance of exchange rates is also evident when one considers the much shorter lag between exchange rate and inflation than that between interest rates and inflation through the aggregate demand relation. This is called as the direct channel by Svensson (1999). Hence, using the direct exchange rate channel, an IT central bank may respond to inflationary shocks very quickly. In this vein, Ball (2000: 5) states that "In open economies, a danger with pure inflation targeting is that policymakers will move exchange rates too aggressively to control inflation. The effect of exchange rates on import prices is the fastest channel from monetary policy to inflation. It works more quickly than the channel through speedups or slowdowns in output. As a result, if policymakers are given a mandate to keep inflation as close as possible to its target, they may respond by moving exchange rates aggressively to offset inflation movements…"

$$i_t = \propto_0 + \propto_1 i_{t-1} + \propto_1 (\pi_t - \pi_t^*) + \propto_2 (y_t - y^*) + \propto_3 \Delta e_t \quad (6.1)$$

where Δe_t (i.e. $e_t - e_{t-1}$) denotes the change in the nominal exchange rate, $(y_t - y^*)$ refers to the output gap (i.e. y_t^g) and $(\pi_t - \pi_t^*)$ refers to the inflation gap (i.e. the difference between expected annual inflation at month t and the appropriate value of the target inflation at month t[30]). This model represents an extended Taylor rule through which the impact of exchange rates on monetary policy decisions is captured. Monetary authority increases interest rate in case of an increase in exchange rate (depreciation), output gap and inflation gap and decrease the policy rate if these variables decrease. On the other hand, it avoids excessive movements of the interest rate (interest rate smoothing), hence the presence of lagged interest rate in the model.

My perception about the monetary policy reaction function resembles to that of Aizenman, Hutchinson and Noy (2008). The difference lies in the fact that instead of an exchange rate difference variable, they include an index to incorporate the impact of all external factors in their setting of monetary policy reaction function. Using this model they conclude that both IT and non-IT central banks in developing countries respond to real exchange rate in their monetary policy decisions via their control over short term interest rates. On the other hand, in order to reveal that central banks in developing countries respond strongly to changes in exchange rate, Filosa (2001) and Mohanty and Klau (2004) use a very similar model. The difference is that they include the change in the real (not nominal[31]) exchange rate and the one lagged term of it (for the latter).

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[30] Construction of the targeted inflation at a given time is given in the Appendix B.

[31] I also run a regression with the real exchange rate yielding very similar results. However, I assume in this study that monetary authority in Turkey takes into account changes in the nominal exchange rate while conducting its operations. Hence the benchmark model incorporates nominal exchange rate variations.

For the Turkish case, a similar model is constructed by Civcir and Akcaglayan (2010). Using IRF and VDC they demonstrate that the CBRT responds to changes in the exchange rate through interest rates. However, their model suffers from the specification of the endogenous variables. Following Hammermann (2005), they use a real exchange rate gap variable -the difference between the exchange rate and the trend exchange rate at time t- instead of a difference exchange rate variable. Moreover, they take the inflation gap as the difference between actual inflation and trend inflation neglecting the inflation targets. In order to find the causes of interest rate changes, on the other hand, Cömert et. al (2010) construct a very similar model to my model. The difference lies in that they include a US interest rate variable in order to incorporate external developments in the model. Yet, given the empirical result that the international interest rates might or might not have played a role in the policy interest rate decisions of the CBRT, this difference does not seem to be substantial.

All of these studies analyze the role of exchange rates in the monetary policy reaction function of central banks in developing countries. However, the model given by equation (6.1) does not give information as to the different response of interest rate to depreciation and appreciation. In this sense, Galindo and Ros (2008) develop a model to capture the asymmetric response of Banco de Mexico to changes in the exchange rate in their model[32]. In their model, the finding that the coefficient of the depreciation variable is statistically significant whereas that of the appreciation variable is not signifies the asymmetric nature of interest rate setting behavior of the central bank. However, the method of Galindo and Ros (2008) is likely to suffer from at least two major deficiencies. First, it is mainly based on the assumption that notorious PPP theorem holds in the long run. However there are a

[32] They estimate an interest rate regression by using the regression equation:

$R_t = \beta_0 + \beta_1 U_t^+ + \beta_2 U_t^- + \beta_3 R_{t-1} + e_t$ (6.2)

where $U_t^+$and U_t^- stands for depreciation and appreciation of the exchange rate respectively.

lot of disputes over this theorem. Especially it is not easy to digest the idea that it holds in developing countries. Furthermore, the equation (6.2) used by Galindo and Ros (2008) can most likely suffer from omitted variable case which can lead to unreliable biased coefficients. For example even if we assume those variables which are included in a very simple conventional central bank reaction function as described by Taylor (1993), it becomes clear that the regression in equation (6.2) most likely suffer from the omitted variable case.

In order to overcome these problems existing in this method, I modify the monetary policy reaction function defined by equation (6.1) in the following sense: in order to investigate whether the interest rate decisions of the CBRT is taken in an asymmetric manner with respect to exchange rate movements, two variables are defined representing depreciation and appreciation of the exchange rate respectively without resorting to the PPP hypothesis:

$$x_t^+ = \max(\Delta e_t, zero)$$

$$x_t^- = \min(\Delta e_t, zero)$$

Then a VAR model, including x_t^+, x_t^-, y_t^g, i_t and π_t^g[33] , ordered according to their exogeneity (from most exogenous to most endogenous), is estimated[34]. IRF analysis then is used to make inferences about the asymmetric policy stance of the CBRT.

6.1.2 Estimation Results

Now, I will analyze the IRF of the interest rate to make inferences about the relative contributions of x_t^+ and x_t^-, on the interest rate decisions of the CBRT. IRF enables us to trace the response of the interest rate to one unit shocks in other variables so

[33] $y_t^g = (y_t - y^*)/y_t$; $\pi_t^g = (\pi_t - \pi_t^*)$.

[34] Actually, since I will use IRF analysis the VAR is estimated with $abs\_x_t^- = |x_t^-| \; \forall t$ in order to investigate the impulse response of interest rate to a positive one standard innovation in appreciation variable.

that we can analyze the relative contribution of x_t^+ and x_t^- on interest rate decisions. The results of the unit root tests given in the appendix imply that all variables are stationary.

The ordering of VAR is important for IRF analysis; hence I apply pairwise Granger Causality tests to each variable. Granger Causality tests presented in Table A7 in the appendix yields that up to sixteen lags x_t^+ Granger causes i_t, whereas the reverse is not true. Up to four lags i_t Granger causes x_t^-, and the converse is not true. Accordingly, up to ten lags, x_t^+ Granger causes x_t^- with the reverse again being not true. Hence, x_t^+ is more exogenous than i_t and i_t is more exogenous than x_t^-. In order to make further restrictions about the specification of the order of variables in the model I make the following assumptions. First, in line with my presumption in the first model, I assume that x_t^+ and x_t^- and y_t^g are more exogenous than π_t^g. Second, according to the Granger Causality results, I assume that the order of exogeneity is such that x_t^+, i_t, y_t^g. Hence, we are left with four specifications for the ordering of VAR[35]. Using the first ordering, I estimate the VAR model and below depict the IRF of the interest rate below for 2 lags which is determined by the Akaike Information Criteria. The VDC of interest rate is also found and given in Figure A.2 in the Appendix. The estimation results of the VAR and diagnostic test results are given in Table A.8, Table A.9 and Table A.10.

[35] Namely: 1-) x_t^+, y_t^g, i_t, x_t^-, π_t^g; 2-) x_t^+, i_t, y_t^g, x_t^-, π_t^g; 3-) x_t^+, i_t, x_t^-, y_t^g, π_t^g; 4-) y_t^g x_t^+, i_t, x_t^-, π_t^g.

