EXCHANGE RATE PASS-THROUGH AND INFLATION TARGETING

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ABSTRACT

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In this study, we aim to investigate the impact of inflation targeting (IT) and the recent global disinflation on exchange rate pass-through (ERPT) using quarterly data from 1980:1 to 2009:1 for 51 industrial and emerging market (EM) countries. To this end, we employ not only the conventional panel data estimation methods but also the recent Common Correlated Effects Pooled estimation procedure by Pesaran (2006) which allows estimating the impact of common global shocks such as global inflation. We also explore some other determinants of ERPT during the recent global disinflation period. Furthermore, we consider asymmetric effects of positive and negative output gaps as proxies for domestic demand conditions on ERPT for IT industrial and EM countries.

Our results strongly suggest that, for the non-IT samples, ERPT is significantly higher in EM countries than industrial countries. For every country groups excluding Euro area countries, we find that ERPT declined substantially during the recent global disinflation period. The decline in the ERPT is, however, much higher in IT countries especially in EM ones. One striking result is the convergence of ERPT coefficients of EM countries to industrial IT countries with the adoption of IT. This supports the endogenous response of ERPT to monetary policy credibility and price stability. Consequently, a high ERPT, *per se*, may be interpreted as not a binding constraint for the adoption of IT as it tends to decline with the success of monetary policy regime. We also find that ERPT appears to be more sensitive to positive output gaps in IT industrial countries whilst it does not have such a response to positive or negative output gaps in IT emerging market countries.

Keywords: Exchange rates, Pass-through, Inflation targeting, Panel data, Emerging market countries.

ÖZ

DÖVİZ KURU GEÇİŞKENLİĞİ VE ENFLASYON HEDEFLEMESİ

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Bu çalışmada, 51 gelişmiş sanayi ve yükselen piyasa (YP) ülkesinin 1980:1-2009:1 dönemi için 3 aylık verileri kullanılarak, enflasyon hedeflemesinin (EH) ve son dönem küresel düşük enflasyon oranlarının döviz kuru geçişkenliği (DKG) üzerindeki etkisinin araştırılması amaçlanmıştır. Bu amaçla, geleneksel panel veri tahmin tekniklerinin yanında, Pesaran (2006)'ın küresel enflasyon gibi ortak küresel şokların etkilerini de tahmin etmeyi sağlayan Ortak İlgileşimli Etkiler Havuzlanmış tahmin yordamı da kullanılmıştır. Ayrıca, küresel düşük enflasyon dönemindeki diğer DKG belirleyicileri de araştırılmıştır. Buna ek olarak, EH uygulayan sanayi ve YP ülkelerinde yurt içi talep koşullarının yerine kullanılan pozitif ve negatif çıktı açığının DKG üzerindeki bakışımsız etkisi de incelenmiştir.

Sonuçlarımız göstermektedir ki, EH uygulanmayan örneklemde DKG yükselen piyasa ülkelerinde gelişmiş ülkelerden anlamlı olarak daha yüksektir. Euro bölgesi dışındaki her ülke grubu için, küresel düşük enflasyon döneminde DKG belirgin bir şekilde düşmüştür. Ancak, DKG'deki bu düşüş EH uygulayan ülkelerde, özellikle YP ülkelerinde, daha yüksektir. EH uygulanmasıyla YP ülkelerinin DKG katsayısının gelişmiş ülkeler DKG katsayısına yakınsaması da dikkat çekici bir sonuçtur. Bu durum, DKG'nin para politikası güvenilirliğine ve fiyat istikrarına olan içsel tepkisini desteklemektedir. Sonuç olarak, DKG para politikası rejiminin başarısıyla düşüş gösterdiği için, aslında yüksek DKG oranlarına sahip olunması EH uygulanması için bir kısıt olarak tanımlanmayabilir. Ayrıca bu çalışmada, EH uygulayan YP ülkelerinde DKG'nin pozitif ve negatif çıktı açığına karşı tepkisi yokken, EH uygulayan gelişmiş ülkelerde DKG'nin pozitif çıktı açığına karşı daha duyarlı olduğu sonucu da bulunmuştur.

Anahtar Kelimeler: Döviz kuru, Geçişkenlik, Enflasyon hedeflemesi, Panel veri, Yükselen piyasa ülkeleri.

To My Family

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CHAPTER I

INTRODUCTION

The degree of responsiveness of domestic prices to exchange rate movements (exchange rate pass-through, ERPT) is a central issue in international macroeconomics literature and crucially important for the design and implementation of monetary policy. Low level of ERPT provides greater freedom for pursuing independent monetary policy. For this reason, in the literature, high and rapid ERPT is often postulated among the main reasons of "fear of floating" (Calvo and Reinhart, 2002) and an effective constraint for the success of an inflation targeting (IT) policy regime (Mishkin, 2004) in emerging market countries. A stable and successful monetary policy can be achieved by establishing strong nominal anchors. A sound monetary policy stance which has a strong and credible nominal anchor assures low and stable inflation. In the literature there is a conventional wisdom that in low and stable inflation environments due to credible and successful monetary policy implementation ERPT tends to be lower (Taylor, 2000). Consistent with this argument ERPT might be expected to decline endogenously with the success of IT regime even in emerging market countries.

Starting in the early 1990s, many industrialized and emerging market countries have experienced low and stable inflation environment. Reasons of this improvement in inflation performance might be accepted as implemented credible monetary policy regimes, favorable global financial conditions and increased competitiveness with the increased financial globalization and deregulation (Bailliu and Fujii (2004); Rogoff (2004)). On the other hand, the recent pass-through literature, bulk of which is based on advanced industrialized countries, often finds that ERPT declined considerably during the last two decades (Gagnon and Ihrig (2004); Mishkin and Schmidt-Hebbel (2007)). Following Taylor's (2000) hypothesis, this may be interpreted as a result of global decline in inflation rates with the increase in financial globalization and a shift towards more credible monetary policy regimes.

Since the pioneer implementation of IT by New Zealand in 1990, a growing number of industrial and emerging market countries used this regime as a nominal anchor to maintain price stability objective. For this reason, adoption of IT regime as a monetary policy framework might have played an important role in achieving low and stable inflation environment and low ERPT levels. Moreover, since IT regime is based on anchoring inflation expectations, successful implementation of this regime weakens the indexation behavior and the role of exchange rate as a nominal anchor. Through this channel changes in the exchange rates become less important in price setting process and ERPT is expected to decline. Since indexation behavior is common in emerging market countries which have high and persistent inflation environment, adoption of IT regime might have contributed more for the recent decline in ERPT level in these countries. However, the number of studies investigating the relationship between ERPT and IT regime especially in developing countries is very limited and recent exception is provided by Edwards (2006). Edwards (2006) uses quarterly data for the period 1985-2005 for seven countries – two advanced and five emerging market - and finds that ERPT declines after the adoption of IT regime.

An important problem with the studies investigating the impact of IT on ERPT is that IT was widely adopted during a favorable economic environment for many countries not just inflation targeters. Stock and Watson (2004) state that the recent favorable economic environment should not be attributed only to implemented good policies, it is the fortuitous result of good luck. Such that the period of IT adoption often coincides with the period of global disinflation and thus the basic cause of the ERPT decline may not be clearly identified. The common global developments in economic environment make it difficult to identify the marginal contribution of IT regime (Walsh, 2009). In this context, Mishkin and Schmidt-Hebbel (2007) compares the performance of some IT countries with thirteen non-IT industrial countries such as Germany and USA which are the most successful countries in macroeconomic and monetary performance and finds that IT countries have not done better in terms of ERPT. As the number of countries in the control group is very limited excluding developing countries and contains some Euro-area countries with fixed exchange rate regimes, such results appear to be interpreted with a caution.

In this study, we aim to investigate the impact of IT and the recent global disinflation on ERPT using quarterly data from 1980:1 to 2009:1 for 51 industrial and emerging market countries. To be able to clearly identify the marginal

contribution of IT regime, we consider also data for a considerably large number of non-IT countries and investigate whether the decline in the ERPT is significantly higher in IT countries during the global disinflation era of the 1990s and 2000s. We also test whether ERPT is invariant to domestic aggregate demand conditions, degree of openness to trade and exchange rate regime in industrial and emerging market countries. In addition, we compare the impacts of IT regime on industrial and emerging market countries. Since during the recent global financial turmoil although high level of depreciations have experienced in many IT countries, inflation levels have remained at low levels; lastly we try to determine the responsiveness of ERPT coefficients to changes in the domestic demand conditions under IT regime.

The rest of this study is organized as follows. Chapter II presents a brief review of the literature on ERPT. In this chapter we basically discuss the definition and determinants of ERPT. Moreover, in this chapter we discuss the reasons of differences in ERPT of industrial and emerging market countries. After explaining the importance of ERPT for monetary policy implementation, lastly we summarize the recent developments in ERPT levels. Chapter III focuses on the impacts of IT regime on ERPT. In this chapter, we firstly discuss the recent literature on the relationship between ERPT and IT. Then we explain the importance of ERPT in IT regime and discuss the role of IT regime in declining ERPT levels. Chapter IV is devoted to data description and empirical results for 51 industrial and emerging market countries' quarterly data for the 1980:1-2009:1 period. In empirical part of our study, we employ not only the conventional panel data estimation methods but also the recent Common Correlated Effects Pooled estimation procedure by Pesaran (2006) which allows estimating the impact of common global shocks such as global inflation. Finally, Chapter V concludes this study.

CHAPTER II

EXCHANGE RATE PASS-THROUGH

II.1 Definition of Exchange Rate Pass-Through

Exchange rate pass-through (ERPT) is the responsiveness of prices (consumer prices or import prices) to the exchange rate movements. Definition of ERPT is based on the principle of purchasing power parity (PPP). PPP maintains that the real exchange rate must be constant in the long run. The real exchange rate (λ) is the ratio of foreign to domestic prices expressed in the same currency, that is $\lambda = EP^*/P$ where E is the nominal exchange rate of domestic currency per unit of foreign currency, P^* is the foreign price index expressed in foreign currency and P is the corresponding domestic price index. This definition implies that when the real exchange rate is constant, a country with a higher rate of inflation than the rest of the world must have a depreciating currency, whereas a low-inflation-rate country will have an appreciating currency. Hence, the differential between the home and foreign inflation is offset by the change in the exchange rate (Rogoff, 1996). This principle is known also as the relative purchasing power parity. On the other side, there is a much stronger version of this principle named as the absolute purchasing power parity. A key ingredient in the logic behind the absolute purchasing power parity is "the law of one price". The "law of one price" asserts that under perfect competition in domestic and international goods markets and with no barriers to trade, the domestic currency prices of similarly traded goods produced at home and abroad are the same. Consequently, "law of one price" implies that the real exchange rate (λ) equals to unity and as a result the similar traded goods sell for the same price in different countries ($P=EP^*$). Under the absolute purchasing power parity, the price level move one to one with the changes in the exchange rate in other words there will be full pass through from exchange rate to the price level.

However, pass-through literature argues that any form of PPP is seldom supported by empirical evidence. There are plenty of alternative explanations for the failure of the PPP hypothesis[1]. One of the explanations is the "pricing to market"[2] which refers to the case that firms sell the same product for different prices in different markets. "Pricing to market" indicates that an exporting firm charge prices in the export market by considering its competitors' pricing strategies in the local market. As a result of this, the exporting firm may not -fully- reflect the cost or exchange rate changes in the prices that it set in the export market (Krugman, 1987). In literature, this behavior is mostly related with the exporting firm's monopolistic power and exporting firms' ability to adjust markups of price over marginal cost in response to cost or exchange rate changes. For instance, in the case of depreciation of the currency of the importing country, the exporting firm might reduce markups and stabilize the prices in the currency of the importing country.

Consequently, "pricing to market" phenomenon states that different pricing strategies of exporting firms might induce different prices for the same product in different countries. As a result, PPP may not be hold. Furthermore, under "pricing to market" phenomenon since prices are not fully adjusted with the exchange rate changes, one might expect low level of ERPT. On the other hand, if the importing firms set prices in the currency of the producer then the home country currency price of the imported good will move one to one with changes in the exchange rate and there will be full pass-through from exchange rate changes to domestic currency import prices. This situation is defined as "producer currency pricing (PCP)".

In literature, different pricing strategies of firms induce to different definitions of exchange rate pass-through for industrialized and emerging market countries. While for industrialized countries ERPT is defined as the impact of exchange rate on the local currency import prices, for emerging market countries ERPT is defined as the impact of exchange rate on consumer prices. Since emerging market

[1] Some of the them are: i) Imperfect competition ii) The choice of the price indices: The price indices of different countries may not include the same basket of goods with the same weights as a result they may not be comparable. iii) Non-tradable and non-homogenous goods: The price indices include non-tradable (such as services) and non-homogenous goods(for instance due to differing national standards). iv) Transportation costs v) Tariffs vi) Nontariff barriers: Rogoff (1996) states that for instance some countries impose strict inspection requirements on food imports and this leads to different prices for the same goods. vii) Balassa- Samuelson Effect: Productivity differentials between countries may lead to different prices for the same products. For more detailed discussion of the factors that lead to deviations from PPP, see Rogoff (1996) and Dornbusch (1985).

[2] "Pricing to market" is also named as local currency pricing in the literature.

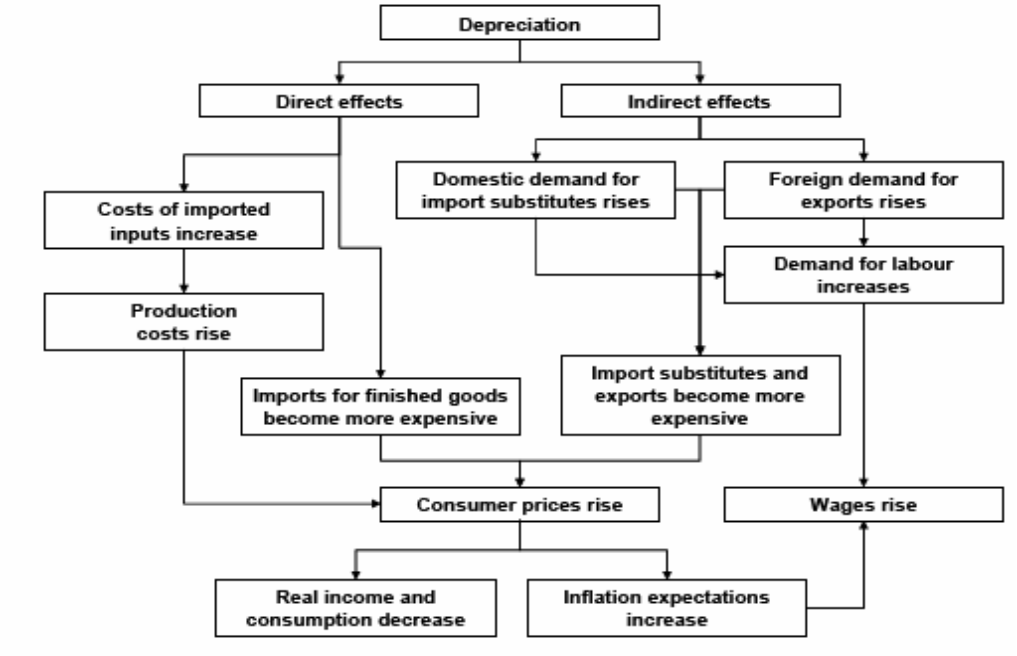
countries are small open economies, pricing to market will be small which means there will be full pass-through from exchange rates to local currency import prices (Kara *et al*., 2007). As a result, for emerging market economies considering ERPT as the impact of exchange rate on consumer prices will be more revealing. On the other hand, since for most of the emerging markets local currency import price data is not available, the impact of exchange rate changes on the consumer prices rather than import prices are taken in the empirical analysis of ERPT for emerging market countries.

II.2 Direct and Indirect Effects of Exchange Rate Changes

In pass-through literature under these definitions it is tried to explain transmission of the exchange rate changes to prices. As mentioned above, depending on the monopolistic power of the firms, the local currency import prices are adjusted with the exchange rate changes. Since imported goods are included in the basket of consumer price index, any fluctuation in the exchange rates also affects directly the consumer prices. Furthermore, changes in the exchange rate have also impact on cost of production via the cost of imported inputs. For instance, emerging market countries use imported intermediate goods in the production process. By assuming limited substitution between imported and domestic inputs in these countries, exchange rate changes lead to changes in the cost of production. Then these changes in the cost of production will be reflected directly and rapidly to prices of domestic goods. Since changes in the exchange rate are directly reflected in prices, ERPT to local currency import prices and imported input prices might be accepted as the direct effect of exchange rate changes on inflation (Figure II.1).

Besides, changes in the exchange rate have also impact on inflation expectations. This effect might be accepted as the indirect effect of exchange rate changes on prices. As seen from Figure II.1, this channel works over a longer period of time. Since in the long run fluctuations in the exchange rate have impacts on the competitiveness of a country, this will lead to changes in the composition of aggregate demand between domestic and import-substitute goods. For instance, with depreciation of domestic currency domestic demand for import substitutes and foreign demand for export goods rise and all these lead to increase in the demand for domestically produced goods. As a result of increase in demand, import

substitutes and export goods will become more expensive and consumer prices will rise.



Source: Buddhari and Chensavasdijai (2003).