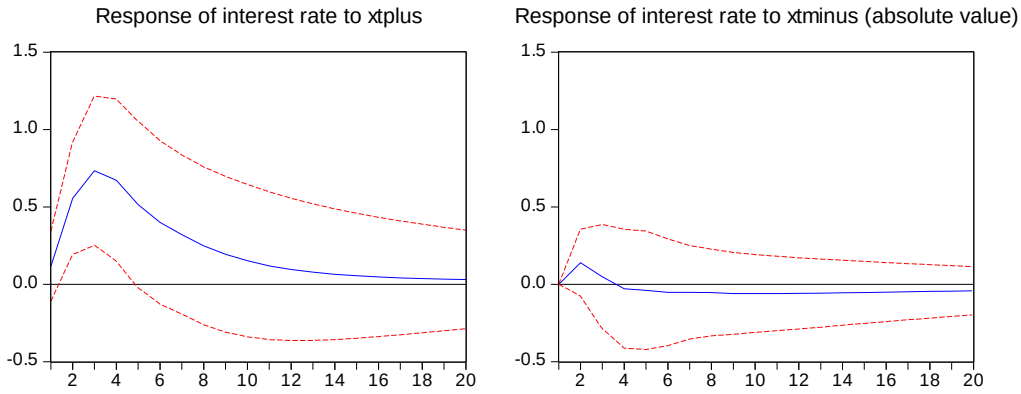

Figure 6.1. Impulse response of the interest rate to shocks in x_t^+ and x_t^-

Following the shocks, the interest rate increases within the first three months as a result of a one unit shock in x_t^+. However, the response of the interest rate to a shock in depreciation variable is much greater than that to a shock in the appreciation variable. Indeed, one unit increase in the appreciation variable does not seem to have a considerable impact on interest rate decisions of the CBRT as Figure 6.1 indicates. Thus, the impact of a unit increase in depreciation on i_t is evidently much more significant indicating that monetary authority adjusts interest rates in response to changes in the nominal exchange rate in an asymmetric way.

This finding is not without any reservation and a caveat seems to be necessary at this juncture. Exchange rate depreciation is not the most dominant factor of interest rate decisions. One striking fact is the dominance of interest rate smoothing tendency of the CBRT during the period. VDC of interest rate yields that interest rate is the dominant factor in explaining variation in itself, possibly an inevitable consequence of interest rate smoothing tendency. In their paper, Cömert et. al (2010) present econometric evidence to verify their argument that interest rate smoothing was the main tendency of the CBRT between 2002 and 2008 and that the CBRT did not respond to changes in output, however it slightly responds to the

movements in the exchange rate. According to the authors, interest rate smoothing was a consequence of the quest for a predictable policy environment through which the confidence of international investors is retained. Hence a gradual movement of interest rates in response to developments in the economy was perceived as necessary for the CBRT in order to assure financial stability and maintenance of capital inflows. Yet, besides the interest rate smoothing tendency, the asymmetric nature of interest rate decisions is apparent from the econometric evidence as Figure 6.1 depicts.

The test results are robust to other specifications: with all other orderings the impulse response functions of the interest rate are very similar. Moreover, different lag specifications (up to 6 lags) do not distort the asymmetric response of interest rate to exchange rates[36]. To further increase the robustness of the analysis, I replicate the same procedure with new variables w_t^+ and w_t^- defined as:

$$w_t^+ = \begin{cases} \Delta e_t \; if \; \Delta e_t > 0.02 * e_{t-1} \\ 0 \;\; otherwise \end{cases}$$

$$w_t^- = \begin{cases} \Delta e_t \; if \; \Delta e_t < -0.02 * e_{t-1} \\ 0 \;\; otherwise \end{cases}$$

Hence, now I assume that monetary authority takes into account only the changes bigger than two percent of the existing exchange rate. This assumption seems to be more realistic since monetary authority may remain irresponsive to small deviations of the exchange rate. The Granger Causality tests and the VAR analysis give quite similar results with the new variables as Figure 6.2 indicates. However, the findings

[36] A VAR model with the first difference of interest rate is also estimated in case the interest rate follows a random walk with trend. Actually, this may happen due to acute reductions in interest rate until the first half of 2004 although there is not an observable trend after 2004. The results with the new variable, again, clearly reveal the asymmetric nature of the policy stance, however the R-squared in the new regression remains low as expected. Hence, I stick into the model with the interest rate and not its first difference.

of the model with the new variables suffer from degrees of freedom problem[37]. Hence, I take the model with x_t^+ and x_t^- instead of that with w_t^+ and w_t^- as the benchmark case.

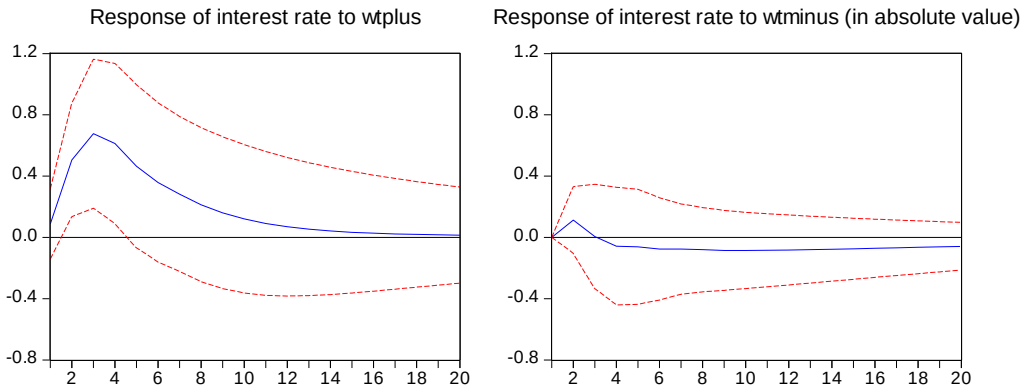

Figure 6.2. Impulse response of the interest rate to shocks in w_t^+ and w_t^-

Asymmetric exchange rate policy stance of the CBRT does not only consist of its decision on interest rate. The Bank also exhibits an affirmative approach towards appreciation in its operations in foreign exchange market as the next section discusses.

6.2 Asymmetric Behavior in Foreign Exchange Market

During the period under investigation, foreign exchange purchases are perceived by the CBRT as not to influence the value of exchange rate which is said to be determined by market forces (CBRT, 2004; Akıncı et. al 2005b). This is presented as the main reason why most of the purchases are made as auctions the terms of which are pre-announced. The CBRT claims that the aim of purchases is not

[37] w_t^+ takes a positive value only 16 times whereas w_t^- takes a negative value only 23 times with other observations remaining zero.

affecting the level of exchange rate but rather to increase foreign exchange reserves, the abundance of which is important for the sake of the Turkish economy due to the need for a safety measure in case of an external shocks, for an increase in confidence to the economy, for resources to make the payments of the treasury and for clearing the high cost worker remittances from the CBRT's balance sheet (CBRT, 2006).

With regards to the impact of foreign exchange sales and purchases on the level of exchange rate, however, using descriptive statistics[38] indicate that sale operations are important in affecting the level and volatility of the exchange rate while purchase operations are not found to have a considerable role in explaining changes in the exchange rate. It is clear, from the Table A.11 that purchase interventions do not change the level of exchange rate in a notable way[39]. Hence, it can be argued that the impulse behind purchase interventions is to accumulate foreign exchange reserves rather than reverse the appreciation trend of the lira. On the other hand, aggressive purchase operations of the CBRT in the midst of the increased financial fragilities in May and June 2006 reversed the depreciation trend with an immediate and acute appreciation of the lira as can be seen from Table A.11.

The changes in the level of daily foreign exchange purchases of the CBRT through auctions can also be considered as a way to intervene in the foreign exchange market. As can be seen from Table A.12, the asymmetric nature of the CBRT with

[38] Due to a very small sample (13 purchase and 3 sale operations above 100 million U.S. dollars), using econometric analysis is not possible.

[39] Two situations, namely interventions carried out at 25.09.2003 and 09.03.2005, seem to be exception as the exchange rate exhibited a considerable depreciation after the first month of the intervention. However, for the first case, comparing the level of exchange rate after intervention (1.35) and before intervention (1.33) yields that exchange rate simply returned approximately to its previous level, presumably not as a consequence of the intervention. In the second case, depreciation trend of the exchange rate commenced much after the intervention carried out. At October 9 exchange rate was 1.38 and it gradually increased to 1.48 until October 25. This reveals that depreciation may not be the result of the intervention but rather other factors are responsible for this trend.

respect to exchange rate is valid in this case as well in the sense that decreases in the level of foreign exchange purchased in the auctions are always preceded by a substantial depreciation of the exchange rate whereas increases are loosely related with appreciation. This finding again suggests that the foreign exchange purchases of the CBRT are to a great extent associated with the purpose of accumulating reserves[40] and that whenever a depreciation trend is observed the CBRT subordinates this goal in order to refrain from depreciation.

Hence seen, it is apparent that the nature of foreign exchange interventions in this period is compatible with the asymmetric nature of the exchange rate policy of the CBRT. Capital inflows into Turkey during these years have been so intense that foreign exchange purchases of the CBRT have never hindered the appreciation trend of the lira whereas whenever the signals of permanent depreciation are observed, the CBRT responded immediately.

[40] In fact, increases and decreases in foreign exchange purchases is closely related with increases and decreases in capital inflows. As Table A.12 indicates, most of the increases in purchases happened when capital inflows increase relative to the previous month whereas the CBRT decreased its purchase level through auctions when capital inflows decrease.

CHAPTER 7

POLICY IMPLICATIONS AND CONCLUDING REMARKS

Thus far, I have shown that the monetary policy of the CBRT between 2002 and 2008 was asymmetric with respect to the exchange rate in that all of the interventions in the form of both sales and purchases into the foreign exchange market, foreign exchange purchase auctions of the CBRT and its interest rate decisions exhibited a tendency for appreciation of the Turkish lira. This is not to say that if the monetary policy was not asymmetric, appreciation of the lira would not be the case. Instead, I merely claim that, the CBRT *tolerated* appreciation pressures and responded to depreciation pressures. TL might have appreciated whether or not an asymmetric policy agenda is in effect given the enormous capital inflows during this period.

Now, we will try to understand the dynamics behind the asymmetry in order to explore new research areas. Is the asymmetric policy stance peculiar to Turkey or does IT itself incorporate such a tendency in developing countries? As we have seen, exchange rate appreciation has happened in most of the ITDC in the recent period. Was it a consequence of a deliberate policy choice or not? If all these central banks have had a tendency as that in Turkey what might be the cause behind such a policy stance?

The first reason behind the inclination towards an asymmetric policy may be the ineffectiveness of the monetary authorities in developing countries to curb inflation which is mostly related with external factors such as commodity prices. These central banks may have a tendency for appreciation in order to compensate the negative effects of other external shocks on domestic inflation.

Second, stickiness in non-tradable goods' prices in developing countries also hinders the effectiveness of monetary policy in its combat with inflation. Conventional approach to IT extensively focuses on the experience of advanced countries where credibility problems are less repressive compared to developing countries. In this respect, Kumhof (2000) show that under imperfect credibility of the inflation target in a small open economy where non-tradable goods' prices are sticky, the monetary authority is forced to reduce the level of depreciation through a tight monetary policy so as to meet the target. This is because non-tradable goods prices remain higher than the targeted inflation due to the public perception that sustaining a low CPI is not sustainable (Kumhof, 2001). As a consequence, Kumhof (2001) claims that monetary tightening to reduce exchange rate depreciation is the endogenous policy response in the presence of non-tradable goods' price stickiness. Hence, lack of credibility is, in a way, offset by the exchange rate increasing (depreciation) more slowly than CPI (Kumhof, 2000).

Third, the bottlenecks in the usual monetary transmission mechanism which are mostly peculiar to developing countries also restrict the capability of monetary policy to affect the real economy[41]. In such an environment where most of the inflationary developments are beyond what monetary authority can affect, appreciation of domestic currencies emerges as an indispensable outcome of the main aim of reaching the inflation targets.

Fourth, asymmetries in ERPT may prompt the monetary authority to respond to exchange rate fluctuations asymmetrically. If the impact of depreciation on domestic inflation is greater than that of appreciation on inflation, then monetary policy is likely to react more to depreciation pressures. Although there does not

[41] See Mishra and Montiel (2012) and Mishra, Montiel and Spiliembergo (2010) for a detailed discussion on the causes of bottlenecks of monetary transmission mechanism in developing countries.

emerge a consensus about the ERPT asymmetry in the literature, the impact of this issue on monetary policy decisions can be very important.

Taking into account these constraints in restraining inflation and given that the supply side factors are the most prominent determinants of inflation in developing countries, IT central banks may be, in a way, forced to resort to exchange rate movements so as to hit their inflation target. In other words, what the central bank could not do is left to an upward trend (appreciation) of the real exchange rate[42].

It is worth to note that these findings are only intuitive and further research on this issue is needed. Indeed, new researches investigating whether there is an asymmetric behavior with respect to the exchange rate in IT developing countries may uncover the very logic behind the IT regime that IT developing countries are obliged to resort to exchange rate movements in order to achieve their targets[43]. Hence, the IT itself may force central banks to behave asymmetrically. A further caveat is that I am dealing with the period until the beginning of the global crisis. This specification is necessary for the aftermath of the crisis witnessed more complex forms of IT in which issues related with financial stability gained importance in developing countries. Hence, whether the asymmetric stance can be extended into the aftermath of the crisis or not needs further research.

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[42] In this context, arguably the most explicit statement from a central bank (though non-IT) about the role of exchange rate to curb inflation is made by Monetary Authority of Singapore (MAS) in its exchange rate policy report. In this report MAS states that "…MAS has found the exchange rate to be the most effective instrument to keep inflation low. Other possible intermediate targets, in particular interest rates, are less effective in influencing real economic activity and domestic inflation outcomes" (MAS, 2001: 17).

[43] This argument can be considered as the other side of what is proposed by Ho and McCauley (2003:10): "…if the focus of monetary policy is mainly or exclusively on inflation, then one would expect that monetary authorities in emerging market economies would devote greater attention to the evolution of the exchange rate and its influence on domestic prices."

Exchange rate appreciation, on the other hand, does not happen without its costs. The asymmetric nature has also been strengthened by capital inflows into these countries. IT central banks have taken a positive stance toward capital inflows. An increase in capital flows leads to the appreciation of their currencies. This asymmetry may contribute to increasing vulnerabilities in developing countries. Many economists and central banks seem to have forgotten very quickly the lessons of the currency crises of the 1990s[44]. The recent history of Mexico 1994, Turkey 2001, Argentina 2001 and Asian crisis 1997 has shown their devastating impacts on developing economies. In this vein, Frenkel and Taylor (2006) render a persistently strong exchange rate as an invitation to disaster due to destabilizing capital flows it bring with and its malign side effects on resource allocation and prospects for development. Nevertheless, many studies do not consider accumulated risks stemmed from over appreciation of currencies in these countries. Under free capital mobility a significant reversal of capital flows can be very costly.