Figure II.1: Direct and Indirect Effects of Domestic Currency Depreciation on Consumer Prices

On the other hand, shifts in the demand will be reflected by adjustment of domestic production level and consequently inflation expectations of wage bargainers and price-setters will change with the fluctuations in the exchange rate. In addition, as Nogueira (2006) interprets, ERPT reflects expected effect of monetary shocks on the current and future costs. Therefore, in price setting process, firms will take into account of the influence of the exchange rate changes on the expected values of future costs and future inflation. By this way, changes in the exchange rate will also lead to changes in the inflation expectations.

Cost of production and inflation expectations channels of ERPT might also be explained by "indexation behavior". In a persistent inflationary environment, it is less likely that the exchange rate movements are taken as transitory and more likely that economic agents have more sensitivity to exchange rate fluctuations in price setting process and inflation expectations. In literature, this behavior of

economic agents is known as “indexation”. In line with “indexation behavior” Ca’Zorzi *et al.* (2007) states that the more persistent the inflation, the less the exchange rate movements are taken as transitory and the more firms respond via price adjustments. As a consequence all these statements point that “indexation behavior” corroborates the cost of production and inflation expectations channels of ERPT.

II. 3 Determinants of Exchange Rate Pass-Through

In this section, factors that lead to cross country differences in ERPT and changes in ERPT over time in a country will be discussed. The analytical framework that underlies the determinants of ERPT based on the pricing behavior of exporting foreign firms from microeconomic perspective (Bailliu and Fujii, 2004). Accordingly, a simple static profit-maximization problem faced by an exporting firm is examined. In this framework, we consider a foreign firm that exports its product to domestic country. The exporting firm solves the following profit-maximization problem:

$$\max \pi = e^{-1}pq - C(q) \qquad (1)$$

where π denotes profits in foreign currency, e is the exchange rate in terms of units of domestic currency per unit of foreign currency, p is the price of the good in domestic currency, C is the cost function, and q denotes the quantity demanded for the good. Solving equation (1) yields the following first-order condition:

$$p = eC_q\mu \qquad (2)$$

where C_q is the marginal cost, and μ is the mark-up of price over marginal cost. As mentioned in Bailliu and Fujii (2004) this expression shows that the domestic currency price of imported good depends on change in the exchange rate, change in the firm’s marginal cost and/or a change in the mark up level. Therefore, change in the firm’s marginal cost and/or a change in the mark up level might also affect ERPT level. These factors might be explained by the economic environment conditions of the country and might be grouped as microeconomic and macroeconomic determinants.

In literature, microeconomic factors are accepted as determinants of ERPT to import prices; whilst macroeconomic factors are taken as determinants of ERPT to

consumer prices. For instance in a study on ERPT to import prices Campa and Goldberg (2002) indicate that the most important determinants of changes in the pass-through to import prices over time are microeconomic factors. For this reason while explaining the determinants of ERPT we grouped them as microeconomic and macroeconomic factors.

II. 3.1 Microeconomic Determinants

In pass-through literature, microeconomic factors are used especially in explaining ERPT to domestic currency import prices at the sectoral or aggregate level. Demand elasticity in the market, market structure and competitiveness in the market, and composition of goods in the basket of price index are taken as microeconomic determinants of ERPT. In the following part, these factors will be discussed in detail.

II. 3.1.1 Demand Elasticity in the Market

Traditional literature suggests that ERPT to domestic currency import prices are determined by microeconomic factors and one of these factors are the demand elasticity in the market (Choudhri and Hakura, 2006). Several studies emphasize the convexity of the import demand schedule in explaining price adjustments following exchange rate changes[3]. If price elasticity of an imported good is large, then the exporting firm will not reflect the cost changes that are due to exchange rate changes to the price level. Campa and Goldberg (2002) state that if the exporters face highly elastic demand curves, they will reflect a lower percentage of exchange rate changes into the prices. Otherwise, since consumers have highly elastic imported good demand, quantity response will be high and the firm will lose its share in the market.

This channel of ERPT also depends on the degree of substitutability between domestic and imported goods that is determined by the degree of product differentiation. The theoretical explanations suggest that the lower the degree of substitutability between domestic and imported goods, the lower price elasticity of imported goods and thereby the higher the ERPT to domestic currency import prices. For instance, Dornbusch (1987) considers Dixit- Stiglitz (1977) model where product substitutability between imported and domestic good determines demand

[3] See, for example, Dornbusch (1987), Feenstra (1989) and Marston (1990).

elasticity and suggests that ERPT is larger the more differentiated (or the less substitutable) the good in the market. In the case of high substitutability, a price increase is more likely to induce consumers to switch to other variants in the market. Then, the exporting (foreign) firms are more likely to keep their prices in line with the domestic price and unlikely to pass exchange rate shocks on the prices. Instead, these firms choose to adjust their markups by absorbing exchange rate shocks. On the other hand, when the imported and domestic goods are highly differentiated namely less substitutable, exporting firms directly pass exchange rate shocks on the prices since they are less worried about losing share (Yang, 1996). Moreover, Frankel *et al.* (2005) emphasize that if ERPT is higher in a small economy, this is due to insufficiency of local substitutes for imported goods in small countries.

II. 3.1.2 Market Structure and Competitiveness

As mentioned in previous section, it is crucial whether firms set prices in the local currency where they sell the product or in the currency of where production takes place. In other words, it is important whether firms have local currency or producer currency price setting behavior. The price setting behavior of firms depends on the structure of competition in the market. Consequently, ERPT to domestic currency import prices depends on the structure of competition in the industry (Campa and Goldberg, 2002).

Behavior of the other firms in the market is essential for the structure of competition. For instance, Greenspan (1999) point that under more competitive environment, firms lose pricing power and they are unwilling to react to exchange rate changes. Due to the fact that, if they change prices their competitors will not follow and they will lose the market share and profits. All these indicate that, the more competitive environment provides the less ERPT to domestic currency import prices. Furthermore, Mihaljek and Klau (2008) state that the globalization of economic activity increases competition thereby globalization reduces the pricing power of dominant firms in the tradable sector. In such a competitive environment, firms may absorb temporary cost increases that are due to exchange rate movements and may not reflect exchange rate changes in prices, thereby ERPT will be lower.

On the other hand, in order to capture market and competitiveness structure in the economy, some studies included real GDP in empirical analysis (Campa and

Goldberg, 2002). Since higher income countries are more competitive and large economies, one expects a negative relation between real GDP and ERPT coefficient. However, a statistically significant relation could not be found.

II. 3.1.3 Composition of Goods in the Basket of Price Index

This factor should be especially used in explaining changes in the ERPT to import and consumer prices over time in the country. As mentioned previously, different market structures and competitiveness in the market lead to differences in ERPT at disaggregated level. Consequently, over time any sectoral shift in imports and consumer goods lead to change in the ERPT to import and consumer prices at the aggregated level. Campa and Goldberg (2002) indicate that without changes in the competitive structures of industries, change in the composition of import and consumption bundles over time may lead to change in the degrees of ERPT in the country. For instance, decline in the relative weight in overall imports of energy and raw materials may be accepted as the main reason of the recent decline in the ERPT to import prices. In studies on ERPT to five industry categories (food, manufacturing, energy, raw materials, and non-manufactured goods) for OECD countries, Campa and Goldberg (2005, 2006) state that in explaining changes in ERPT into aggregated import prices, the sectoral composition of a country's imports have been more important than other variables such as macroeconomic volatility. Furthermore, they point that change in the sectoral composition of a country's import is a structural reason and more robust variable in explaining changes in ERPT level.

Since basket of consumer price index include imported goods, shifts in the consumption basket through more imported goods, especially from "high pass through" imported goods to "low pass through" ones might lead to decline in ERPT to consumer prices.

In empirical analysis, in order to capture differences in the consumption basket, Ho and McCauley (2003) included per capita income as a determinant of ERPT by referring Engel's law which states that the consumption share of food declines as income rises. This statement indicates that in higher-income economies services which are non-traded goods have large share in consumption basket. As a consequence of this, higher-income country prices are less sensitive to exchange rate. Since low-income countries include more traded goods in the consumption basket they will be more responsive to exchange rate changes.

Empirical findings support Engel's law and indicate that there is a negative association between per capita income and ERPT level.

II. 3.2 Macroeconomic Determinants:

In the pass-through literature, macroeconomic factors are used especially in explaining ERPT to consumer prices. Monetary policy stance, inflation performance, degree of trade openness, domestic demand conditions, exchange rate regime and exchange rate flexibility are often postulated as the main macroeconomic determinants of ERPT. In the following part, these factors will be discussed in detail.

II. 3.2.1 Monetary Policy Stance

A stable and successful monetary policy can be achieved by establishing strong nominal anchors. In turmoil times, when the economy is hit by shocks, strong nominal anchors help the monetary authority to shape the expectations of economic agents. If the nominal anchor is weak or there is no nominal anchor, the economy will be buffeted by the nominal shocks thereby there will be an unstable monetary framework. Consequently, "…what really matters for successful monetary policy is establishing a strong nominal anchor" (Mishkin and Schmidt-Hebbel, 2007).

Mishkin (2008) emphasizes that ERPT will be high in an unstable monetary policy environment in which nominal shocks induce both high inflation and exchange rate depreciation. A monetary policy stance that is sufficiently responsive to inflation deviations retains inflation from the effects of shock that cause the exchange rate to depreciate. This monetary policy environment will persist as long as the monetary authority successfully anchors the economic agents' expectations with responding aggressively to shocks that have persistent adverse effects on inflation and inflation expectations. Mihaljek and Klau (2008) states that such a monetary policy stance also increases the willingness of firms to absorb exchange rate fluctuations by adjusting their markup levels. Besides, Gagnon and Ihrig (2004) argue that if central bank's responses are correctly realized by the economic agents, it is less likely that cost increases due to exchange rate changes will be pass-through prices. Therefore, monetary policy stance has important implications on price setting behavior of firms. For instance, under more credible

monetary policy regime, importing firms will change prices less frequently. Consequently, exchange rate changes will be reflected on prices less frequently and ERPT will be lower[4] (Devereux and Yetman, 2003).

In theoretical framework, by using new open-economy macroeconomic models Gagnon and Ihrig (2004) and Choudhri and Hakura (2006) derive a negative association between ERPT to consumer prices and the degree of monetary policy reaction to short-run price deviations from the long run path. Since ERPT contains expected effect of monetary shocks on current and future inflation, a monetary policy stance which respond aggressively to price deviations and also strictly based on inflation stabilization leads to decline in ERPT (Choudhri and Hakura, 2006).

In order to give empirical evidences for the relationship between monetary policy stance and ERPT, Gagnon and Ihrig, (2004) estimate ERPT coefficients and forward-looking Taylor type policy rules for 20 industrial countries for the period of 1971-2003. Then cross country ERPT coefficients are estimated on the monetary policy parameters however no statistically significant relationship between these variables could be found. For each country the sample is divided in two parts according to monetary policy changes and then the same procedure is applied for each sub-sample. Then changes in ERPT coefficients across the two sub-samples are estimated on the changes in the monetary policy parameters and a statistically significant relationship could be found. These findings are considered as ERPT might decline the most in countries where monetary policy emphasize more on stabilizing inflation (Gagnon and Ihrig, 2004).

On the other hand, Devereux *et al*. (2004) indicates that ERPT is related to the relative stability of monetary policy. Stability of monetary policy is defined in terms of volatility of monetary aggregate growth rates. Key results of this theoretical study show that there is a positive association between countries' relative volatility of money growth and relative ERPT levels. Since volatile money growth leads to instability in both the exchange rate and price level, there will be a close link between inflation and exchange rate depreciation in the presence of a monetary shock.

[4] Devereux and Yetman (2003) state that ERPT depends on the degree of price stickiness that is endogenous to monetary policy stance. Higher price stickiness which is a consequence of "tighter" monetary policy provides lower ERPT.

II. 3.2.2 Inflation Performance

A sound monetary policy stance which has a strong and credible nominal anchor assures low and stable inflation. Thereby, the level and variability of inflation may provide clue about the soundness of monetary policy. As a result, an indirect way of exploring relationship between monetary policy and ERPT is to determine the link between ERPT and the inflation performance (Gagnon and Ihrig, 2004).

In literature, Taylor's (2000) argument that low inflation implies low ERPT is crucial in explaining the relationship between ERPT level and inflation environment. Taylor (2000) states that pass-through of cost changes into prices can not be taken as exogenous to a country's inflation performance[5]. Degree of pass-through of cost changes into prices is interpreted as pricing power of firms. In order to determine the link between inflation level and pricing power, Taylor (2000) used microeconomic model of staggered price setting in imperfect competition. Theoretical results point that there is a positive relation between pricing powers of firms and expectations level of the persistence of price and cost movements. In other words, if firms expect that cost changes are more persistent, they are more willing to reflect them on prices. Moreover, by estimating auto regressions for the quarterly inflation rate in the United States, econometric evidence of decline in the persistence of inflation in low inflation period is demonstrated. The period is divided in two parts, one is for higher inflation period (1960-1979) and the other is for period of lower and stable inflation (1982-1999). By comparing the sum of auto regression coefficients, it is concluded that persistence of cost and price changes is lower when inflation rate is lower. For instance, exchange rate changes may be taken as more transitory when inflation is more stable. Consequently, Taylor (2000) suggests that the monetary policy that provides low inflation environment will lead to decline in ERPT through decline in the persistence of cost and price changes. On the other hand, Taylor's hypothesis points a virtuous circle of lower inflation and lower ERPT. Low inflation environment leads to decline in ERPT and lower ERPT helps to sustain low inflation environment. However, if the low inflation environment ends for instance by a persistent adverse price shock, low ERPT environment disappears.

[5] While explaining pass through of cost changes, Taylor (2000) did not use exchange rate. Cost changes due to exchange rate changes or other factors such as increase in the price of inputs are considered.

In literature, Choudhri and Hakura (2006) test Taylor's hypothesis that low inflation leads to low ERPT to domestic prices. With the aim of giving empirical evidence, a large database that contains 1979-2000 data for 71 countries is used. In this study, countries are classified in three groups (low, moderate and high) based on the average inflation rate. Then for each group by estimating current domestic inflation on lagged domestic and foreign inflation and change in the exchange rate, ERPT coefficient is determined. It is found that average pass-through is the lowest for the low inflation group and highest for the high inflation one. Moreover, in order to examine the effects of average inflation and other macroeconomic variables such as inflation variability, exchange rate variability and the degree of openness on ERPT level, for each inflation group ERPT coefficients are regressed on average inflation rate, the variance of inflation, the variance of exchange rate change and the import of GDP ratio respectively. Empirical results indicate that average inflation is the dominant macroeconomic variable in explaining ERPT differences.

Moreover, Devereux and Yetman (2003) empirically show that the mean of inflation and ERPT degree have a positive but non-linear relation. They indicate that mean inflation increases the degree of ERPT but at a decreasing rate. For instance, when inflation reaches a certain threshold level, further increases in mean inflation will not affect ERPT. They also point that high inflation and low inflation countries show weaker relation between mean inflation and the level of ERPT.

On the other hand, in a study on ERPT to import prices in emerging markets Mihaljek and Klau (2001) found counter arguments for Taylor's hypothesis. Their empirical results suggest that lower persistence of inflation in the emerging markets associated with the higher exchange rate pass through. They could not find an intuitive explanation why this relation holds but point that it is fairly robust. These results might be interpreted that lower persistence of inflation may be due to volatile inflation and this may lead to high and unstable inflation environment.

Campa and Goldberg (2002) state that inflation environment is not the first order determinant of ERPT to import prices since although there is a low inflation environment in OECD countries; decline in ERPT is not experienced. They provide an alternative argument to Taylor's hypothesis which contains that decline in ERPT will be missed if low inflation environment disappears. They argue that if industrial composition of traded goods changes, ERPT will be more robust to inflation

changes. As mentioned previously, since they examine ERPT to import prices, they approach in microeconomic perspective.

II. 3.2.3 Degree of Trade Openness

Degree of trade openness of a country is another macroeconomic determinant of ERPT. However, in pass-through literature a common argument on the net effect of trade openness on ERPT level has not been found yet.

There is a conventional wisdom that when a country is more open to the rest of the world, it is expected that consumption basket of this country includes more imported and exported goods. As a result, consumer price index will be more sensitive to exchange rate movements due to changes in import and export prices. Especially, this transmission channel will be stronger if the country is a small open economy. In other words, the country which is more open and smaller, it will have higher ERPT to import and consumer prices (Soto and Selaive, 2003). For instance, Campa and Goldberg (2002) state that ERPT will be higher if the exporters are large in number relative to local competitors.

However, when the effect of openness to trade on inflation level is considered, the association between openness to trade and ERPT becomes more complicated. Romer (1993) finds theoretical and empirical evidence that more openness of a country to trade leads to decline in inflation level. Then with Taylor's hypothesis that low inflation leads to low ERPT, there will be negative association between degree of openness to trade and ERPT. Moreover since openness to trade increases with globalization of economic activity, it also increases competition between domestic and foreign firms. In order to maintain market share, foreign and domestic firms will be unlikely to reflect exchange rate changes on prices. As a result, ERPT will be lower when a country is more open to trade with rest of the world.

Consequently, openness to trade affects ERPT through two opposite channels. The net effect depends on which channel is dominant for a country. Although, in theoretical framework plausible explanations can be made for openness to trade as a macro-determinant of ERPT, it has weak empirical support. For instance, in a panel study for 71 countries, Goldfajn and Werlang (2000) take openness to trade (by taking the sum of exports and imports as a percentage of GDP) as a determinant of ERPT however they could not find a robust relation. The effect of openness on ERPT is found as more sensitive to the sample and horizon

chosen. Moreover, in studies on ERPT in emerging market countries Ca'Zorzi *et al*. (2007) and Ho and McCauley (2003) find that the correlation between openness to trade and ERPT is statistically insignificant.

II. 3.2.4 Domestic Demand Conditions

Demand conditions in the market have important implications in pricing behavior of firms. To be able to reflect cost changes in prices, demand conditions should be strong. If there is a strong demand in the market, it will be easier for firms to respond cost changes due to exchange rate fluctuations via price adjustments. On the other hand, if there is weak demand conditions, even though cost pressures occur firms will unlikely to reflect these changes on prices. For instance, in recent global financial turmoil, although most of the emerging markets have experienced high level of depreciation in domestic currency, since demand conditions have been weak, inflation levels have remained in low levels.

In pass-through literature, as a proxy for demand conditions generally output gap is included into inflation models from which ERPT coefficient is estimated (Bailliu and Fujii, 2004; Goldfajn and Werlang, 2000). Since output gap is the deviation of output from potential output, it gives information about the demand conditions in the market. While positive output gap provides appropriate environment for pass-through of cost changes in prices, negative output gap environment may not be appropriate for price adjustments due to cost changes. Thereby, ERPT level to domestic prices may be different from each other for the presence of negative or positive output gaps in the economy. For instance, in a panel study for 71 countries Goldfajn and Werlang (2000) have pointed that when the economy is booming, growing above its potential level; depreciations have a higher ERPT to domestic prices. In addition, in a study on ERPT in Brazil da Silva Correa and Minella (2006) found that ERPT is higher when the economy is growing faster.

II. 3.2.5 Exchange Rate Regime and Exchange Rate Flexibility

In general it is expected that ERPT will be higher if exchange rate is taken as a nominal anchor to inflationary expectations. Especially in countries which have high and persistent inflation environment domestic currency loses its function of being unit of account and store of value, and consequently exchange rate

movements will have more weight in the expectation formations. In such an environment in price setting process firms will take exchange rate changes as a reference and there will be “indexation behavior” (Ize and Parrado, 2002; Honohan and Shi, 2001). All these point that in firms’ price setting behavior exchange rate regime is important. Under a managed and crawling peg since exchange rate changes are taken as more permanent, indexation behavior will be more. However, under floating exchange rate regime since movements in the exchange rate are unforeseeable there will be less indexation behavior and firms are unlikely take exchange rate movements as a reference in price setting process. Since under floating exchange rate regimes there is always probability of reversing movements in the exchange rate, firms do not choose to reflect changes in the exchange rate to prices directly and rapidly. In a study on New Zealand economy Steel and King (2004) investigate the effect of the choice of exchange rate regime on the level of ERPT. It is argued that shifting floating exchange rate regime in 1985 lead to dramatic declines in ERPT. Steel and King (2004) also consider the effect of inflationary environment changes on ERPT and find that the later shift to low inflation environment has not contributed to the level of ERPT. Then, it is suggested that shifting to a more volatile exchange rate regime alone is the determinant of ERPT in New Zealand.

In addition to exchange rate regime, volatility in the exchange rate is also essential in the determination of ERPT. In a study on ERPT into import prices for 23 OECD countries Campa and Goldberg (2005) emphasize that by country levels of ERPT are significantly higher in countries with higher nominal exchange rate variability however several studies in pass-through literature indicate that there is a negative association between exchange rate volatility and level of ERPT. For instance, Krugman (1989), Froot and Klemperer (1989) and Taylor (2000) argue that in an environment where exchange rate fluctuations are less persistent, firms are less likely to pass-through changes in the exchange rate. With fear of losing market share they wait to see whether this change in the exchange rate is permanent before adjusting prices. Consequently, more volatile exchange rate regimes lead to decline in ERPT level. Actually decline in ERPT by shifting floating exchange rate regime verifies this channel. In pass-through literature there are several studies that indicate decline in ERPT level with adoption of flexible exchange rate regimes (Kara *et al*. (2007, on Turkey), Guinigundo (2008, on the Philippines)).

II.4 Exchange Rate Pass-Through in Industrial and Emerging Market Countries

In literature on ERPT, there is a conventional argument that ERPT is higher in emerging market countries than industrial ones. For instance, in an empirical study Calvo and Reinhart (2000) find that average ERPT in emerging market countries are four times larger as in industrial countries. Reasons behind this argument lie on different macroeconomic and microeconomic environment in these countries as explained in previous section. In pass-through literature, some extra factors are also used in the explanation of higher ERPT in emerging market countries. In this part of study, factors that lead to differences in ERPT between emerging market and industrial economies will be discussed.

From microeconomic perspective, since emerging market countries are small and open economies, "pricing to market" behavior will be small and producer currency pricing will be dominant in price setting process. Thereby, change in exchange rate will be fully transmitted to prices. Furthermore, since these economies are small economies, there will be insufficiency of local substitutes to imported goods. Besides, market structure in emerging market economies is less competitive than industrial economies. Consequently, all these factors indicate that ERPT to domestic currency import prices will be higher in emerging market countries from microeconomic perspective.

From macroeconomic perspective, previous studies give similar evidences to our arguments. Since most of the emerging market countries have high and persistent inflation environment, in line with Taylor's hypothesis, we expect higher ERPT in emerging market countries. For instance, in a study on the comparison of ERPT to import and consumer prices between 12 emerging market countries and a benchmark of developed countries Ca'Zorzi *et al*. (2007) emphasize that ERPT into both consumer and import prices are always higher in emerging countries than industrial ones however low-inflation emerging economies especially the Asian emerging countries have small ERPT to consumer prices[6]. On the other hand, Ho and McCauley (2003) in a study on IT emerging markets found a positive but not very significant relationship between inflation environments and pass through. Pass-through literature also points some other macroeconomic determinants as the reason of higher ERPT in emerging market countries. For instance, Schmidt-Hebbel and Werner (2002) states that pass-through from exchange rate

[6]Ca'Zorzi *et al*. (2007) especially state that this result is hold only when the outlier countries Argentina and Turkey were excluded.

depreciation to inflation is larger in emerging market economies than in industrial economies due to low central bank credibility, history of high inflation and high degree of openness in emerging market countries.

As Honohan and Shi (2002) state in a high and persistence inflation environment, as in most of the emerging market economies, domestic currency loses its role as a “unit of account” and “store of value”. In such an environment, economic agents shifts part or full of their economic activities into foreign currency. They will have foreign currency denominated asset and liabilities in their balance sheets. Thereby, since any change in the level of exchange rate will lead to change in the financial position of agents, movements in the exchange rate will be followed closely by economic agents. Therefore, in anchoring expectations the role of exchange rate becomes more evident. In such an environment, firms will be more willing to pass-through exchange rate changes into prices. Consequently, since emerging market economies are more sensitive to changes in the exchange rate due to such vulnerabilities, it is expected that ERPT will be higher in emerging market economies. In addition, Honohan and Shi (2002) report a tight relation between dollarization and ERPT for a large number of emerging market countries. They find that ERPT to prices is higher with higher dollarization. However, in literature on ERPT, as Ho and McCauley (2003) state that “there is the question of whether dollarization is a determinant of ERPT in its own right or is in fact, together with ERPT, jointly derived from a common factor, such as inflation history”. In the study on the IT emerging market countries, they find a weak relationship between dollarization and ERPT.

For emerging market economies, the extent of initial overvaluation of the real exchange rate (real exchange rate misalignments) is also defined as an important determinant of ERPT (Goldfajn and Werlang, 2000; Mihaljek and Klau, 2008). Real exchange rate misalignments are included as a control variable in inflation models and it is defined as deviation of the real effective exchange rate from its long-term equilibrium trend which is estimated by a Hodrick-Prescott filter. The real exchange rate misalignment captures trending movement of real exchange rates and non-equilibrium deviations from this trend (Mihaljek and Klau, 2008). For instance, if there is an overvaluation of domestic currency, it can be corrected by change in the relative price of tradable to non-tradable goods. These large depreciations for the purpose of correction of real exchange rate misalignment would not lead to change in the prices. However, large depreciations that are not lead to adjustments in real exchange rate would either influence inflation or reverse itself through a future

nominal appreciation (Goldfajn and Werlang, 2000). In a study on ERPT in emerging market countries, Mihaljek and Klau (2008) point that if these effects are ignored, given the recent observed tendency of real exchange rates to appreciate, ERPT might be under estimated. In a consistent manner, for several emerging market countries which have experienced real exchange rate appreciation, controlling for real exchange rate misalignment leads to increase in the level of ERPT. Moreover, Golfajn and Werlang (2000) state that the degree of initial overvaluation of the real exchange rate is the most important determinant of inflation in emerging market countries.

II.5 Why is Exchange Rate Pass-Through Important?

In monetary policy framework, there are many reasons in order to take into account ERPT in policy implementations. Firstly, the degree of pass through is important for forecasting inflation and deciding on degree of policy response to a monetary shock such as the depreciation of the domestic currency. For instance, decline in degree of pass through of cost changes that are due to exchange rate movements helps to keep inflation low under the strong demand pressures (Taylor, 2000). As Choudhri and Hakura (2006) imply that low ERPT contributes greater freedom for pursuing independent monetary policy. Since low ERPT leads to low expenditure switching effect, monetary authority will be more effective in responding shocks (Campa and Goldberg, 2002).

According to so-called “Impossible trinity” argument, policymakers can choose at most two of the following three policy stance: fixed exchange rate, capital mobility and independent monetary policy. As a consequence, in international macroeconomic literature there is an agreement that flexible exchange rate regime provides ability to conduct independent monetary policy in an open economy. However this relation is not valid for emerging market economies since they have higher ERPT to prices. A relatively high degree of ERPT for emerging market countries is accepted as a rationale for these countries’ exchange rate policy stance (Frankel *et al*., 2005). Under high ERPT to prices, with the aim of price stability, central banks in emerging market countries have to follow closely changes in the exchange rates and as Mishkin (2000) points, most of the emerging market countries are reluctant to ignore exchange rate movements in policy implementations. For instance, with the aim of smoothing volatile movements in the exchange rate, exchange rate bands or frequent interventions in

the foreign exchange markets might be implemented. Furthermore, even option of conducting an independent monetary policy might have limited value and therefore a strong fixed regime could be superior to a floating exchange rate regime. Besides, high and rapid ERPT is often postulated among the main reasons of "fear of floating" in emerging market economies (Calvo and Reinhart, 2002). Consequently, high level of ERPT is a constraint for an independent monetary policy and degree of ERPT has also implications in the implementation of exchange rate regime.

On the other hand, in a study on Israel economy, Fischer (2006) addresses a counter argument which states that a tight link between exchange rate and prices improves monetary policy efficiency when inflation is hit by the shocks other than depreciation of currency. Since with globalization and liberalization of regimes, exchange rate becomes more sensitive to interest rate differentials and then higher ERPT provides rapid response of monetary policy instrument to a price shock. By this way for an unexpected price shock, policy instrument could be used in order to bring down the inflation (Eckstein and Soffer, 2008). On the other hand, ERPT is important because it has effects on international transmission of shocks. As well-known, exchange markets are generally unstable. In the movements of exchange rate, not only domestic conditions but also factors that are exogenous to a small economy play essential role. With high level of ERPT to prices, passing this instability to local prices is not a likely development (Eckstein and Soffer, 2008). Accordingly, lower ERPT provides decline in inflationary pressures coming from abroad.

Another reason for considering ERPT in monetary policy implementation is related to the role of exchange rate in determination of trade balance. For instance, depreciation improves current account deficit and part of this improvement comes from the decline in the imported quantity because of increased domestic price of imported goods, which is due to transmission of currency depreciation to domestic currency import prices. Then in the case of high level of ERPT to domestic prices, the real exchange rate will not be changed by nominal devaluations. Therefore, emerging market economies with an open current account may have a limited ability to conduct an independent monetary policy (Hausmann *et al*., 2001)[7]. The effect of exchange rate on the determination of trade balance is also known as the

[7] Hausmann *et al*. (2001) states that "Original Sin"-limited ability to borrow long-term in domestic currency either domestically or abroad- is another constraint for implementation of independent monetary policy in emerging economies.

role of exchange rate as a "shock absorber". Edwards (2006) states that ERPT does not only affect inflation but also the role of exchange rate as a "shock absorber". By considering the domestic relative price of tradable to non-tradable goods definition of real exchange rate, as an effective "shock absorber" in the depreciation of the nominal exchange rate, the real exchange rate should increase in order to create expenditure switching effect. Decline in ERPT to non-tradable goods prices and/or increase (or at least not decline) in ERPT to tradable goods prices increase the effectiveness of exchange rate as a "shock absorber". One should note that role of exchange rate as a "shock absorber" depends on differences in the level of responses of tradable and non-tradable good prices to exchange rate[8]. In this case, higher ERPT to tradable goods than non-tradable goods is desired.

Besides, in literature several studies take ERPT as a contributor to dollarization. For instance, Honohan and Shi (2002) use minimum variance portfolio model which postulates that if the real exchange rate is more stable, real income will be more protected against unexpected shocks when denominated in the foreign currency. Since high levels of ERPT leads to real exchange rate remain stable, it also contributes to dollarization. In a theoretical framework, Ize and Parrado (2002) find that dollarization declines in response to an increase in the volatility of real exchange rate, that may be succeed by the help of low level of ERPT. Furthermore since with higher ERPT real value of liability declines much when there is depreciation Calvo and Reinhart (2000) states that "while a high pass through is undesirable from inflation controlling view, it helps the cushion the effects of depreciation (or devaluation) when there is high level of liability dollarization".

II.6 Recent Developments in Exchange Rate Pass-Through Levels

Recent pass-through literature often declares that ERPT declined considerably during the last two decades. For instance, Taylor (2000) states that in 1990s consumer prices showed little response to exchange rate movements even in small economies where imported goods are used as intermediate inputs in production and also have large fraction in consumption basket. In literature the

[8] On the other hand, Artis and Ehrmann (2006) states that "exchange rate can act as a shock absorber only if an economy is hit by an asymmetric shock with respect to its trading partner". One can expect that with increase in globalisation that countries hit by symmetric shocks, the role of exchange rate as a"shock absorber" declines.

most popular evidences for the decline in ERPT are given as the experiences of United Kingdom and Sweden in 1992 and Brazil in 1999. In these countries, although domestic currency had high level of depreciation, consumer price inflation showed less response. Besides, the common belief of decline in ERPT shared by monetary authorities in many industrialized and emerging market countries. In a BIS questionnaire, ten out of fifteen emerging market country central banks declared a recent decline in ERPT (Mihaljek, Klau, 2008). The amount of decline in ERPT is stated from about one-third (Colombia, Israel, Peru and Turkey) to one half (Poland) or even more (Thailand).

All these developments have led to a growing interest on investigating the reasons of decline in the level of ERPT to prices. In parallel with determinants of ERPT there are many arguments on this issue. For instance, Mihaljek and Klau (2001) suggest that shifts in ERPT are result of two main effects such as greater macroeconomic stability and wide-ranging structural reforms like domestic deregulation, foreign trade and investment liberalization implemented in the emerging markets during the 1990s. Also they point that these reforms made production of goods and services globally more integrated thereby competition increased and to pass on price increases resulting from currency depreciation become difficult for firms.

As Mishkin and Schmidt-Hebbel (2007) state that the fall in inflation levels is part of worldwide trend in 1990s and both industrial and emerging market countries experienced significant declines in inflation levels. Decline in inflation is attributed to implemented credible and independent monetary policies. Moreover, increased competitiveness with the increased globalization and deregulation might be accepted as the main reasons of the decline in inflation in early 1990s (Rogoff, 2004). Following Taylor's (2000) hypothesis that low inflation implies low ERPT, in pass-through literature most of the studies -bulk of which for industrial countries- attributed recent decline in ERPT to the recent low inflation environment. Some of these studies will be summarized below.

For instance, Gagnon and Ihrig (2004) examine this issue for 20 industrial countries for the period between 1971 and 2003. For each country they first divide the sample into two sub-samples by assigning break date which is chosen exogenously according to inflation data and changes in monetary policy regime for each country. For the majority of countries break date points nearly to the end of 1980s and beginning of 1990s. Gagnon and Ihrig (2004) declare that for each

country the mean rate of inflation is lower after the break date (in the second sub-sample). Then, by using quarterly consumer price index, trade weighted exchange rate and trade weighted consumer price index for each country ERPT coefficients are estimated. The results show that there has been decline in ERPT in the second sub-sample. Moreover, in order to capture the link between inflation environment and ERPT, cross country ERPT coefficients are estimated on the mean rate of inflation rates for the full period. The results indicate that about one-third or more of cross country variation in the ERPT might be explained by change in the inflation environment. In addition to these, in order to give inter-temporal evidences, changes in ERPT coefficients across sub-samples are regressed on changes in the mean rate of inflation level and a statistically significant link is found. As a consequence of these results, in line with Taylor's hypothesis Gagnon and Ihrig (2004) argue that ERPT falls as the average rate of inflation falls and attribute the recent decline in ERPT to the recent disinflation period.

Sekine (2006) estimates ERPT of six major industrial countries (United States, Japan, Germany, United Kingdom, France and Italy) using a time-varying parameter with stochastic volatility model for the period 1974:1-2004:4. In this study, ERPT is divided into two parts as first-stage pass through and second-stage pass through. The first-stage pass through reflects the response of domestic currency import prices to exchange rate fluctuations while the second-stage pass through shows the impacts of import price movements on the consumer prices. This study points that both stages of pass-through have declined over time for all the sample countries. In addition, this study examines whether the decline in ERPT is associated with the inflation environment in the sample countries. It is found that while the decline in second-stage pass-through is related to the low and stable inflation environment, this relationship is weak for the first-stage pass-through.