IT seems to contribute to the ignorance of aforementioned dangers faced by developing countries. In fact, some formal models with imperfect credibility of low inflation target support this idea. For example, using a model of a small open economy with sticky non-tradable goods prices, Kumhof (2000) shows that central banks are forced to reduce the rate of currency depreciation through a tight monetary policy in order to reach their inflation targets. The model suggests that, at the end of the period, this brings about large current account deficits which may cause the collapse of the currency. Similarly, Kumhof et. al (2007) document that inflation targeting regime is also vulnerable to speculative attacks as opposed to claims of the proponents of this regime. Accordingly, with regards to the Turkish case, the ensuing real appreciation of the lira, has posed major challenges for the

[44] See Kaminsky et. al (1998) for a detailed literature review of the indicators of currency crises. The level of real exchange rates emerges as a significant indicator in many studies.

Turkish economy. Current account deficit along with the size of the imports soared in this period.

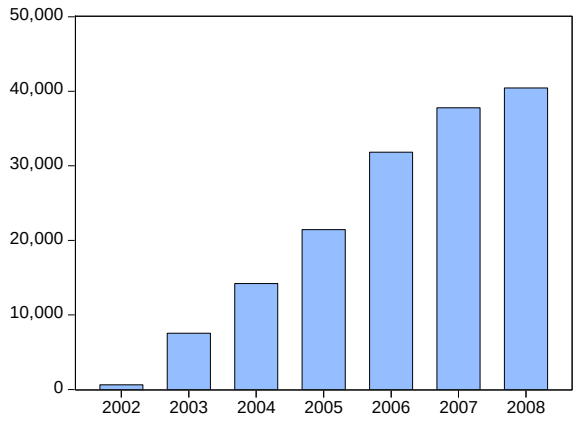

Figure 7.1. Current Account Deficit in Turkey (million dollars)

In addition to the systemic threads it poses in developing countries, empirical studies suggest that real exchange rate appreciation is harmful for the economic growth in developing countries. In fact, there is a vast literature still growing on the long term growth-related impacts of exchange rate undervaluations in developing countries. For instance, Razmi et. al (2009) indicate that undervaluation of real exchange rates is a driving factor for investment growth. On the other hand, Rodrik (2008) report that undervaluation stimulates economic growth in developing countries. This effect is due to the favorable impact of sustained undervaluation on the profitability of tradable sector which typically suffers disproportionately from institutional weaknesses and market failures (Rodrik, 2008: 404). A real depreciation increases profitability in investing tradable sector and the ensuing reallocation of sources between sectors boost productivity growth through a structural change. Frenkel and Rapetti (2008) illustrate the nexus between competitive exchange rate and economic growth on the basis of Argentinian

experience between 2002 and 2007. They assert that competitive exchange rate policy promoted expansion of the tradable sector and thereby contributed to the economic growth.

Thus seen, real exchange rate appreciation may jeopardize long term economic development in developing countries not only through triggering a currency crisis but also through its negative impact on economic growth. It is worth to mention here that appreciation may happen even in the absence of asymmetric exchange rate policy due to massive capital inflows. Thus, given the aforementioned dangers created by appreciation, this study does not offer a symmetric exchange rate policy. Indeed, an asymmetric policy favoring a competitive exchange rate may be helpful in the two issues I mentioned above. Yet, the likely consequences of such a policy stance need to be carefully analyzed.

In the Turkish case, the asymmetric monetary policy stance to exchange rate is apparent as evidence suggests. Hence, the asymmetric nature of policy response toward movements in exchange rate contributes to the appreciation of the lira. However, real exchange rate appreciation brings along with its negative impacts on economic development as in the lines argued above. Thus, a broader perspective encompassing the developmental aspects of overvaluation and implementation of IT seems to be what is needed when conducting monetary policy.

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APPENDICES

APPENDIX A

TABLES AND FIGURES

Table A.1 Annual inflation in consumer prices and nominal wage inflation

Annual Inflation		Annual Nominal Wage Inflation[45]	
2002	29,75	2003	23
2003	18,36	2004	13,3
2004	9,32	2005	12,3
2005	7,72	2006	11,5
2006	9,65	2007	9,4
2007	8,39	2008	9,9

Source: Central Bank of the Republic of Turkey, Turkish Statistical Institute.

[45] Quarterly data for hourly wage index in manufacturing industry is used

Table A.2. Values of the variables in the models

Time	π_t	π_t^w	e_t	y_t^g	i_t	b_t	π_t^g	x_t^+	x_t^-
2002-7	2,51	2,74	1,69	-0,83	51,5	1,7	-13	0,12	0
2002-8	2,58	0,46	1,62	0,01	49,5	0,87	-10,3	0	-0,07
2002-9	2,88	6,04	1,65	0,02	49,5	2,06	-8,88	0,03	0
2002-10	2,27	-0,11	1,66	2,47	49,5	1,33	-6,89	0,01	0
2002-11	2,14	-0,73	1,54	2,72	47,5	0,98	-5,4	0	-0,13
2002-12	1,85	4,78	1,64	-7,21	47,5	-2,81	-3,8	0,1	0
2003-1	2,46	2,54	1,64	5,65	47,5	1,25	-3,64	0	0
2003-2	2,48	3,57	1,59	-6,71	47,5	1,6	-2,33	0	-0,05
2003-3	3,16	-6,15	1,7	-1,23	47,5	1,02	-1,01	0,11	0
2003-4	1,91	-5,43	1,57	-4,02	44,5	1,96	1,9	0	-0,13
2003-5	1,45	-0,29	1,42	-4,49	44,5	0,39	1,01	0	-0,15
2003-6	0,71	2,2	1,41	-2,59	41,5	1,04	0,83	0	-0,01
2003-7	0,66	-0,7	1,41	0,19	38	1,16	-0,06	0	0
2003-8	0,54	2,41	1,39	0,32	35	3,33	-0,25	0	-0,02
2003-9	1,32	-1,03	1,38	1,76	32	1,3	-1,23	0	-0,01
2003-10	0,42	6,05	1,48	4,11	28,5	1,76	-1,52	0,09	0
2003-11	0,85	5,01	1,46	-4,19	28,5	0,85	-1,41	0	-0,02
2003-12	1,11	2,51	1,39	2,72	28,5	0,98	-0,9	0	-0,06
2004-1	0,61	1,73	1,34	2,57	28,5	-0,11	-4,73	0	-0,06
2004-2	0,8	0,93	1,32	-1,61	26,5	1,63	-4,6	0	-0,02
2004-3	0,95	3,67	1,31	2,1	24,5	4,13	-4,77	0	-0,01
2004-4	0,37	1,84	1,42	2,53	24,5	1,79	-4,84	0,11	0
2004-5	0,24	3,4	1,49	3,09	24,5	1,61	-4,21	0,08	0
2004-6	0,72	-3,39	1,48	3,63	24,5	0,61	-3,58	0	-0,01
2004-7	1,18	1,23	1,46	4,14	24,5	3,74	-3,55	0	-0,02
2004-8	0,97	4,98	1,5	0,34	24,5	1,33	-3,42	0,04	0
2004-9	0,42	0,75	1,5	-0,48	22	1,46	-2,99	0	-0,01
2004-10	1,24	8,46	1,47	-1,8	22	0,88	-3,26	0	-0,03
2004-11	0,77	-1,95	1,43	-3,09	22	1,3	-2,23	0	-0,04
2004-12	0,72	-3,56	1,34	-0,32	20	1,22	-1,9	0	-0,09
2005-1	0,46	3,57	1,33	0,39	19	2,32	-0,81	0	-0,01
2005-2	0,31	2,11	1,28	0,78	18,5	1,16	-1	0	-0,05
2005-3	0,34	8	1,35	-1,23	17,5	2,03	-1,39	0,07	0
2005-4	0,43	0,4	1,38	0,61	17	1,58	-1,28	0,04	0
2005-5	0,73	-5,02	1,36	-1,41	16,5	1,71	-1,27	0	-0,03