On the other hand, Bailliu and Fujii (2004) investigate the question of whether recent decline in ERPT is a result of decline in inflation level by using panel data for 11 industrialized countries over the period from 1977 to 2001. The study employs multiple break test developed by Bai and Perron (1998) to investigate the presence of breaks in inflation series for each country in the sample. More than one break dates are found for most of the countries. Then Bailliu and Fujii (2004) checked whether time of these changes in inflation is coincided with changes in monetary policy regimes. For majority of countries while the first break date points to the early 1980s, the second one points to the early 1990s coinciding with monetary policy changes during the period. Then, it is argued that whereas the aim

of policy changes in 1980s are on reducing inflation from 1970's high levels, 1990's policy changes aim at achieving and maintaining low and stable inflation levels. In estimation process of ERPT structural breaks in inflation environment are taken into account by identifying dummies for each of them. Then these dummies are interacted with the exchange rate. The estimation results reveal that ERPT decline with the low inflation period in 1990s however there is no such a shift following a similar episode in the 1980s. Bailliu and Fujii (2004) explain these findings by comparing the monetary policies implemented in 1980s and 1990s. It is pointed that since changes in the monetary policy regime adopted in 1990s are taken as more credible than those of 1980s and also overtime the credibility of implemented monetary policies is acquired then even though in 1980s inflation falls, ERPT did not decline. These findings might also be considered as low inflation environment is not sufficient for the decline in ERPT also credible monetary policy regimes should be adopted in order to acquire favorable effects of low inflation environment on ERPT.

In the literature, in addition to low inflation environment, another reason of recent decline in ERPT is also suggested as the greater exchange rate flexibility especially in emerging market countries. In the BIS questionnaire, one of the main reasons for decline in ERPT is defined as greater exchange rate flexibility by central bank authorities in emerging market economies (Mihaljek and Klau, 2008)[9]. In a study on monetary transmission mechanism in Colombia, Vargas (2008) suggests that ERPT started to fall in 1991 when the flexible exchange rate arrangements are begin to hold. It is argued that under flexible exchange rate regimes changes in the exchange rate are transmitted to prices only if they are considered as persistent and also since floating exchange rate regime brings uncertainty about the level of the exchange rate, ERPT declines substantially with adoption of flexible exchange rate regimes in Colombia. Furthermore, in a study on pass-through in Turkish economy Kara and Öğünç (2005) attribute decline of ERPT to the adoption of floating exchange rate regime. During the 1990s Turkey implemented crawling pegs or real exchange rate targeting regimes. Such regimes lead exchange rates to be taken as a nominal anchor since under less volatile exchange rate regimes probability that agents consider changes in exchange rates more permanent is higher. As a result of these, also under such regimes indexation behavior in price setting is more common. Consequently, Turkey had high level of

[9] In a BIS volume on monetary transmission mechanism in emerging economies, Başçı *et al*. (2008) for Turkey and Guinigundo (2008) for Philippines suggest greater flexibility in exchange rate as one of the main reasons for the recent decline in ERPT.

ERPT during 1990s. After 2000-2001 financial crises, Turkey left the real exchange rate targeting regime and started to implement floating exchange rate regime. Under floating exchange rate regime the value of the exchange rate determined in the foreign exchange rate market according to demand and supply conditions. Therefore, predicting whether any change in the foreign exchange rate is persistent or transitory is not possible. Shifting from real exchange rate targeting to floating exchange rate regime weakens the role of exchange rate as a nominal anchor. Consequently, ERPT declines with the adoption of more flexible exchange rate regime in Turkey.

CHAPTER III

EXCHANGE RATE PASS-THROUGH and INFLATION TARGETING

As mentioned in the previous part, the recent decline in ERPT is mostly explained by change in the inflation environment. However, the number of studies investigating the relationship between ERPT and monetary policy regimes is very limited. As Bailliu and Fujii (2004) point that low inflation environment is not sufficient also credible monetary policy regimes should be adopted in order to realize decline in ERPT. Eichengreen (2002) and Schmidt-Hebbel and Werner (2002) argue that declining ERPT in recent years is a by-product of credibility gains of monetary policy regimes. Moreover, following the credible monetary policies, countries which have historically high level of ERPT experienced significant level of declines in ERPT in last two decades (Mishkin, 2008). Under credible and stable monetary policy regimes, monetary authorities act in order to maintain price stability objective. Thereby, under such a framework inflation expectations are expected to be much more anchored and this case might help monetary authorities to reduce the responsiveness of prices to exchange rate movements. Consequently, implementing a credible monetary policy regime like IT regime might affect the level of ERPT.

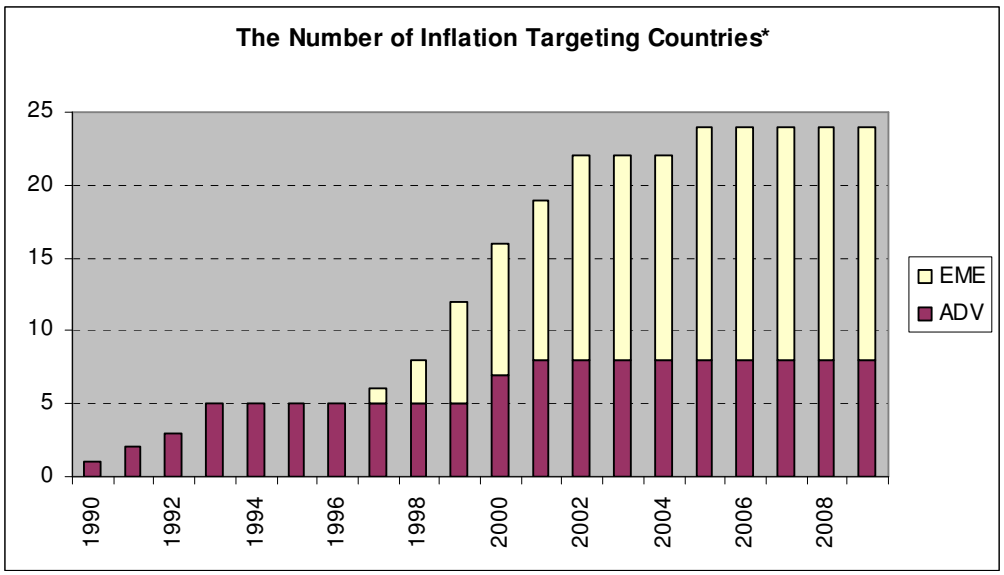
III.1 Recent Literature on ERPT and Inflation Targeting

By using VAR approach Leiderman *et al*. (2006) show that with the adoption of IT regime ERPT declines in Peru. They also state that since the level of ERPT is endogenous to the policy regime and the key policy target variable becomes less volatile, the implementation of IT regime leads to decline in the level of ERPT. Moreover, in a study on 20 industrial countries Gagnon and Ihrig (2004) state that for IT countries while ERPT is higher than that for the non-targeting countries in pre-targeting period, ERPT fell below the average ERPT or the other countries with the adoption of inflation targeting regime. This finding is accepted as the result of stricter and credible monetary response to inflation with IT regime.In addition to

these studies, by using panel data approach for twenty-one industrial and emerging market IT countries, Mishkin and Schmidt-Hebbel (2007) find that ERPT declines with the adoption of IT regime. In this study also the performance of IT countries is compared to a control group of thirteen non-IT countries such as Germany and United States which are the most successful countries in macroeconomic and monetary performance in the world. Then, comparison results show that IT countries have not done better in terms of ERPT. In this study, Mishkin and Schmidt-Hebbel (2007) also group the sample countries as emerging market and industrial ones and also distinguished the IT countries as stationary targeters in which the inflation target is stationary and converging targeters in which inflation targets are converging to the long run equilibrium value. Furthermore, differences in the group behavior of inflation targeters and non-targeters and among targeters changes in the level of ERPT between pre- and post- IT periods are tested by making statistical inferences from panel data estimations, panel vector autoregressive models and panel impulse responses. On the other hand, the estimation results show that inflation response to exchange rate movements have not significantly changed with the adoption of IT in the full sample of inflation targeters. However, stationary-target inflation targeters experienced a larger decline in ERPT levels. They also point that industrial inflation targeters (after IT) and industrial stationary inflation targeters experienced a significantly lower ERPT than either emerging market inflation targeters (after the adoption of IT) or emerging market stationary inflation targeters. While all industrial inflation targeters have ERPT levels that are close to zero and insignificant, emerging market groups have positive and significant ERPT levels. It is also claimed that in industrial inflation targeters the adoption of both IT and stationary-target IT have not lead to change in ERPT compare to their own pre-targeting period and experiences of non-targeters after 1997 which is accepted as the average IT adoption date. In addition Mishkin and Schmidt-Hebbel (2007) declare that in emerging market countries ERPT declined after the adoption of stationary IT however ERPT is still significant in those countries while it becomes insignificant in non-targeting countries after 1997. They also conclude that emerging market inflation targeters and stationary inflation targeters have higher level of ERPT than non-targeting countries. It is also pointed that these results are highly dependent on country groups. As the number of countries in the control group is very limited and does not contain developing countries, the results appear to be interpreted with a caution.

III.2 The Importance of Exchange Rate Pass-Through in Inflation Targeting Regime

With the aim of providing low and stable inflation environment, central banks used nominal anchors as basis of monetary policy. Nominal anchors help central banks to build a credible monetary policy environment. With change in economic environment, various nominal anchors are used in history. Mostly used nominal anchors are gold-exchange standard which means fixing domestic currency to value of gold or a common currency such as pound sterling or US dollar (Freedman and Laxton, 2009). However with the collapse of Bretton Woods system and great increases in the global inflation in the first half of 1970s monetary authorities especially in industrialized countries began to search for new nominal anchors. First, in order to achieve stable and low inflation many central banks try to anchor monetary policy by targeting a monetary aggregate. However, because of instability in the money demand function these regimes did not work successfully. On the other hand, some countries used exchange rate targets as a nominal anchor. In the beginning of 1990s some countries such as United Kingdom, Finland and Sweden had to abandon exchange rate targeting due to market pressures. Also in mid-1990s and early 2000s many emerging market countries experienced currency crashes. Again a nominal anchor that implemented in order to provide low and stable inflation environment did not work. Then monetary authorities decided to use inflation itself as a nominal anchor instead of using other tools like monetary aggregates and foreign currency as nominal anchors for maintaining price stability. Then, IT regime firstly adopted by New Zealand in 1990 and over time a growing number of industrial and emerging market countries used this regime as a nominal anchor to maintain price stability objective (Figure III.1). In the beginning, IT was common among industrial economies then emerging market countries have started to implement this regime. As of mid-2009, 24 countries- 16 emerging market and 8 industrial - have been implementing IT regime.



*Based on *de facto* adoption dates for countries excluding Indonesia and Romania.

Source: IMF (2005) and Central Bank websites

Figure III.1: The Number of Inflation Targeting Countries

IT is a monetary policy framework which is based on public announcement of a quantitative target for inflation and the explicit acknowledgement of maintaining price stability as the main goal of monetary policy (Bernanke *et al*., 1999). Under IT regime monetary policy decisions are taken considering a wide set of variables not just monetary aggregates or exchange rates thereby it is an information inclusive strategy (Mishkin, 2004). Moreover, transparently communication with public on monetary policy decisions, plans and objectives also constitutes essential part of IT framework. In addition, accountability mechanism also plays an essential role in this monetary policy framework. In the case of monetary policy objectives not satisfied, accountability mechanism comes into place and monetary authorities have to explain the reasons of the failure to public. On the other hand, for the successful adoption of IT regime some institutional, technical and economic preconditions should be satisfied (IMF, 2005). Central bank independence and a sound financial system are defined as the institutional preconditions. Furthermore to be able to build information inclusive strategy under IT framework, a well developed technical infrastructure is needed. In addition, lack of fiscal dominance, low level of dollarization, fully deregulated prices and insensitive domestic prices to

exchange rate movements that defined as economic preconditions are needed for successful inflation control (IMF, 2005).

Since most of the emerging market countries do not satisfy these preconditions, in literature there are some arguments such that IT does not work in emerging market countries. As mentioned in previous parts, ERPT tends to be higher in emerging market countries. As Mishkin (2004) state that since high level of ERPT is an effective constraint for implementing independent monetary policy, it should be at low levels to be able to successfully adopt IT regime. In other words, high ERPT implies a greater difficulty for achieving inflation targets (Fraga, Goldfajn and Minella, (2003)).

Even though, having low ERPT is often suggested as a prerequisite for an IT regime, recent empirical findings suggest that with successful adoption of IT, ERPT might decline. For instance, in a study on the relationship between ERPT and IT in Turkey, Kara and Öğünç (2008) claim that after adoption of IT inflation expectations have structural changes such that inflation targets constitute an important part of inflation expectations and consequently domestic prices show much smaller response to exchange rate movements. In the same vein, in a theoretical study on ERPT to import and consumer prices, Bouakez and Rebei (2008) show that ERPT declines with the shift of monetary policy towards IT in Canada.

Edwards (2006) examines the effects of IT regime on the role of nominal exchange rate as a shock absorber which is related to the ERPT. Edwards (2006) claims that in literature most of the studies argue decline in ERPT as a positive development however this inflation-centered view ignores the effects of ERPT on relative prices especially on the real exchange rate. By considering the domestic relative price of tradable goods to non-tradable goods definition of real exchange rate, the effect of IT on real exchange rate is investigated for seven IT countries- two industrial and five emerging market - for the period 1985-2005[10]. The empirical results reveal that, for most of the sample countries, both ERPT in non-tradable and tradable goods prices decline with the adoption of IT and the decline in the non-tradable goods prices is larger. Therefore, these findings indicate that with the adoption of IT regime shock absorber role of nominal exchange rate increases. Besides, as the level of ERPT to non-tradable goods prices is taken as a sign for

[10] As a proxy for price of non-tradable goods Consumer Price Index and for price of tradable goods Producer Price Index are used.

"indexation" behavior, larger decline in non-tradable goods prices also suggests decline in the "indexation" behavior with the adoption of IT regime.

III.3 The Role of Inflation Targeting Regime in Declining Exchange Rate Pass-Through

As mentioned previously, limited number of studies attribute recent decline in ERPT to the adoption of IT regime. However, IT regime might lead to decline in ERPT at least through two channels (Nogueira, 2006). The first channel is by stabilizing and lowering inflation and the second one is by gaining credibility of monetary authority as an inflation fighter under IT regime. In addition to these channels, ERPT might decline through the adoption of more flexible exchange rate regimes under IT framework. In this part, these channels will be discussed in detail.

To be able to work of the low inflation channel on ERPT, the adoption of IT should firstly succeed to achieve low inflation environment. In pass-through literature, the effects of IT regime on inflation level are discussed in a limited number of studies. For instance, Mishkin and Schmidt- Hebbel (2007) state that while annual inflation levels in IT countries and non-targeting countries are very different in the late 1980s and early 1990s, the difference become insignificant with the adoption of IT regime after the 1990s. They attribute the convergence of inflation levels between targeters and non-targeters to the performance of IT emerging market countries. They also state that while emerging market countries experienced high level of decline in inflation when compared to non-targeters, they do not record better monetary policy performance relative to their control group of highly successful non-inflation targeters. Mishkin and Schmidt- Hebbel (2007) also find that IT is helpful for all country groups to move toward performance of the control group. Their results further suggest that industrial-country inflation targeters generally perform better than of emerging market-economy inflation targeters and their performance are similar to that of industrial non-IT countries.

In a study on the effects of IT on macroeconomic performance for twenty OECD countries (seven inflation targeter and thirteen non-targeter) Ball and Sheridan (2003) claim that, on average, IT does not improve macroeconomic performance. It is also suggested that in IT countries inflation fell by a larger amount than non-targeters basically due to substantially higher inflation rates of the targeters before adopting IT. The results by Ball and Sheridan (2003) based on a

regression to the mean approach does not support the hypothesis that IT improves the macroeconomic performance.

As already mentioned, the world economy have experienced global disinflation since the mid-1990s. Both industrial and emerging market countries – regardless of their monetary policy stance-- have had lower inflation environment since the mid-1990s. The global disinflation period coincides with the adoption of IT regimes in many countries pioneered by New Zealand in 1990. This fact, however, creates an important problem for the studies investigating the impact of IT on ERPT through low inflation environment channel as the impacts of low inflation and IT may not be easily identified. Consequently, whether the decline in inflation and ERPT is a part of global disinflation or a consequence of IT regime should be investigated carefully. In literature, this channel has yet to be investigated.

Another channel through which adoption of IT leads to decline in ERPT is more flexible exchange rate regimes which are indeed consistent with the adoption of an IT regime. Crawling pegs or managed exchange rate regimes appear to be implemented most of the emerging market IT countries before switching to IT. For instance, Kara and Öğünç (2008) suggest the behavior of exchange rate as a contributor to decline in ERPT after the adoption of IT regime in Turkey. Since under flexible exchange rate regimes, exchange rates can fluctuate at any direction, economic agents may not follow frequent and transitory fluctuations systematically. However, under IT regime with the strict and credible commitment to achieve inflation target, exchange rate changes are likely to be viewed by economic agents as temporary, and this channel works to weaken the ERPT (Guinigundo, 2008). However, in pass-through literature, this channels also yet to be investigated.

The last channel through which adoption of IT regime contributes to decline in ERPT is gained central bank credibility as an inflation-fighter with its implementation. For instance, in a study on Turkish economy Kara and Öğünç (2008) state that with the adoption of IT ERPT becomes weaker and slower in Turkey. One of the factors that lead to decline in ERPT is defined as the central bank credibility. This channel works through the effects on the expectation formations. As an inflation fighter, successful implementation of IT regime leads to change in the expectations formations. Under credible and successfully implemented regime, indexation behavior weakens and the role of exchange rate as a nominal anchor declines. In other words, economic agents begin to less follow

changes in the exchange rates in price setting process. Furthermore, inflation targets begin to play an important role in the expectations formations. Kara and Öğünç (2008) provide empirical evidences for the significance of inflation targets in the inflation expectations in the Turkish economy. In parallel with inflation expectations, inflation targets are taken as a nominal anchor in price setting process and fluctuations in the exchange rate will not lead to change in the inflation expectations. Then as a result of all these developments ERPT declines under IT framework.

Since low inflation and flexible exchange rates are achieved under IT framework, these channels might be accepted as the indirect effects of IT on the decline of ERPT. However, credibility of monetary policy regime is directly related to the monetary policy framework. Consequently, the credible monetary policy channel might be accepted as the basic effect of IT regime on the decline of ERPT. However, in pass through literature, the number of studies that investigate the effect of IT regime as a monetary policy stance on ERPT appears to be very limited with the recent exceptions including Mishkin and Schmidt- Hebbel (2007) and Nogueira (2006).

CHAPTER IV

EMPIRICAL ANALYSIS

In this part of the study, we empirically investigate the impact of IT on ERPT using quarterly panel data for considerably large number of industrial and emerging market countries. To this end, we also aim to identify the impacts of global disinflation and IT on ERPT for different country groupings. For industrial and emerging market countries we also explore the other determinants of ERPT in global disinflation period. This chapter also considers asymmetric effects of positive and negative output gaps as proxies for domestic demand conditions on ERPT for IT industrial and emerging market countries.

The plan of the rest of this chapter is as follows: In Section IV.1 we present country groupings and the data. Section IV.1 focuses also on the evolution of inflation, exchange rates and exchange rate regimes during the whole sample period (1980:1-2009:1) for different country groupings. In Section IV.2 we briefly give empirical framework for our analysis and then we give the empirical results. In empirical results section we firstly estimate ERPT coefficients for different country groups for the whole sample period and sub-sample periods which are defined according to global inflation trends. Then we investigate the determinants of ERPT coefficient in industrial and emerging market countries in IT period of 1990:Q1-2009Q1. In the following part, we also try to determine the effects of IT adoption as a monetary policy framework on ERPT coefficient in industrial and emerging market countries. Lastly, since the relationship between domestic demand conditions and ERPT coefficient has become more evident during the recent global financial turmoil, we examine the effects of domestic demand conditions on ERPT coefficient under IT regime.

IV.1 The Data and Country Groups

Our sample contains quarterly data for 51 countries[11]. Table IV.1 presents our country groupings used in this study. The definitions of country groups are listed as following:

ALL: This group includes all countries in our sample.

IND: This group consists of 23 industrial countries.

EME: This group consists of 28 emerging market countries.

Table IV.1: Country Groups

Inflation Targeting (IT)		**Non-Inflation Targeting (NIT)**	
IT_IND	**IT_EME**	**NIT_IND**	**NIT_EME**
Australia	Brazil	Denmark	Bolivia
Canada	Chile	Japan	Botswana
Iceland	Colombia	United States	Costa Rica
New Zealand	Czech	**Euro Area**	Georgia
Norway	Republic	**(NIT_IND_E)**	India
Sweden	Hungary	Austria	Jamaica
Switzerland	Indonesia	Belgium	Latvia
United	Israel	Finland	Lithuania
Kingdom	Korea	France	Malaysia
	Mexico	Germany	Morocco
	Peru	Greece	Russia
	Philippines	Ireland	Tunisia
	Poland	Italy	
	Romania	Luxembourg	
	South Africa	Netherlands	
	Thailand	Portugal	
	Turkey	Spain	

IT: This group includes 24 countries that have adopted IT regime as a monetary policy framework in our sample. *De facto* adoption dates of IT regime are listed in Table IV.2.

[11] Our country selection was mainly determined by the availability of the data for all the variables considered in this study. As the exchange rate changes are amongst the basic variables in our models, countries with a currency board regime, with a fixed exchange rate regime or with a pre announced horizontal band are not included in our sample.

NIT: This group includes 27 countries that have not adopted IT regime as a monetary policy framework in our sample.

IT_IND: This group consists of 8 industrial countries that have adopted IT regime.

IT_EME: This group consists of 16 emerging market countries that have adopted IT regime.

Table IV.2: IT Adoption Dates[12]

Emerging Market Countries	Date	Industrial Countries	Date
Brazil	1999:Q2	Australia	1993:Q1
Chile	1999:Q3	Canada	1991:Q1
Colombia	1999:Q3	Iceland	2001:Q1
Czech Republic	1998:Q1	New Zealand	1990:Q1
Hungary	2001:Q3	Norway	2001:Q1
Indonesia	2005:Q3	Sweden	1993:Q1
Israel	1997:Q2	Switzerland	2000:Q1
Korea	1998:Q2	United Kingdom	1992:Q4
Mexico	2001:Q1		
Peru	2002:Q1		
Philippines	2002:Q1		
Poland	1999:Q1		
Romania	2005:Q3		
South Africa	2000:Q1		
Thailand	2000:Q2		
Turkey	2002:Q1		

Source: IMF (2005) and Central Bank websites.

NIT_IND: This group consists of 15 industrial countries that have not adopted IT regime as a monetary policy framework in our sample.

NIT_IND_E: This group is a sub-group of NIT_IND group and consists of 12 industrial euro area countries that have not adopted IT regime in our sample.

NIT_EME: This group consists of 12 emerging market countries that have not adopted IT regime as a monetary policy framework in our sample.

The data used in this study excluding exchange rate regime classification series are obtained from International Financial Statistic (IFS) -the statistical

[12] *De facto* adoption dates for countries, excluding Indonesia and Romania. *De jure* adoption dates may be different.

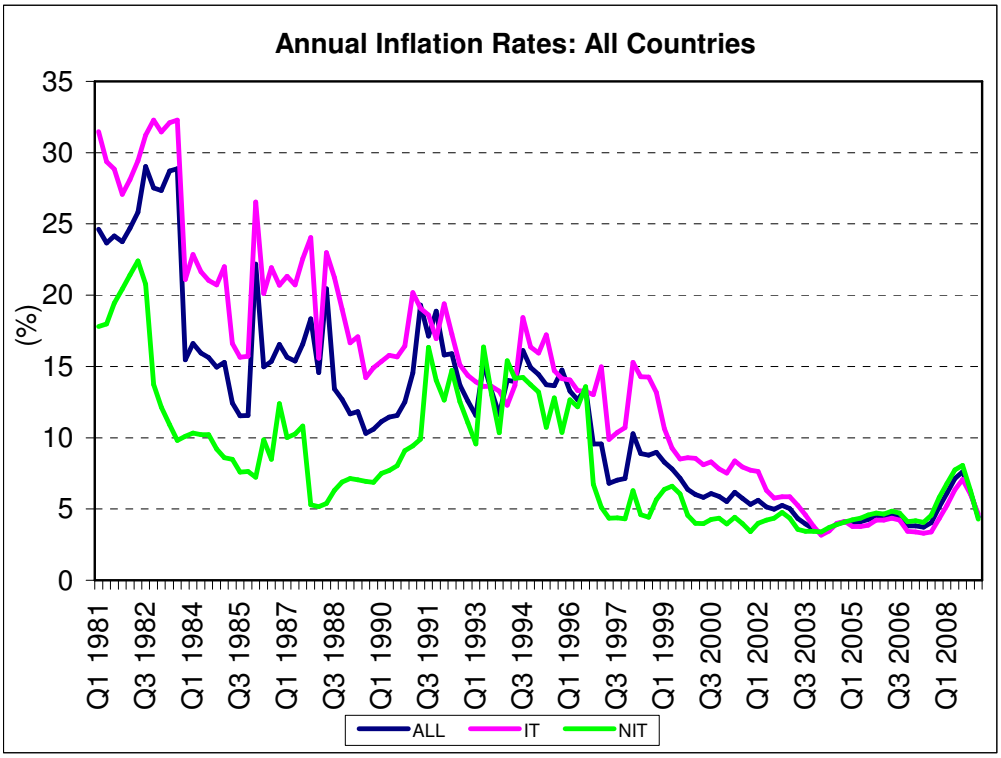
database of IMF. The *de facto* exchange rate regime classification series are from Reinhart and Rogoff (2004)[13]. All the series are quarterly. We have an unbalanced panel data set and the sample time period starts with the first quarter of 1980 and extends through the first quarter of 2009. The definitions of the series are as following:

Consumer Price Index (CPI)

Inflation rate is defined as the quarterly change in the CPI (Δp_{it}). The base year for CPI index is 2005. In the estimation process, inflation rate series for each country are computed by taking natural logarithm differences of CPI on each quarter. On the other hand, to discuss the evolution of inflation rates for different country groups over the sample period, we consider cross-sectional means (CSMs) of annual inflation rates (percentage change in CPI) in each quarter. Figures IV.1-IV.3 presents CSMs of annual inflation rates for different country groups. These figures exclude annual inflation rates above 150 % in order to reduce the outlier affects of hyperinflation or extremely high inflation episodes of relatively small number of countries.

Figure IV.1 plots the CSMs of annual inflation rates for the IT and NIT countries during the sample period. The figure suggests a substantial decline in inflation rates in all the countries after the mid-1990s. In 1980's the average annual inflation rate was about 18%, in 1990's it declined to about 12% and for 2000's it has became about 4% level. Furthermore, the fluctuation of inflation rates appears to be much smaller for all country groups after the late 1990s.

[13] We consider the "fine" classification of Reinhart and Rogoff (2004). Carmen Reinhart's web page http://www.terpconnect.umd.edu/~creinhar/Papers.html provides the data and methodology for the estimation of the de facto exchange rate regime classifications.



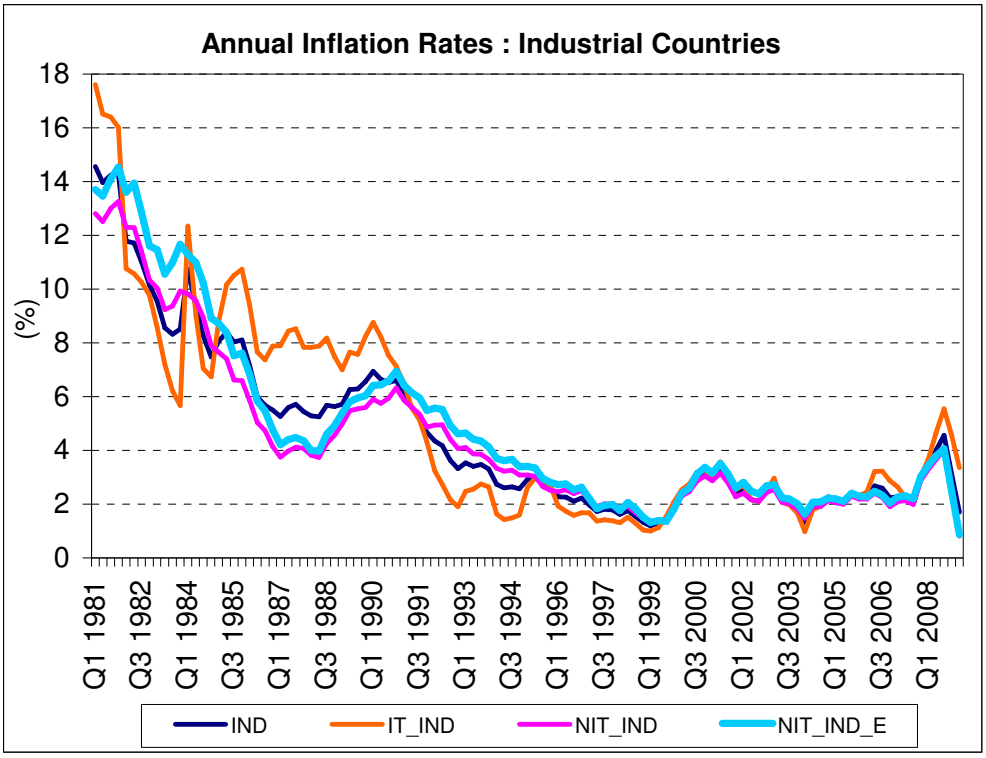
Source: IFS and own calculations

Figure IV.1: CSMs of Annual Inflation Rates: All Countries

When the inflation performance of country groups are investigated according to adopted monetary policy regimes, there has been increase in the performance of IT country group by declining inflation rates from high and unstable levels to low and stable levels in last decade. At the beginning of our sample the IT country group has had more fluctuating and higher inflation rates than NIT country group; then the gap between these country groups' inflation rates has closed in last years. For instance, in 1980's average annual inflation rate was about 23% for IT group and about 11% for NIT group, these rates in 2000's have become about 5% and 4.5% for IT and NIT groups, respectively. This appears to be consistent with the findings of Mishkin and Schmidt- Hebbel (2007) attributing the convergence of inflation levels between targeters and non-targeters to the performance of IT emerging market countries.

According to Figure IV.2, average inflation rates of industrial countries have a declining trend during the 1980s and 1990s. This decline in inflation rate became more evident during the 1990s. After an increase in the beginning of 2000s annual average inflation rate has become stationary until 2008. In the first three quarters of 2008 there has been a jump in the average inflation rate due to the sharp

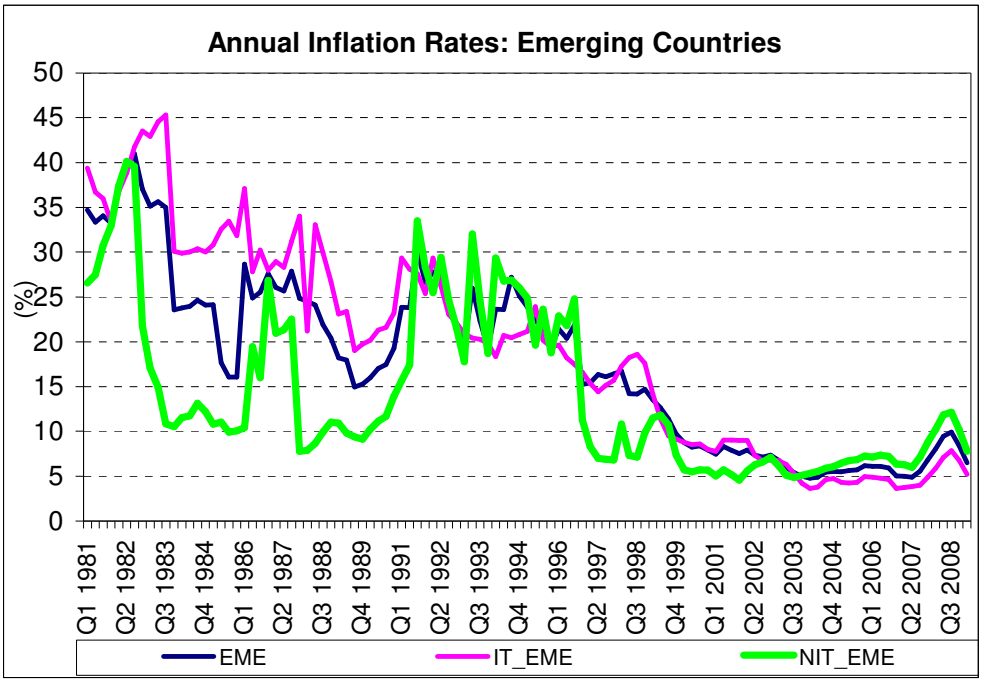
increases in energy and other commodity prices and then in the last two quarters it has declined substantially as a result of tight demand conditions due to the recent global financial turmoil.



Source: IFS and own calculations

Figure IV.2: CSMs of Annual Inflation Rates: Industrial Countries

The inflation targeting industrial (IT_IND) countries had higher and volatile inflation rates before the 1990s. These countries, however, exhibited a substantial decline in their inflation rates since 1990 with the beginning of IT regime adoption. As shown in Table IV.2, since most of the IT_IND countries started to implement IT regime in the first half of 1990s, they had better inflation performance than in other IND groups in 1990 period as seen in Figure IV.2. During the 2000s all industrial country groups have similar average inflation rates except in the last quarters. IT_IND group inflation rates have been affected more than the other IND groups from the recent global shocks. On the other hand, while NIT_IND and NIT_IND_E countries had volatile and high inflation levels in the beginning of our sample period, in the first half of 1990s it started to decline and has achieved stable and low levels in the last decade (Figure IV.2).