2005-6	0,93	5,76	1,33	-1,62	16,25	2,14	-1,16	0	-0,02
2005-7	0,25	1,29	1,32	-3,51	16,25	1,24	-1,16	0	-0,01
2005-8	1,27	7,01	1,35	0,63	16,25	1,91	-1,46	0,03	0
2005-9	0,59	2,12	1,34	1,68	16,25	1,41	-1,22	0	-0,01
2005-10	0,82	-0,55	1,34	-0,38	16	2,17	-1,08	0	0
2005-11	0,64	-0,38	1,35	0,34	15,75	2,48	-0,73	0,01	0
2005-12	0,77	2,95	1,34	0,93	15,5	3,23	-0,18	0	-0,01
2006-1	0,69	4,14	1,32	-11,6	15	2,13	-1,81	0	-0,02
2006-2	0,54	-1,82	1,31	-0,69	15	2,01	-1,52	0	-0,01
2006-3	0,35	0,04	1,34	1,79	15	1,63	-1,22	0,04	0
2006-4	0,97	9,92	1,32	0,99	14,75	1,17	-0,98	0	-0,03
2006-5	1,63	1,68	1,56	0,42	14,75	2,88	-0,28	0,24	0
2006-6	1,14	-2,31	1,57	1,99	19,75	2,81	2,46	0,01	0
2006-7	1,58	2,39	1,48	-0,48	20	2,71	4,15	0	-0,09
2006-8	0,02	0,55	1,45	-0,41	20	1,36	4,84	0	-0,03
2006-9	0,94	-6,63	1,5	0,87	20	1,51	4,33	0,05	0
2006-10	0,3	-0,78	1,45	-2,01	20	1,21	4,59	0	-0,04
2006-11	0,52	4,37	1,45	5,83	20	2,1	4,7	0	-0,01
2006-12	0,66	3	1,41	-1,23	20	0,83	4,98	0	-0,04
2007-1	0,98	-9,15	1,41	-2,25	20	0,17	-2,06	0,01	0
2007-2	0,76	4,25	1,41	1,22	20	0,92	-1,43	0	0
2007-3	1,02	1,94	1,38	0,72	20	5,42	-0,74	0	-0,03
2007-4	0,76	6,35	1,36	-1,21	20	1,17	-0,21	0	-0,02
2007-5	0,17	-1,25	1,32	1,18	20	1,14	0,55	0	-0,04
2007-6	0,57	1,3	1,31	0,2	20	0,33	0,9	0	-0,01
2007-7	-0,1	1,78	1,48	-0,48	20	0,51	1,09	0,18	0
2007-8	0,54	-2,22	1,29	1,47	20	2,09	1,27	0	-0,19
2007-9	0,71	7,85	1,21	-0,31	19,75	1,67	1,69	0	-0,09
2007-10	0,86	7,49	1,17	2,2	19,13	1,66	2,03	0	-0,03
2007-11	1,2	9,53	1,17	9,14	18,5	0,72	3,3	0	0
2007-12	0,73	-0,34	1,16	-6,26	17,88	1,18	4,7	0	-0,01
2008-1	0,77	1,56	1,17	4,83	17,5	1,49	-1,49	0,01	0
2008-2	1,61	5,01	1,18	4,16	17,25	2,07	-1,19	0,01	0
2008-3	1,07	4,19	1,31	-0,47	17,25	0,77	-0,27	0,13	0
2008-4	1,17	4,25	1,29	1,35	17,25	2,1	1,16	0	-0,02
2008-5	1,11	5,65	1,21	0,21	17,75	-0,01	3,2	0	-0,08

Table A.2. (continued)

2008-6	0,46	4,28	1,22	-1,93	18,25	2,05	4,54	0,01	0
2008-7	1,18	-0,39	1,16	-0,16	18,5	2,27	5,07	0	-0,06
2008-8	0,32	-8,86	1,18	-5,86	18,5	4,07	5,6	0,02	0
2008-9	0,12	-7,74	1,23	-8,79	18,5	-0,88	5,77	0,06	0

Table A.2. (continued)

Table A.3. Unit Root Tests of the Variables in the First and Second Model[46].

Variables	ADF(1)[47]			ADF(2)			Result
	Lag	p-value	t-value	Lag	p-value	t-value	
CPI inflation	0	0.00	-3.82	0	0.01	-4.26	Stationary under all specifications
WCPI inflation	0	0.00	-7.27	0	0.00	-7.21	Stationary under all specifications
Output gap	0	0.00	-8.55	0	0.00	-8.47	Stationary under all specifications
Interest rate	0	0.00	-3.87	0	0.86	-1.38	Stationary under ADF(1)
Exchange Rate	0	0.09	-2.64	0	0.05	-3.44	Non-stationary under ADF(1)
Exchange rate (first difference)	0	0.00	-9.16	0	0.00	-9.11	Stationary under all specifications
Budget balance to output ratio	2	0.00	-6.30	2	0.00	-6.45	Stationary under all specifications
x_t^+	0	0.00	-9.63	0	0.00	-9.54	Stationary under all specifications
x_t^-	0	0.00	-7.62	0	0.00	-7.61	Stationary under all specifications
Inflation gap	0	0.02	-3.23	0	0.02	-3.77	Stationary under all specifications

[46] The results are quite similar for the Phillips-Perron unit root test.

[47] ADF(1) represents random walk with intercept; ADF(2) represents random walk with trend and intercept.