Source: IFS and own calculations

Figure IV.3: CSMs of Annual Inflation Rates: Emerging Market Countries

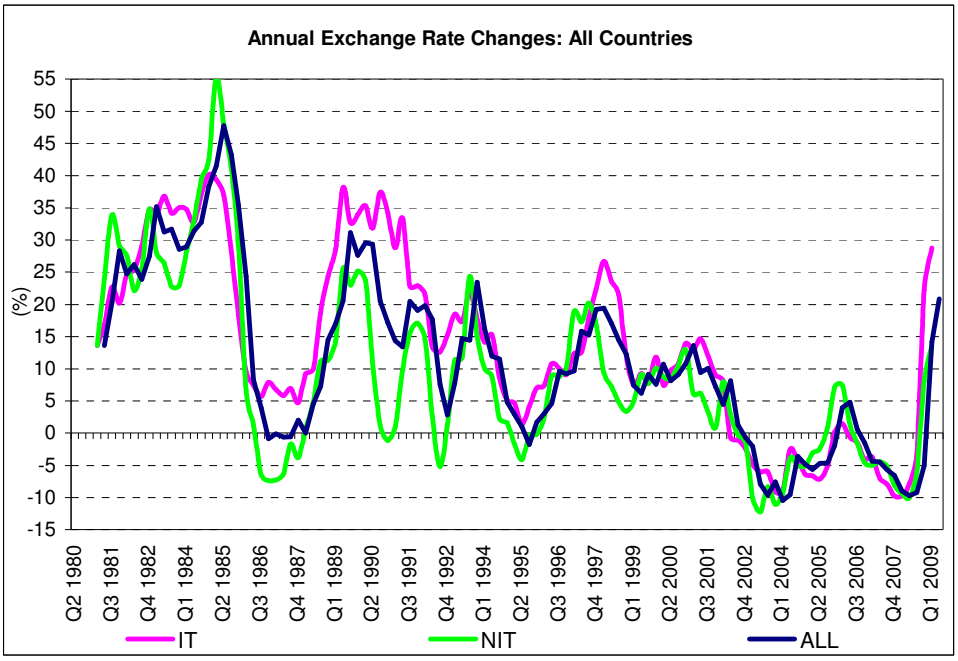
Emerging market countries experience high and volatile inflation rates during the 1980s and the early 1990s as plotted by Figure IV.3. As the other country groups, EME countries have experienced decline in both the level and volatility of inflation rates after the mid-1990s. The EME group achieved declining inflation rates from the 1980s' level of 25 % to 8 % in 2000s. Consequently, the gap between EME and IND country group inflation rates has declined substantially in the recent decades. As in the other country groups, in last decade there has been a convergence in the inflation rates of the EME subgroups. While in the beginning of our sample period inflation rate of IT_EME group was higher than that of NIT_EME group since the beginning of 1990s it has declined substantially and become lower and more stable than NIT_EME inflation rates. On the other hand, Figure IV.3 also shows that although NIT_EME average inflation rate has declined substantially from the high levels of the beginning of the sample period and has become less volatile, it has showed higher response to foreign price and demand shocks than the IT_EME group during the last decade.

To summarize, all the average inflation figures presented up to now show that there has been a global disinflation period since the mid-1990s and the level of average inflation rates converge to low levels for all sub-country groups in the last decade. That is to say, the gap in inflation rates of country groups has declined

substantially in the last decade and all countries have experienced similar inflation performances.

***Exchange Rates*:**

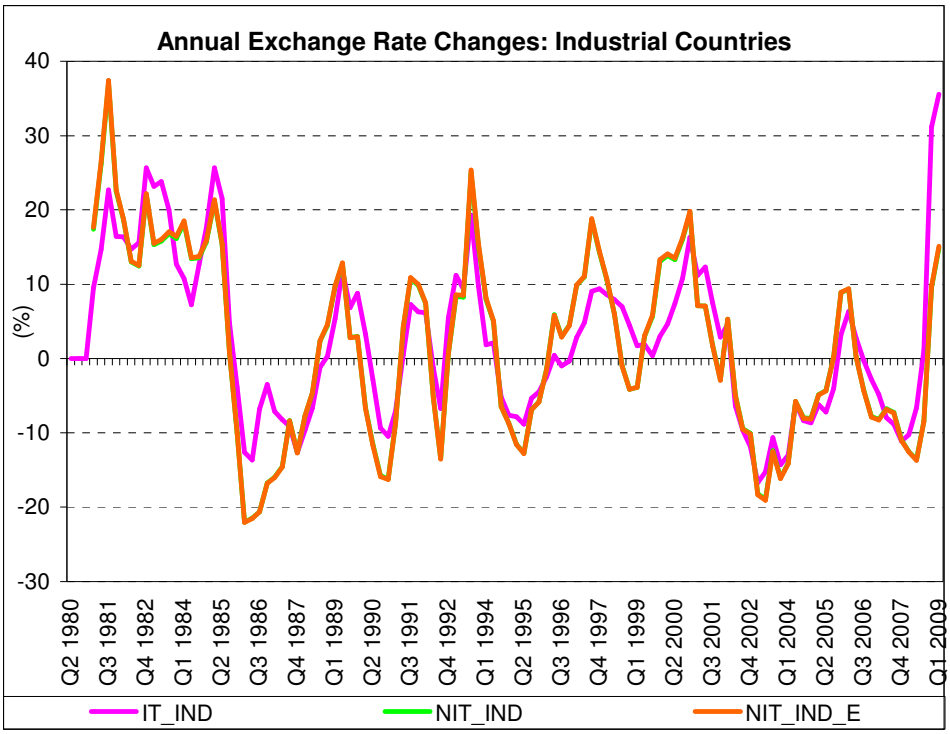
In this study, exchange rate for a country is defined as the period-average national currency units per U.S. dollar. In the estimation process, changes in exchange rate (Δe_{it}) series for each country are computed by taking natural logarithm differences of exchange rates on each quarter. On the other hand, to discuss the evolution of exchange rate changes for different country groups over the sample period, we consider CSMs of annual exchange rate changes (percentage change in exchange rates) in each quarter. Figures IV.4-IV.6 plots the CSMs of annual exchange rate changes for all country groups.



Source: IFS and own calculations

Figure IV.4: CSMs of Annual Exchange Rate Changes: All Countries

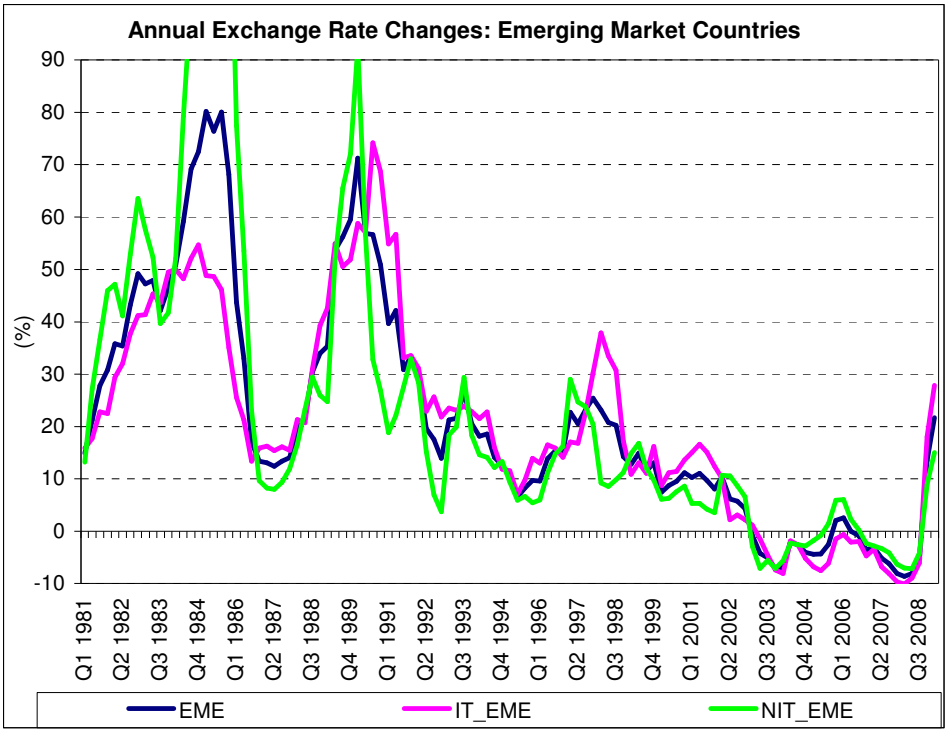
Figure IV.4 suggests that the annual exchange rate volatility have been broadly similar for the IT and NIT countries after the mid-1990s. The exchange rate volatility, however, appears to be higher in the IT countries until this period. As there was no country adopting IT before 1990, the decline in the exchange rate volatility in the IT sample may be attributed to the IT regime during the last two decades. That is to say, the adoption of IT may be interpreted as leading countries to reduce exchange rate volatility and to exhibit similar performance with the NIT countries.



Source: IFS and own calculations

Figure IV.5: CSMs of Annual Exchange Rate Changes: Industrial Countries

The exchange rate volatility of the industrial countries, on the other hand, tends to be the same for the IT and non-IT countries during the whole sample period as depicted by Figure IV.5. Consequently, the decrease in the exchange rate volatility with IT tends to be the case especially for emerging market countries. This interpretation is further supported by Figure IV.6 suggesting the annual exchange rate volatility convergence for the IT and non-IT emerging market countries during the last decade.



Source: IFS and own calculations

Figure IV.6: CSMs of Annual Exchange Rate Changes: Emerging Market Countries

Output gap

Output gap series (o_gap) are based on real GDP series (base year 2005, source: IMF-IFS). For each of the country, output gaps are defined the deviations of real GDP series (log, seasonally adjusted) from their potential levels which are estimated using the Hodrick-Prescott filter.

***Openness to Trade*:**

We compute openness to trade index by taking the percentage ratio of exports (X) plus imports (M) to gross domestic product (GDP). Openness to trade index (OPEN) equals to ((X+M)*100/GDP).

***De Facto* Exchange Rate Regimes Classification**

As the announced (*de jure*) and actually implemented (*de facto*) exchange rate regimes may differ substantially (Reinhart and Rogoff, 2004), we consider the *de facto* exchange rate classification by Reinhart and Rogoff (2004). Table IV.3 presents the *de facto* (fine grid) classification by Reinhart and Rogoff (2004). As

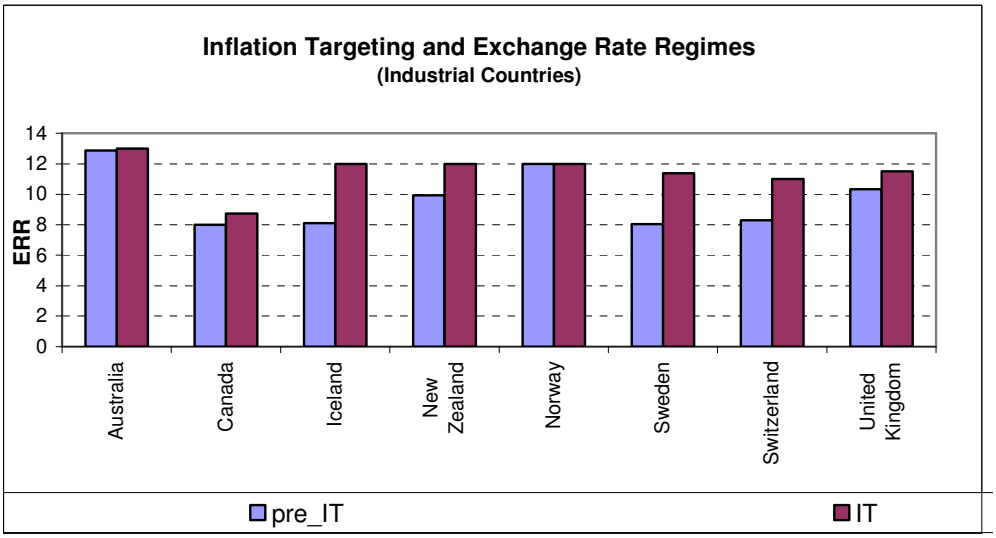
the data are available for monthly, we consider the quarterly averages of the *de facto* exchange rate regimes (ERR) classification in the estimation process.

Table IV.3: *De Facto* Exchange Rate Classification

Code	Exchange Rate Regime Classification
1	No separate legal tender
2	Pre announced peg or currency board arrangement
3	Pre announced horizontal band that is narrower than or equal to +/-2%
4	De facto peg
5	Pre announced crawling peg
6	Pre announced crawling band that is narrower than or equal to +/-2%
7	De factor crawling peg
8	De facto crawling band that is narrower than or equal to +/-2%
9	Pre announced crawling band that is wider than or equal to +/-2%
10	De facto crawling band that is narrower than or equal to +/-5%
11	Moving band that is narrower than or equal to +/-2% (i.e. allows for both appreciation and depreciation over time)
12	Managed floating
13	Freely floating
14	Freely falling

Source: Reinhart and Rogoff (2004).

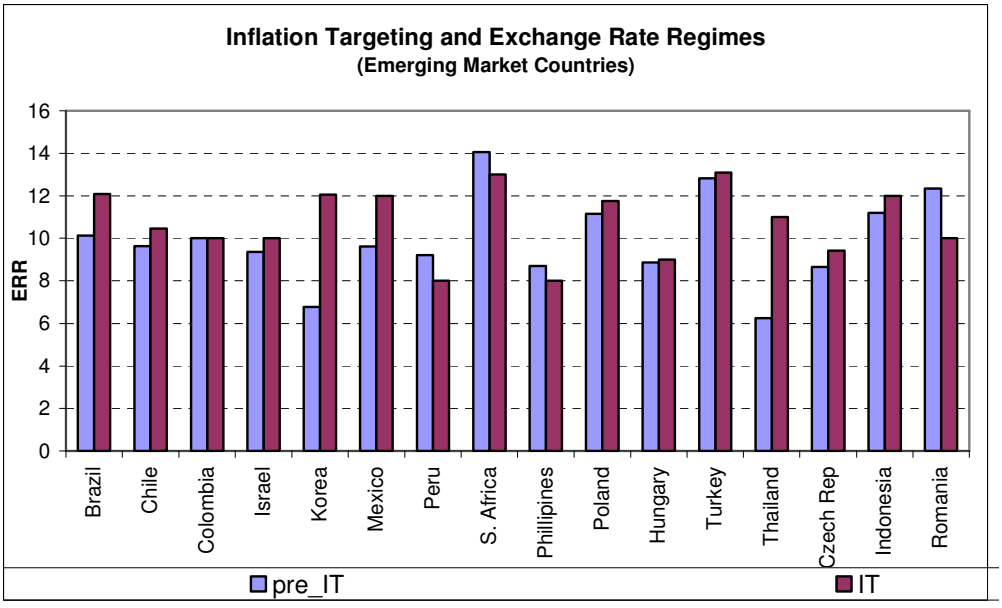
On the other hand, to discuss the evolution of exchange rate regimes with the adoption of IT, we compare average levels of ERR in pre_IT and IT periods for industrial and emerging market countries. For pre_IT period averages we take 10 year averages of ERR before IT implemented.



Source: Reinhart and Rogoff (2004).

Figure IV.7: IT and Exchange Rate Regimes in Industrial Countries

Figure IV.7 and IV.8 plots the *de facto* exchange rate regimes (ERR) for the IT emerging market and industrial countries, respectively. From the figures it may be inferred that no country applied a fixed exchange rate regime with a horizontal band after the adoption of an IT regime.



Source : Reinhart and Rogoff (2004).

Figure IV.8: IT and Exchange Rate Regimes in Emerging Market Countries

Furthermore, the exchange rate flexibility appears to be increased in all the countries except Peru, South Africa, Philippines and Romania after the adoption of IT. Peru, South Africa, Philippines and Romania may be interpreted to continue to implement their crawling peg regimes even after the adoption of IT. The results, however, are broadly consistent with the view that IT precludes a fixed exchange rate regime.

IV.2 Empirical Results

In this section we first briefly present the empirical framework of our analysis and then proceed with the presentation of our estimation results.

IV.2.1 Empirical Framework

We start by estimating the following model[14]:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + \varepsilon_{it} \quad (1)$$

where Δp_{it} is the quarterly natural logarithm difference of CPI index, Δe_{it} is the quarterly natural logarithm difference of period-average national currency units per U.S. dollar series and ε_{it} is the error term. In this model, γ_1 measures the ERPT level to consumer prices and since exchange rate series is defined as period-average national currency units per U.S. dollar, we expect this coefficient to be positive. At the beginning, we follow Gagnon and Ihrig (2004) and Edwards (2006) and do not include control variables to our model.

The recent empirical studies on ERPT often employ fixed effects estimation procedures to allow heterogeneity between the panels of the countries considered. However, common global shocks arising from crisis contagion or commodity price shocks may induce cross-section dependence in the data and thus lead to inconsistent regression coefficient estimates if they are correlated with the explanatory variables. The importance of cross sectional dependence arises also from the fact that common global shocks like increase in price of oil and commodity prices or recent global financial crisis have led to similar responses of inflation and change in exchange rate series for all country groups. This situation might induce cross-section dependence in our country groups and thus lead to inconsistent

[14] The most important challenge for the estimation of the model is the endogeneity problem of exchange rate changes. This problem might be solved by using instrumental variable estimation methods like two stage least square or generalized methods of moment. However, as Meese and Rogoff (1983) state that exchange rates are unlikely explained or predicted by standard macroeconomic variables and most exogenous variables are not highly correlated with changes in the nominal exchange rate.

coefficient estimates if they are correlated with the explanatory variables (Pesaran, 2006 and Kapetanios and Pesaran, 2007). Therefore, to take into account for cross-sectional dependence in country groups, we use the Common Correlated Effects Pooled (CCEP) estimation method by Pesaran (2006). This method provides consistent estimates in the presence of common factors and accepted as to provide the most efficient estimators (Kapetanios and Pesaran, 2007). The CCE estimators yield consistent estimates also in the presence of common factors and appears to be the most efficient and robust to alternative hypotheses of non-stationarity of variables (Coakley *et al*., 2006; Kapetanios and Pesaran, 2007 and Kapetanios, Pesaran and Yamagata, 2009). The basic idea behind the CCEP method is to filter the explanatory variables in the model by cross-section averages of the dependent and explanatory variables such that the differential effects of unobserved common factors are eliminated (Pesaran, 2006). By this way, the estimators of this method would be augmented with these cross-section averages. Therefore, to obtain the CCEP estimator of ERPT coefficient, we consider the following equation:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + c_1 csm\_\Delta p_t + c_2 csm\_\Delta e_t + u_{it} \quad (2)$$

where $csm\_\Delta p_t$ and $csm\_\Delta e_t$ denote the cross-sectional means (CSMs) of the quarterly natural logarithm differences of CPI and period-average exchange rates respectively. For all county groups, the series of $csm\_\Delta p_t$ and $csm\_\Delta e_t$ might be accepted as the quarterly global average of inflation rate and global average change in the value of domestic currency in terms of U.S. dollar, respectively. Note that, the coefficients of the CSMs do not need to have any economic meaning as their inclusion simply aims to improve the coefficient estimates of interest, in other words CSMs are included into our model to get consistent estimates. However, in our specific case, the CSMs may be attributed to contain also some important information for the evolution of inflation rates. The effect of changes in global inflation (common global shocks) may plausibly be expected to be represented by $csm\_\Delta p_t$. An increase in global inflation for instance due to an increase in price of oil will lead to also increase in the domestic inflation therefore we expect the estimated c_1 to be positive. On the other hand, changes in the global value of the U.S. dollar might be expected to be represented by $csm\_\Delta e_t$. An increase in $csm\_\Delta e_t$ reflects average global depreciation of domestic currencies against U.S. dollar and while domestic currency stays at the same level, this causes relative

appreciation of domestic currency against U.S. dollar that leads to decline in domestic inflation. Consequently, we expect the estimated c_2 to be negative. Eq. (2) constitutes our base model for ERPT estimation and this model is similar to that of Gagnon and Ihrig (2004) and Edwards (2006) by not including other control variables such as output gap, real output, price of oil etc.

IV.2.2 ERPT Estimates for the Country Groups

Our sample covers 51 countries for the period of 1980:Q1-2009:Q1. However, as mentioned in the previous parts of our study, Taylor (2000) argues that low and stable inflation environment brings low ERPT levels. As shown in Figure IV.1, inflation rates have been declined substantially and become more stable since the mid-1990s in all country groups . Following Taylor's argument, we should take into account the global disinflation environment in ERPT coefficient estimates. For this reason, in order to examine the response of ERPT coefficient to changes in the inflation environment, the sample period is divided also into two parts and ERPT coefficients are estimated for each sub-period. First sub-period contains the period of 1980:Q1-1995Q4 as a high and volatile inflation environment, while the second sub-period is defined for 1996Q1:2009Q1 period as a low and stable inflation environment. We first employ cross-section fixed effects estimation of Eq. (1) and then apply CCEP method which is obtained by the fixed effects estimation of Eq. (2) for all country groups in our sample (ALL, IND, EME, IT, NIT, IT_IND, IT_EME, NIT_IND, NIT_IND_E and NIT_EME) for the whole and sub-periods. By considering several country groups in our estimation process, we aim to reveal the marginal contribution of IT regime on the changes in the ERPT coefficient in the global disinflation period. For all country groups the estimation results for the whole period and the sub-periods are presented in Tables: IV.4-13.

Table IV.4: ERPT in All Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (4.1)	**Eq. (4.2)**	**Eq. (4.1.a)**	**Eq. (4.2.a)**	**Eq. (4.1.b)**	**Eq. (4.2.b)**
constant	0.017** (0.000)	0.002* (0.001)	0.023** (0.001)	0.007* (0.003)	0.012** (0.000)	2.75E-05 (0.001)
Δe_{it}	0.599** (0.006)	0.647** (0.007)	0.642** (0.009)	0.675** (0.009)	0.128** (0.006)	0.179** (0.007)
$csm^{ALL}\_\Delta e_t$		-0.572** (0.020)		-0.502** (0.033)		-0.179** (0.012)
$csm^{ALL}\_\Delta p_t$		0.753** (0.028)		0.574** (0.065)		0.997** (0.056)
# of Count.	51	51	50	50	51	51
# of Obs.	5485	5485	2784	2784	2701	2701
R^2	0.659	0.717	0.772	0.791	0.454	0.538
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 and 5 % levels respectively.						

For ALL country group, Eq. (4.1) estimation results suggest that an increase in the exchange rate change significantly increases inflation rates in all periods (Table IV.4). The results by Eq. (4.1.a) and Eq. (4.1.b) show the decline in ERPT level in low and stable inflation environment of the post mid-1990s. Our base model Eq. (4.2) estimation results indicate that, in the whole period, ERPT coefficient equals to 0.647 which means that net effect of 1 % increase in the exchange rate change is 0.647 % increase in the level of inflation. All coefficients have the expected signs. Such that, the net effects of 1 % increase in the global inflation level ($csm^{ALL}\_\Delta p_t$) and 1 % relative appreciation of domestic currency (with 1 % increase in the $csm^{ALL}\_\Delta e_t$) are 0.753 % increase and 0.572 % decline in the domestic inflation rates, respectively.

The results from the sub-period estimations show that in the high and volatile inflation period ERPT coefficient is higher than that of low and stable inflation period. Consistent with global declining trends in inflation rates, for ALL country group ERPT coefficient declined from the level of 0.675 to 0.179 level in the second sub-period. Besides, as seen from Table IV.4 in the second period while the effect of global inflation changes on domestic inflation has increased, changes in the global value of U.S. dollar have influenced domestic inflation less.

Table IV.5: ERPT in Industrial Countries

	1980:Q1-2009Q1		**1980:Q1-1995:Q4**		**1996:Q1-2009:Q1**	
	Eq. (5.1)	**Eq. (5.2)**	**Eq. (5.1.a)**	**Eq. (5.2.a)**	**Eq. (5.1.b)**	**Eq. (5.2.b)**
constant	0.011** (0.000)	-5.26E-05 (0.000)	0.015** (0.000)	-0.000 (0.000)	0.005** (0.000)	-1.35E-17 (0.000)
Δe_{it}	0.056** (0.005)	0.088** (0.007)	0.077** (0.007)	0.089** (0.010)	0.001 (0.004)	0.037** (0.037)
$csm^{IND}\_\Delta e_{it}$		-0.087** (0.008)		-0.086** (0.012)		-0.037** (0.007)
$csm^{IND}\_\Delta p_{it}$		1.005** (0.023)		1.011** (0.039)		1.000** (0.037)
# of Count.	23	23	23	23	23	23
# of Obs.	2619	2619	1400	1400	1219	1219
R^2	0.221	0.553	0.382	0.583	0.109	0.462
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.						

Table IV.5 reports the results for the group of industrial countries (IND). All the coefficients in the equations have the expected signs. Compared with the results by Table IV.4., the IND country group appears to have much lower ERPT coefficients for all the periods. The results by Eq. (5.1) suggest that an increase in the exchange rate change significantly increases inflation rates in the whole and first periods. However, in the low and stable inflation environment, ERPT coefficient becomes insignificant. On the other hand, our base model Eq. (5.2) estimation results show that in the whole period ERPT coefficient equals to 0.088 which means that net effect of 1 % increase in the exchange rate change is 0.088 % increase in the level of inflation. Moreover, the net effects of 1 % increase in the industrial countries inflation level ($csm^{IND}\_\Delta p_t$) and 1 % relative appreciation of domestic currency (with 1 % increase in the $csm^{IND}\_\Delta e_t$) are 1.005 % increase and 0.087 % decline in the domestic inflation, respectively. On the other hand, sub-sample estimation results indicate that in the first sub-period ERPT coefficient is higher than that of the second sub-period. Parallel to decline in the inflation levels, for IND country group ERPT coefficient declined from the level of 0.089 to 0.037 in the low and stable inflation environment. Besides, as seen in Table IV.5, in the second period, while the response of domestic inflation to changes in the foreign inflation has showed small decline, the response to changes in the global value of U.S. dollar has declined substantially.

Table IV.6: ERPT in Emerging Market Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (6.1)	**Eq. (6.2)**	**Eq. (6.1.a)**	**Eq. (6.2.a)**	**Eq. (6.1.b)**	**Eq. (6.2.b)**
constant	0.020** (0.001)	0.004* (0.001)	0.029** (0.002)	0.011* (0.005)	0.017** (0.000)	-5.170E06 (0.001)
Δe_{it}	0.682** (0.009)	0.689** (0.009)	0.712** (0.012)	0.718** (0.012)	0.408** (0.009)	0.208** (0.012)
$csm^{EME}\_\Delta e_t$		-0.522** (0.035)		-0.297** (0.063)		-0.208** (0.019)
$csm^{EME}\_\Delta p_t$		0.655** (0.034)		0.398** (0.069)		1.000** (0.059)
# of Count.	28	28	27	27	28	28
# of Obs.	2866	2866	1384	1384	1482	1482
R^2	0.714	0.748	0.805	0.810	0.454	0.552

Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.

Table IV.6 reports the results for the emerging market countries (EME). For EME country group, Eq. (6.1) estimation results suggest that an increase in the exchange rate change significantly increases inflation rates in all periods Eq. (6.1.a) and Eq. (6.1.b) estimation results strongly suggest the decline in ERPT level in low and stable inflation environment. The whole period base model Eq. (6.2) estimation results show that all the coefficients have expected signs and EME country group has higher ERPT than IND group, such that net effect of 1 % depreciation of domestic currency is 0.689 % increase in the domestic inflation rate whilst this rate is 0.088 % for IND group. Moreover, for EME group while the response to a change in the emerging market countries average inflation rates is less than IND group, domestic inflation has been more sensitive to changes in the global value of U.S. dollar during the whole sample period.

The results further suggest that, as in IND group, sub-period EME group estimation results declare the decline in ERPT coefficient with global declining trend in inflation rates. In the high and volatile inflation period ERPT coefficient was 0.718 and then it has declined to 0.208 in the second sub-period. Moreover, Table IV.6 shows that for EME group in the second sub-period domestic inflation rates have become more sensitive to changes in the foreign inflation rates and less sensitive to changes in the relative value of domestic currency to other currencies per U.S. dollar.

Table IV.7: ERPT and IT: Inflation Targeting Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (7.1)	**Eq. (7.2)**	**Eq. (7.1.a)**	**Eq. (7.2.a)**	**Eq. (7.1.b)**	**Eq. (7.2.b)**
constant	0.018** (0.001)	0.004** (0.001)	0.024** (0.001)	0.007* (0.003)	0.015** (0.000)	7.19E-06 (0.001)
Δe_{it}	0.616** (0.009)	0.651** (0.009)	0.683** (0.011)	0.698** (0.011)	0.135** (0.009)	0.171** (0.010)
$csm^{IT}\_\Delta e_t$		-0.571** (0.027)		-0.503** (0.050)		-0.171 (0.017)
$csm^{IT}\_\Delta p_t$		0.691** (0.029)		0.575** (0.052)		0.999 (0.065)
# of Count.	24	24	24	24	24	24
# of Obs.	2639	2639	1368	1368	1271	1271
R^2	0.702	0.764	0.816	0.835	0.468	0.561

Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.

As reported by Table IV.7 for the inflation targeting (IT) country group, Eq. (7.1) suggest that an increase in the exchange rate change significantly increases inflation rates in all periods and in the second period there is a substantial decline in ERPT level. Furthermore, our base model Eq. (7.2) estimation results for the whole period indicate that all the coefficients have the expected sign and IT group has high level of ERPT such that net effect of 1 % depreciation of domestic currency is 0.651 % increase in the domestic inflation rate. Moreover, the net effects of 1 % increase in the IT countries' average inflation level ($csm^{IT}\_\Delta p_t$) and 1 % relative appreciation of domestic currency (with 1 % increase in the $csm^{IT}\_\Delta e_t$) are 0.691 % increase and 0.571 % decline in the domestic inflation rates respectively.

The sub-period estimation results (Eqs. 7.1. a and 7.1.b) show that IT group have experienced a substantial decline in ERPT level in the second sub-period. Decline in the inflation rates might have play an important role in this substantial decline in the ERPT coefficient. In addition, adoption of IT regime as a monetary policy framework might have been effective. In the first sub-period, there were only 5 IT countries then this number has reached to 24 countries in our second sub-period. The adoption of IT regime by more countries might have contributed to the decline in ERPT in the second period. In the following section of our study, this issue will be discussed in further detail. In addition to these, in the second sub-period for IT group while the impact of change in foreign inflation levels on domestic inflation rates has increased, changes in the global value of U.S. dollar have influenced domestic inflation less in this period.

Table IV.8: ERPT and IT: Industrial Countries

	1980:Q1-2009Q1		**1980:Q1-1995:Q4**		**1996:Q1-2009:Q1**	
	Eq. (8.1)	**Eq. (8.2)**	**Eq. (8.1.a)**	**Eq. (8.2.a)**	**Eq. (8.1.b)**	**Eq. (8.2.b)**
constant	0.012** (0.000)	-7.84E-5 (0.000)	0.017** (0.000)	7.74E-5 (0.001)	0.006** (0.000)	8.09E-18 (0.000)
Δe_{it}	0.074** (0.010)	0.115** (0.012)	0.110** (0.015)	0.136** (0.018)	0.012 (0.007)	0.047** (0.009)
$csm^{IT\_IND}\_\Delta e_t$		-0.111** (0.015)		-0.124** (0.024)		-0.047** (0.011)
$csm^{IT\_IND}\_\Delta p_t$		1.011** (0.038)		1.000** (0.062)		1.000** (0.063)
# of Count.	8	8	8	8	8	8
# of Obs.	923	923	499	499	424	424
R^2	0.205	0.554	0.332	0.563	0.151	0.490

Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.

As in IND group, for IT_IND group Eq. (8.1) estimation results suggest that an increase in the exchange rate change significantly increases inflation rates in the whole and first periods. However, in the low and stable inflation environment, ERPT coefficient becomes insignificant (Table IV.8). On the other hand, Eq. (8.2) estimation results indicate that, throughout our sample period, IT_IND group has low level of ERPT but this level is above that of IND country group. One important thing in the whole period estimation results of our base model Eq. (8.2) is the sensitivity of IT_IND group inflation rate to change in the inflation rates of other IT_IND countries. As seen in Table IV.8, 1 % change in the average inflation rate of IT_IND countries ($csm^{IT\_IND}\_\Delta p_t$) will lead to more than 1 % change in the domestic inflation rate. On the other hand, as in the other country groups IT_IND group has experienced decline in ERPT level in the second sub-sample. The ERPT coefficient has declined from 0.136 to 0.047. Low and more stable inflation environment might have provided this decline in ERPT coefficient by confirming Taylor's hypothesis. In addition to low inflation environment also adoption of IT regime might have helped to decline in ERPT. However, in the first sub-sample most of IT_IND countries had started to implement IT regime as a monetary policy framework, only two of them have begun to implement this regime in the second sub-sample. Therefore, contribution of IT regime on the decline of ERPT might be expected to be limited in the low and stable inflation period. Moreover, in this sub-period while the responsiveness of domestic inflation to changes in the global inflation rates has not changed, response to changes in the global value of U.S. dollar has diminished (Table IV.8).

Table IV.9: ERPT and IT: Emerging Market Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (9.1)	**Eq. (9.2)**	**Eq. (9.1.a)**	**Eq. (9.2.a)**	**Eq. (9.1.b)**	**Eq. (9.2.b)**
constant	0.022** (0.001)	0.006** (0.002)	0.029** (0.002)	0.007 (0.005)	0.020** (0.000)	-1.94E-5 (0.001)
Δe_{it}	0.667** (0.011)	0.679** (0.010)	0.725** (0.014)	0.728** (0.014)	0.165** (0.012)	0.178** (0.013)
$csm^{IT\_EME}\_\Delta e_t$		-0.552** (0.036)		-0.435** (0.067)		-0.179** (0.024)
$csm^{IT\_EME}\_\Delta p_t$		0.639** (0.032)		0.509** (0.054)		1.002** (0.064)
# of Count.	16	16	16	16	16	16
# of Obs.	1716	1716	869	869	847	847
R^2	0.736	0.787	0.835	0.851	0.458	0.582
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.						

Table IV.9 reports the results for inflation targeting emerging market (IT_EME) countries. The results suggest that there is a positive association between change in the exchange rate and inflation and this relationship has become weaker in the second period. Our base model Eq. (9.2) estimation results indicate that during the sample period, as expected IT_EME group has higher ERPT than IT_IND such that net effect of 1 % depreciation of domestic currency is 0.679 % increase in the domestic inflation rate while this rate is 0.115 % for IT_IND group. Moreover, the net effects of 1 % increase in the average inflation rate ($csm^{IT\_EME}\_\Delta p_t$) and 1 % relative appreciation of domestic currency (by 1 % increase in the $csm^{IT\_EME}\_\Delta e_t$) are 0.639 % increase and 0.552 % decline in the domestic inflation respectively. On the other hand, sub-sample estimation results show that IT_EME group has experienced a substantial decline in ERPT level in the second sub-sample. ERPT coefficient has declined from 0.728 to 0.178 in this period. IT_EME group is the country group that has experienced the highest decline in ERPT level in the second sub-sample. As in the other groups, decline in inflation rates might have contributed to this decline in ERPT coefficient. However, the impact of the IT regime on ERPT coefficient also should be taken into account. Such that, while in the first period there was no IT_EME country that adopted IT regime, all of the IT_EME countries have started to implement this regime as a monetary policy framework in the second period. Furthermore, in this sub-period the responsiveness of domestic inflation to changes in the global value of U.S. dollar has diminished and domestic inflation has become much more sensitive to changes in the IT emerging market countries' average inflation rates (Table IV.9).