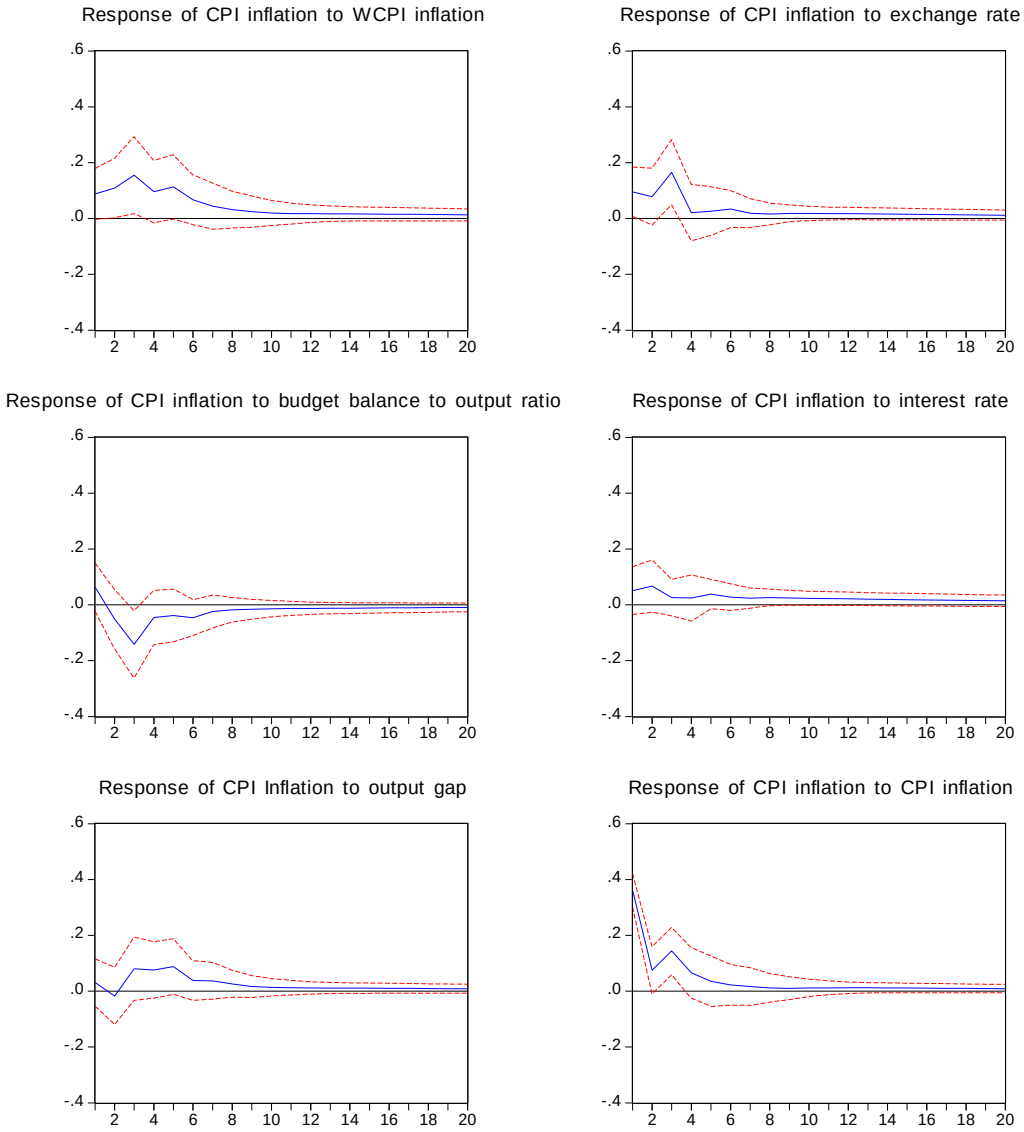

Figure A.1. Impulse response functions of CPI inflation.

Table A.4. Estimation results of the VAR model

	π_t^w	Δe_t	b_t	i_t	y_t^g	π_t
π_{t-1}^w	0.070366	0.001024	0.011381	0.026166	0.097598	0.024552
	(0.13315)	(0.00216)	(0.03752)	(0.03167)	(0.11234)	(0.01303)
	[0.52847]	[0.47464]	[0.30330]	[0.82619]	[0.86875]	[1.88500]
π_{t-2}^w	-0.161957	-0.000414	-0.046845	-0.011712	0.070296	0.014324
	(0.13400)	(0.00217)	(0.03776)	(0.03187)	(0.11306)	(0.01311)
	[-1.20859]	[-0.19077]	[-1.24046]	[-0.36744]	[0.62174]	[1.09272]
Δe_{t-1}	-10.94640	-0.123527	3.631549	3.682126	7.891630	0.685753
	(7.48123)	(0.12120)	(2.10829)	(1.77947)	(6.31210)	(0.73182)
	[-1.46318]	[-1.01923]	[1.72251]	[2.06923]	[1.25024]	[0.93705]
Δe_{t-2}	6.523950	-0.200704	2.734140	3.554599	-0.628175	2.002011
	(7.85952)	(0.12732)	(2.21489)	(1.86944)	(6.63127)	(0.76882)
	[0.83007]	[-1.57632]	[1.23444]	[1.90142]	[-0.09473]	[2.60399]
b_{t-1}	-0.555123	0.001583	-0.120594	0.020056	-0.484954	-0.038798
	(0.48131)	(0.00780)	(0.13564)	(0.11448)	(0.40610)	(0.04708)
	[-1.15335]	[0.20299]	[-0.88908]	[0.17518]	[-1.19418]	[-0.82403]
b_{t-2}	-0.325930	0.010292	-0.077655	-0.244921	0.156188	-0.149755
	(0.48642)	(0.00788)	(0.13708)	(0.11570)	(0.41040)	(0.04758)
	[-0.67006]	[1.30609]	[-0.56650]	[-2.11689]	[0.38057]	[-3.14732]
i_{t-1}	-0.895192	-0.010127	-0.041955	1.003514	0.266594	0.064282
	(0.52980)	(0.00858)	(0.14930)	(0.12602)	(0.44700)	(0.05183)
	[-1.68969]	[-1.17996]	[-0.28101]	[7.96341]	[0.59640]	[1.24037]
i_{t-2}	0.780056	0.009474	0.011934	-0.092834	-0.183009	-0.048153
	(0.47897)	(0.00776)	(0.13498)	(0.11393)	(0.40412)	(0.04685)
	[1.62862]	[1.22105]	[0.08842]	[-0.81486]	[-0.45286]	[-1.02774]
y_{t-1}^g	0.338857	0.001476	-0.039526	-0.021411	-0.081303	-0.007663
	(0.16706)	(0.00271)	(0.04708)	(0.03974)	(0.14095)	(0.01634)
	[2.02835]	[0.54545]	[-0.83957]	[-0.53884]	[-0.57681]	[-0.46892]
y_{t-2}^g	0.036180	0.004802	-0.051881	0.035278	0.040169	0.013495
	(0.16620)	(0.00269)	(0.04684)	(0.03953)	(0.14023)	(0.01626)
	[0.21769]	[1.78336]	[-1.10767]	[0.89238]	[0.28645]	[0.83004]
π_{t-1}	0.452234	0.031534	0.261888	0.542828	-1.007336	0.207263
	(1.18664)	(0.01922)	(0.33441)	(0.28225)	(1.00120)	(0.11608)

	[0.38110]	[1.64037]	[0.78314]	[1.92321]	[-1.00613]	[1.78555]
π_{t-2}	0.173397	-0.027646	-0.270716	0.481782	-1.031656	0.290435
	(1.20797)	(0.01957)	(0.34042)	(0.28732)	(1.01919)	(0.11816)
	[0.14354]	[-1.41271]	[-0.79525]	[1.67679]	[-1.01223]	[2.45788]
C	4.971808	-0.018511	2.740244	1.170496	0.211788	0.311573
	(2.12269)	(0.03439)	(0.59820)	(0.50490)	(1.79097)	(0.20764)
	[2.34222]	[-0.53830]	[4.58084]	[2.31828]	[0.11825]	[1.50052]
R-squared	0.208310	0.216734	0.159282	0.992624	0.146577	0.691630
Adj. R-squared	0.049972	0.060081	-0.008862	0.991149	-0.024108	0.629956
Sum sq. resids	972.6496	0.255263	77.24487	55.02867	692.4012	9.307212
S.E. equation	4.026267	0.065226	1.134643	0.957677	3.397061	0.393853
F-statistic	1.315605	1.383530	0.947296	672.9083	0.858758	11.21431
Log likelihood	-198.1016	102.8585	-105.6455	-93.26743	-185.6968	-28.40456
Akaike AIC	5.783606	-2.461878	3.250562	2.911436	5.443748	1.134372
Schwarz SC	6.191496	-2.053988	3.658453	3.319326	5.851638	1.542262
Mean dependent	1.589779	-0.005329	1.567259	24.06164	-0.106154	0.932471
S.D. dependent	4.130803	0.067278	1.129649	10.17955	3.356839	0.647452
Determinant resid covariance (dof adj.)		0.091340				
Determinant resid covariance		0.028160				
Log likelihood		-491.1955				
Akaike information criterion		15.59440				
Schwarz criterion		18.04174				

Table A.4 (continued).

Table A.5 Test Results for Heteroskedasticity

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Sample: 2002M07 2008M09
Included observations: 73

Joint test:

Chi-sq	df	Prob.
503.4723	504	0.4983

Individual components:

Dependent	R-squared	F(24,48)	Prob.	Chi-sq(24)	Prob.
res1*res1	0.219165	0.561362	0.9361	15.99907	0.8881
res2*res2	0.304346	0.874992	0.6303	22.21725	0.5663
res3*res3	0.245971	0.652418	0.8704	17.95589	0.8051
res4*res4	0.737120	5.608048	0.0000	53.80979	0.0005
res5*res5	0.213593	0.543212	0.9461	15.59229	0.9022
res6*res6	0.172091	0.415724	0.9888	12.56264	0.9728
res2*res1	0.378885	1.220016	0.2730	27.65861	0.2747
res3*res1	0.169490	0.408158	0.9900	12.37276	0.9754
res3*res2	0.290907	0.820506	0.6948	21.23625	0.6248
res4*res1	0.352555	1.089067	0.3897	25.73653	0.3667
res4*res2	0.500203	2.001625	0.0204	36.51482	0.0489
res4*res3	0.273952	0.754637	0.7697	19.99846	0.6969
res5*res1	0.318396	0.934254	0.5599	23.24290	0.5055
res5*res2	0.355405	1.102722	0.3762	25.94454	0.3560
res5*res3	0.337967	1.021000	0.4610	24.67163	0.4238
res5*res4	0.345650	1.056466	0.4230	25.23242	0.3932
res6*res1	0.253718	0.679951	0.8457	18.52140	0.7770
res6*res2	0.366457	1.156851	0.3257	26.75138	0.3162
res6*res3	0.168133	0.404230	0.9907	12.27368	0.9766
res6*res4	0.362374	1.136634	0.3440	26.45329	0.3306
res6*res5	0.298197	0.849801	0.6603	21.76835	0.5931

Table A.6 Test Results for Autocorrelation

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Sample: 2002M07 2008M09
Included observations: 73

Lags	LM-Stat	Prob
1	32.69449	0.6266
2	32.87348	0.6181
3	48.54222	0.0791
4	24.19588	0.9332
5	47.33615	0.0979
6	35.84480	0.4759
7	40.01729	0.2964
8	48.64716	0.0776
9	40.93691	0.2627
10	45.64635	0.1301

Table A.7. Pairwise Granger Causality Tests between x_t^+, x_t^-, i_t.

F-statistic/p-value						
Hypothesis	1 lag	2 lags	3 lags	4 lags	5 lags	6 lags
i_t DNGC[48] x_t^+	0.00/0.98	0.04/0.96	0.02/1	0.19/0.94	0.40/0.85	0.37/0.90
x_t^+ DNGC i_t	10.17/0.00	7.07/0.00	5.96/0.00	6.12/0.00	4.70/0.00	4.04/0.00
i_t DNGC x_t^-	3.01/0.09	3.33/0.04	2.72/0.05	2.35/0.06	1.25/0.30	1.21/0.31
x_t^- DNGC i_t	0.04/0.85	1.74/0.18	1.35/0.27	1.38/0.25	1.74/0.14	1.30/0.27
x_t^+ DNGC x_t^-	6.06/0.02	7.83/0.00	5.93/0.00	3.90/0.00	3.43/0.01	3.15/0.01
x_t^- DNGC x_t^+	0.03/0.87	0.76/0.47	0.73/0.54	0.63/0.64	0.54/0.75	0.38/0.89

[48] DNGC: Do Not Granger Cause

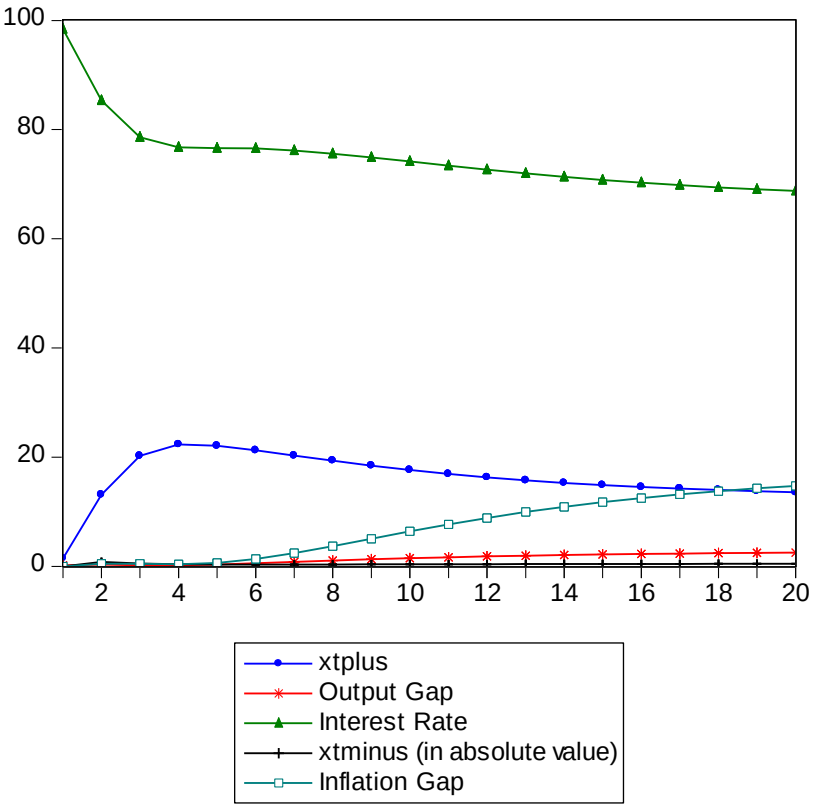

Figure A.2. Variance decomposition of interest rate.

Table A.8. Estimation results of the VAR model

Vector Autoregression Estimates

Sample (adjusted): 2002M09 2008M09
Included observations: 73 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	x_t^+	y_t^g	i_t	$\lvert x_t^- \rvert$	π_t^g
x_{t-1}^+	-0.118831	5.371187	9.613622	0.238284	8.384810
	(0.12950)	(9.38943)	(2.73014)	(0.09590)	(3.75517)
	[-0.91759]	[0.57205]	[3.52129]	[2.48480]	[2.23287]
x_{t-2}^+	-0.183830	11.24077	1.307079	0.225331	3.114789
	(0.14555)	(10.5528)	(3.06842)	(0.10778)	(4.22046)
	[-1.26300]	[1.06519]	[0.42598]	[2.09068]	[0.73802]
y_{t-1}^g	0.001101	-0.069288	-0.004515	-0.000502	0.066500
	(0.00179)	(0.13014)	(0.03784)	(0.00133)	(0.05205)
	[0.61345]	[-0.53243]	[-0.11932]	[-0.37792]	[1.27772]
y_{t-2}^g	0.002566	0.155962	0.011334	-0.002955	-0.116960
	(0.00184)	(0.13344)	(0.03880)	(0.00136)	(0.05337)
	[1.39446]	[1.16882]	[0.29212]	[-2.16806]	[-2.19166]
i_{t-1}	3.98E-05	-0.155974	1.161690	0.003552	0.243871
	(0.00552)	(0.40031)	(0.11640)	(0.00409)	(0.16010)
	[0.00721]	[-0.38963]	[9.98042]	[0.86869]	[1.52326]
i_{t-2}	-9.15E-06	0.091276	-0.208383	-0.002685	-0.247453
	(0.00527)	(0.38240)	(0.11119)	(0.00391)	(0.15294)
	[-0.00173]	[0.23869]	[-1.87413]	[-0.68752]	[-1.61802]
$\lvert x_{t-1}^- \rvert$	0.055747	-11.82191	4.352363	0.049757	1.684295
	(0.16111)	(11.6812)	(3.39650)	(0.11930)	(4.67171)
	[0.34601]	[-1.01205]	[1.28143]	[0.41706]	[0.36053]
$\lvert x_{t-2}^- \rvert$	-0.115624	24.06292	-4.506478	-0.128486	3.648496
	(0.16239)	(11.7734)	(3.42332)	(0.12025)	(4.70861)
	[-0.71204]	[2.04383]	[-1.31640]	[-1.06853]	[0.77486]
π_{t-1}^g	-0.000180	-0.476423	0.080028	0.005945	0.941551
	(0.00414)	(0.29990)	(0.08720)	(0.00306)	(0.11994)
	[-0.04347]	[-1.58858]	[0.91772]	[1.94077]	[7.85001]
π_{t-2}^g	-0.001377	0.208081	-0.120612	-0.003316	-0.098403

	(0.00404)	(0.29313)	(0.08523)	(0.00299)	(0.11723)
	[-0.34061]	[0.70985]	[-1.41508]	[-1.10762]	[-0.83937]
C	0.025532	0.637825	0.544540	-0.000603	-0.069630
	(0.01572)	(1.13996)	(0.33146)	(0.01164)	(0.45591)
	[1.62390]	[0.55952]	[1.64284]	[-0.05182]	[-0.15273]
R-squared	0.090455	0.153095	0.992214	0.331020	0.841445
Adj. R-squared	-0.056245	0.016497	0.990958	0.223120	0.815872
Sum sq. resids	0.130712	687.1129	58.09236	0.071673	109.9027
S.E. equation	0.045916	3.329034	0.967974	0.034000	1.331399
F-statistic	0.616598	1.120774	790.0742	3.067844	32.90315
Log likelihood	127.2880	-185.4169	-95.24499	149.2200	-118.5160
Akaike AIC	-3.185973	5.381286	2.910822	-3.786850	3.548383
Schwarz SC	-2.840835	5.726424	3.255959	-3.441712	3.893520
Mean dependent	0.020192	-0.106154	24.06164	0.025466	-0.447479
S.D. dependent	0.044677	3.356839	10.17955	0.038575	3.102758

Determinant resid covariance (dof adj.)	3.65E-05
Determinant resid covariance	1.61E-05
Log likelihood	-115.1510
Akaike information criterion	4.661671
Schwarz criterion	6.387359

Table A.8 (continued).

Table A.9 Test Results for Heteroskedasticity

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Sample: 2002M07 2008M09
Included observations: 73

Joint test:

Chi-sq	df	Prob.
321.2366	300	0.1910

Individual components:

Dependent	R-squared	F(20,52)	Prob.	Chi-sq(20)
res1*res1	0.131934	0.395163	0.9873	9.631168
res2*res2	0.105984	0.308226	0.9973	7.736848
res3*res3	0.574789	3.514606	0.0001	41.95957
res4*res4	0.378015	1.580165	0.0945	27.59510
res5*res5	0.376932	1.572899	0.0967	27.51604
res2*res1	0.225881	0.758655	0.7472	16.48929
res3*res1	0.131675	0.394271	0.9875	9.612293
res3*res2	0.274594	0.984199	0.4948	20.04535
res4*res1	0.135358	0.407025	0.9849	9.881139
res4*res2	0.201186	0.654826	0.8500	14.68659
res4*res3	0.654716	4.930035	0.0000	47.79428
res5*res1	0.375741	1.564936	0.0992	27.42908
res5*res2	0.275809	0.990212	0.4884	20.13403
res5*res3	0.321758	1.233442	0.2666	23.48836
res5*res4	0.338910	1.332898	0.2012	24.74042

Table A.10 Test Results for Autocorrelation

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Sample: 2002M07 2008M09
Included observations: 73

Lags	LM-Stat	Prob
1	18.51462	0.8198
2	18.74374	0.8092
3	21.00299	0.6924
4	13.76670	0.9656
5	44.02484	0.0108
6	31.87608	0.1616
7	13.41727	0.9710
8	19.46337	0.7744
9	15.46443	0.9298
10	20.97876	0.6938

Table A.11. The time and amount of exchange rate interventions of the CBRT, and the exchange rate before and after the interventions.

Intervention	Amount (million U.S. dollar)	Exchange rate 1 month before intervention ($/TL)	Exchange rate at the time of intervention ($/TL)	Exchange rate 1 month after intervention
Purchase				
21.05.2003	517	1.59	1.49	1.41
09.06.2003	566	1.50	1.41	1.42
18.07.2003	938	1.42	1.40	1.40
10.09.2003	704	1.40	1.39	1.39
25.09.2003	1442	1.39	1.37	1.48*
16.02.2004	1283	1.34	1.33	1.32
27.01.2005	1347	1.35	1.35	1.29
09.03.2005	2361	1.33	1.28	1.35*
03.06.2005	2056	1.37	1.36	1.34
22.07.2005	2366	1.36	1.34	1.36
04.10.2005	3271	1.33	1.35	1.36
18.11.2005	3164	1.36	1.37	1.35
15.02.2006	5441	1.33	1.34	1.33
Sale				
13.06.2006	494	1.36	1.61	1.59
23.06.2006	763	1.51	1.71	1.55*
26.06.2006	848	1.54	1.66	1.52*

Source: Central Bank of the Republic of Turkey.

Table A.12. Changes in the level of foreign exchange purchase of the CBRT through auctions and the exchange rates.

Date	Foreign Exchange Purchase (million dollar)		Exchange rate 1 month before ($/TL)	Exchange rate ($/TL) at the time of intervention	Changes in capital inflows (million dollars)
01.07.2003	30→40	+	1.42	1.41	June-May=200
17.07.2003	40→50	+	1.42	1.39	July-June=537
02.09.2003	50→40	-	1.42	1.39	August-July=303
11.09.2003	40→50	+	1.40	1.39	August-July=303
07.10.2003	50→80	+	1.38	1.38	September-August=1719
21.10.2003	80→40	-	1.36	1.45	October-September=-3879
23.10.2003	40→0	-	1.35	1.48	October-September=-3879
01.03.2004	30→40	+	1.33	1.32	February-January=115
01.04.2004	40→50	+	1.32	1.31	March-February=-2068
07.04.2004	50→70	+	1.32	1.32	March-February=-2068
15.04.2004	70→40	-	1.31	1.37	March-February=-2068 April-March=698
27.04.2004	40→0	-	1.32	1.42	April-March=698
22.12.2004	0→15	+	1.44	1.39	December-November=2915
15.06.2006	20→0	-	1.35	1.45	June-May=-3416 May-April=512
25.07.2007	15→40	+	1.32	1.25	July-June=56
15.08.2007	40→15	-	1.27	1.34	July-June=56 August-July=-2797
05.10.2007	15→30	+	1.31	1.19	September-August=156
07.03.2008	30→15	-	1.20	1.25	February-January=-3189
15.10.2008	15→0	-	1.27	1.39	October-September=-4885 September-August=-2660

Source: Central Bank of the Republic of Turkey.

APPENDIX B

CALCULATION OF MONTHLY INFLATION TARGETS

The method to calculate inflation target of the CBRT at a given month is as follows: Consider we are at the beginning of year t. First, the difference between the inflation target for the year t (π_t^*) and the actual end year inflation of the year $t-1$ (π_{t-1}) is divided by 12. Then, monthly inflation targets are defined as:

$$\pi_{t,i}^* = \pi_{t,i-1}^* - (\pi_{t-1} - \pi_t^*)/12$$

with

$$\pi_{t,1}^* = \pi_{t-1} - (\pi_{t-1} - \pi_t^*)/12$$

where $i = 2,3, \ldots 12$ represents the months at year t and $\pi_{t,i}^*$ represents the inflation target of the central bank at month i of the year t.

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	
Sosyal Bilimler Enstitüsü	X
Uygulamalı Matematik Enstitüsü	
Enformatik Enstitüsü	
Deniz Bilimleri Enstitüsü	

YAZARIN

Soyadı : BENLİALPER
Adı : AHMET
Bölümü : İKTİSAT

TEZİN ADI (İngilizce) : ASYMMETRIC EXCHANGE RATE INTERVENTION UNDER INFLATION TARGETING REGIMES: THE CASE OF TURKEY, 2002-2008.

TEZİN TÜRÜ : Yüksek Lisans [X] Doktora [ ]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [X]
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [X]
3. Tezimden bir (1) yıl süreyle fotokopi alınamaz. [ ]

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: 26.09.2013