Table IV.10: ERPT in NIT Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (10.1)	**Eq. (10.2)**	**Eq. (10.1.a)**	**Eq. (10.2.a)**	**Eq. (10.1.b)**	**Eq. (10.2.b)**
constant	0.014** (0.000)	0.001 (0.001)	0.021** (0.001)	0.010* (0.003)	0.010** (0.000)	3.38E-5 (0.001)
Δe_{it}	0.575** (0.010)	0.650** (0.010)	0.592** (0.013)	0.649** (0.014)	0.115** (0.008)	0.207** (0.010)
$csm^{NIT}\_\Delta e_t$		-0.580** (0.026)		-0.487** (0.040)		-0.206** (0.014)
$csm^{NIT}\_\Delta p_t$		0.805** (0.044)		0.519** (0.078)		0.996** (0.068)
# of Count.	27	27	26	26	27	27
# of Obs.	2846	2846	1416	1416	1430	1430
R^2	0.591	0.666	0.711	0.739	0.394	0.540
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.						

The results reported by Table IV.10 suggest that, for NIT country group, an increase in the exchange rate change significantly increases inflation rates in all periods and in the second period there is a decline in ERPT level. On the other hand, our base model Eq. (10.2) estimation results reveal that in the whole sample period, NIT country group has higher ERPT level than IT country group but the difference has not been much. For NIT group net effect of 1 % depreciation of domestic currency is 0.650 % increase in the domestic inflation rate this rate was 0.651 % for IT group. Moreover, the net effects of 1 % increase in the average foreign inflation rate and 1 % relative appreciation of domestic currency are 0.805 % increase and 0. 580 % decline in the domestic inflation respectively. On the other hand, sub-period estimation results reveal that as in other country groups ERPT declined in the second period. However, for NIT countries decline in ERPT has occurred less than IT countries. It has declined from 0.649 to 0.207 in the second period. Although in the first sub-period IT group has higher ERPT coefficient than NIT countries, in the second period IT group has lower ERPT than NIT group. In other words, while IT group has achieved substantial declines in ERPT level, ERPT coefficient of NIT group has remained higher than IT group. In NIT countries, low and stable inflation environment has not provided decline in ERPT as much as in IT country group. Besides, in the second period NIT countries have become more sensitive to changes in the global inflation level since the coefficient of $csm\_\Delta p_t$ has increased substantially in this period and the responsiveness of domestic inflation to changes in the global inflation rates has

become around 1 % level in this period. On the other hand, in the second sub-period the responsiveness of domestic inflation to changes in the global value of U.S. dollar has diminished for NIT countries (Table IV.10).

Table IV.11: ERPT in NIT Industrial Countries

	1980:Q1-2009Q1		**1980:Q1-1995:Q4**		**1996:Q1-2009:Q1**	
	Eq. (11.1)	**Eq. (11.2)**	**Eq. (11.1.a)**	**Eq. (11.2.a)**	**Eq. (11.1.b)**	**Eq. (11.2.b)**
constant	0.010** (0.000)	3.80E-5 (0.000)	0.015** (0.000)	6.94E-6 (0.000)	0.005** (0.000)	1.97E-18 (0.000)
Δe_{it}	0.046** (0.006)	0.073** (0.009)	0.060** (0.007)	0.053** (0.012)	-0.007 (0.005)	0.011 (0.010)
$csm^{NIT\_IND}\_\Delta e_t$		-0.073** (0.010)		-0.053** (0.013)		-0.011 (0.011)
$csm^{NIT\_IND}\_\Delta p_t$		0.995** (0.025)		0.998** (0.041)		1.000** (0.041)
# of Count.	15	15	15	15	15	15
# of Obs.	1696	1696	901	901	795	795
R^2	0.236	0.604	0.441	0.666	0.085	0.486
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.						

As in other IND groups, for NIT_IND group Eq. (11.1) estimation results suggest that an increase in the exchange rate change significantly but in limited amount increases inflation rates in the whole and first periods. However, in the low and stable inflation environment, ERPT coefficient of Eq. (11.1.b) becomes insignificant (Table IV.11). Base model Eq. (11.2) estimation results show that throughout our sample period NIT_IND has the lowest ERPT coefficient in our country groups, such that net effect of 1 % depreciation of domestic currency is 0.073 % increase in the domestic inflation rate. Besides, NIT_IND group inflation rate has been highly sensitive to changes in the foreign inflation rates while the changes in the global values of U.S. dollar have been less effective on the domestic inflation rate. On the other hand, when the sub-period estimation results are investigated, it may be seen that as in other country groups ERPT coefficient has declined in NIT_IND countries in the low and stable inflation period actually it has become statistically insignificant in the second sub-period while it was in very low levels in the first period. In other words, low and stable inflation environment eliminated the responsiveness of prices to exchange rate changes in NIT_IND countries. Furthermore, as seen from Table IV.11 in this period while the impact of changes in the global value of U.S dollar on domestic inflation has become insignificant, the responsiveness to changes in the global inflation rates has increased.

Table IV.12: ERPT in NIT Euro-area Industrial Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (12.1)	**Eq. (12.2)**	**Eq. (12.1.a)**	**Eq. (12.2.a)**	**Eq. (12.1.b)**	**Eq. (12.2.b)**
constant	0.011** (0.000)	8.91E-5 (0.000)	0.016** (0.000)	6.68E-5 (0.003)	0.005** (0.000)	0.000 (0.001)
Δe_{it}	0.052** (0.006)	0.159** (0.016)	0.065** (0.008)	0.081** (0.018)	-0.007 (0.006)	0.106** (0.035)
$csm^{NIT\_IND\_E}\_\Delta e_t$		-0.159** (0.016)		-0.080** (0.02)		-0.106** (0.036)
$csm^{NIT\_IND\_E}\_\Delta p_t$		0.987** (0.027)		0.993** (0.044)		1.000** (0.045)
# of Count.	12	12	12	12	12	12
# of Obs.	1348	1348	712	712	636	636
R^2	0.229	0.631	0.438	0.679	0.052	0.478
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.						

As seen from Table IV.12 as in other IND groups, for NIT_IND_E group Eq. (12.1) estimation results suggest that in the whole and first period exchange rate changes significantly but in limited amount increases inflation rates. However, in the low and stable inflation environment, ERPT coefficient becomes insignificant. On the other hand, base model Eq. (12.2) estimation results show that throughout our sample period, for NIT_IND_E group ERPT coefficient has been 0.159 which is higher than the average of IND and IT_IND country groups in this period. Moreover, the net effects of 1 % increase in the average foreign inflation rate and 1 % relative appreciation of domestic currency are 0.987 % increase and 0. 159 % decline in the domestic inflation rate respectively. On the other hand, in contrast to other country groups, NIT_IND_E countries have experienced increase in ERPT coefficient in the second-sub sample. Decline in inflation rates have not achieved to diminish ERPT level. One of the reasons of this increase in ERPT might be accepted as the adoption of fixed exchange rate regime via joining to the Euro currency area. Furthermore, as seen from Table IV.12, in the second sub-period, both the effects of changes in the average Euro area inflation rates and in the global value of U.S. dollar on the domestic inflation rates have increased.

Table IV.13: ERPT in NIT Emerging Market Countries

	1980:Q1-2009Q1		1980:Q1-1995:Q4		1996:Q1-2009:Q1	
	Eq. (13.1)	**Eq. (13.2)**	**Eq. (13.1.a)**	**Eq. (13.2.a)**	**Eq. (13.1.b)**	**Eq. (13.2.b)**
constant	0.019** (0.002)	0.003 (0.002)	0.029** (0.003)	0.015** (0.006)	0.015** (0.000)	5.51E-05 (0.001)
Δe_{it}	0.705** (0.015)	0.710** (0.016)	0.695** (0.021)	0.702** (0.023)	0.233** (0.014)	0.282** (0.014)
$csm^{NIT\_EME}\_\Delta e_t$		-0.508** (0.057)		-0.282** (0.089)		-0.281** (0.030)
$csm^{NIT\_EME}\_\Delta p_t$		0.679** (0.054)		0.377** (0.092)		0.996** (0.075)
# of Count.	12	12	11	11	12	12
# of Obs.	1150	1150	515	515	635	635
R^2	0.682	0.721	0.763	0.771	0.448	0.596
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.						

Eq. (13.1) estimation results for NIT_EME group indicates that ERPT coefficient is significant in all periods (Table IV.13). Eq. (13.2) estimation results also reveal that throughout the sample period, NIT_EME has the highest ERPT coefficient in our country groups such that the ERPT coefficient is 0.710. Moreover, the net effects of 1 % increase in the average foreign inflation rate and 1 % relative appreciation of domestic currency are 0.679 % increase and 0.508 % decline in the domestic inflation respectively. In the second sub-sample NIT_EME country has also experienced decline in ERPT level however still NIT_EME group has the highest ERPT coefficient. Although in the first sub-sample IT_EME countries' ERPT level was higher than that of NIT_EME, they have experienced substantial decline in the second sub-sample with the contribution of decline in inflation rates and IT regime. However, NIT_EME countries could not achieve such a decline in ERPT coefficients although in the second sub-sample they have low and stable inflation rates. This situation might be accepted as an important evident of that adoption of IT regime as a monetary policy framework might lead to decline in the level of ERPT coefficient especially in emerging market countries. This issue will be discussed in detail in the following section. On the other hand, base model estimation results also indicate that in the second period NIT_EME group has become more sensitive to changes in the global inflation level since the level of $csm\_\Delta p_t$ coefficient has increased in that period (Table IV.13).

To conclude, consistent with Taylor's argument all country groups, excluding Euro area countries, in our sample have experienced decline in ERPT levels in the low and stable inflation environment of the post 1990s. The highest decline in

ERPT levels has occurred in IT group especially in IT_EME countries. Such that while in the first sub-period ERPT levels in the IT countries were higher than all country average, in the second sub-period it has stayed below the all country average. On the other hand, our estimation results also reveal that during the low inflation period in our country groups NIT group has the worst ERPT performance, especially NIT_EME group. Although they have low inflation environment as in other country groups, ERPT has not declined as much as in others. As Balliu and Fujii (2004) state that low inflation environment is not sufficient to experience decline in ERPT levels also credible and successful monetary policy regimes are necessary. This statement also explains the differences in the ERPT performances of IT_EME and NIT_EME countries in low inflation environment. Although they have similar macroeconomic conditions since NIT_EME is lack of strong nominal anchor which is maintained by a credible monetary policy framework such as IT, in this group ERPT level has not declined as much as IT_EME group.

In contrast to Mishkin and Schmidt-Hebbel (2007), our empirical results indicate that IT countries have done better in terms of ERPT than non-IT countries. Mishkin and Schmidt-Hebbel (2007) reached that result because their non-IT group as a country group is not appropriate. Actually their control group mostly coincides with our NIT_ADV group and to compare the performance of IT countries with such a control group leads to underestimate the beneflts of IT regime. They should have also included non-IT emerging market countries in their control groups. For this reason we make our empirical analyses for a large number of cross sectional units.

IV.2.3 ERPT in Inflation Targeting Period

IT period has begun with the first adoption of New Zealand in 1990 and since then a steadily increasing number of industrial and emerging market countries have explicitly implemented IT regime as a monetary policy framework. In our sample there are 8 industrial and 16 emerging market IT countries. As shown in the previous section of our study, throughout our sample period, IT countries have experienced substantial decline in ERPT levels. In this section, we will examine ERPT developments in the IT period which starts with the first quarter of 1990 and extends through the end of our sample period. In this section, firstly we will attempt to explain differences in levels and determinants of ERPT in inflation targeting industrial and emerging market country groups. Then, we will examine the impacts of IT regime on the level of ERPT for industrial and emerging market IT countries.

Lastly, we will investigate the response of ERPT coefficient to changes in the demand conditions under IT in industrial and emerging market countries.

IV.2.3.1 ERPT in Industrial and Emerging Market Countries

In pass-through literature, there is a conventional wisdom that in emerging market countries ERPT is higher than industrial ones due to different microeconomic and macroeconomic structures in those countries. In the previous section of our study we have estimated ERPT coefficients for each country group and then showed that throughout our sample period and in all sub-periods emerging market countries have higher ERPT than industrial countries. In this section we will compare ERPT levels of industrial and emerging market countries in a single model for the IT period. For this purpose, we consider the following equation:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + c_1 csm^{ALL}\_\Delta p_t + c_2\, csm^{ALL}\_\Delta e_t + \beta_1 IND*\Delta e_{it} + \beta_2 IND*csm^{ALL}\_\Delta p_t + \beta_3 IND*csm^{ALL}\_\Delta e_t + u_{it} \quad (3)$$

where csm_Δp_t and csm_Δe_t denote the cross-sectional means (CSMs) of the quarterly natural logarithm differences of CPI and period-average exchange rates for all countries, respectively, IND is the cross-sectional dummy variable that takes the value of one for the industrial countries and zero for emerging market countries. Therefore, coefficient of dummy variable IND interaction with change in exchange rate, β_1, indicates ERPT differences between industrial and emerging market countries. Besides, IND dummy variable is also interacted with the CSMs in order to explain differences in the responses to changes in the global inflation rates and global value of U.S. dollar between industrial and emerging market economies during IT period.

Table IV.14: ERPT in Industrial and Emerging Market Countries during the IT Period

	Eq. (14.1)
constant	0.002** (0.001)
Δe_{it}	0.667** (0.008)
csm_Δe_t	-0.483** (0.026)
csm_ Δp_t	0.931** (0.036)
IND*Δe_{it}	-0.625** (0.031)
IND*csm_Δe_t	0.407** (0.055)
IND*csm_Δp_t	-0.800** (0.053)
# of Count.	51
# of Obs.	4039
R^2	0.730
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.	

As seen in Table IV.14, in IT period, emerging market countries have higher level of ERPT than industrial countries. Such that, 1 % increase in the value of domestic currency per U.S. dollar leads to 0.667 % increase in domestic inflation in emerging market countries whilst this increase is 0.042 % for industrial countries. Furthermore, the estimation results for the IT period indicate that emerging market countries are more vulnerable to global developments because the impacts of changes in global inflation rates and changes in the global value of the U.S. dollar make higher response in domestic inflation rates of emerging market countries. Such that, 1 % increase in the global inflation rates lead to 0.93 % increase in domestic inflation in emerging market country group, whilst this increase is 0.8 % lower for industrial country group. On the other hand, 1 % relative appreciation of emerging market country domestic currency creates 0.48 % decline in domestic inflation rate whilst this response is 0.077 % for industrial countries. To conclude, in the IT period although much more countries have implemented IT regime in this country group, still emerging market countries have higher ERPT levels than industrial ones.

IV.2.3.2 Determinants of ERPT for Industrial and Emerging Market Countries

In this section, we aim to investigate the determinants of ERPT in industrial and emerging market countries during the IT period of the post 1990s. As already mentioned in previous sections, the determinants of ERPT to import and consumer prices are identified from microeconomic and macroeconomic perspectives, respectively. Since we examine ERPT to consumer prices, we identify ERPT determinants from macroeconomic perspective. From this perspective, ERPT determinants might be accepted as monetary policy stance, inflation environment, domestic demand conditions, openness to trade, and exchange rate regime[15]. In the previous section, we already showed that in low and stable inflation environment all country groups have experienced decline in ERPT levels. Therefore, in this section, we will attempt to identify response of ERPT coefficient to change in other factors in emerging market and industrial countries. In estimation process, we include proxy variables for these factors into our base model Eq. (2) with their interactions with the exchange rate. We also include CSMs of these variables as a requirement of CCEP estimation procedure. Note that while identifying the impacts of these factors on ERPT coefficient, the most important thing is the sign and significance of the interacted variable's coefficient.

Monetary Policy Stance and ERPT

For monetary policy stance, we consider whether or not IT regime has been adopted as a monetary policy framework. Then, as a proxy variable for monetary policy stance we define a dummy variable IT which takes the value of one at the time of IT is adopted and zero otherwise. In order to determine the effects of IT regime on ERPT coefficient we interact this dummy variable with change in the exchange rate. Then for industrial and emerging market countries, we estimate the following model:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + \alpha_1 IT^* \Delta e_{it} + c_1 csm\_\Delta p_t + c_2 csm\_\Delta e_t + u_{it} \quad (4)$$

where $\alpha_1$shows the difference in the ERPT level between post and pre-targeting period. We expect α_1 to be negative since under a stable and credible IT regime which is based on anchoring inflation expectations, exchange rate changes will less likely to pass-through to domestic prices. The estimation results for industrial

[15] In this section, as we consider the impact of exchange rate regime on ERPT our emerging market country sample contains also Argentina, Bulgaria and Estonia. These countries adopted fixed exchange rate regimes such as currency boards during the most of the sample period.

and emerging market groups are presented in Table IV.15 Column (IT). One striking result is that while implementing IT regime leads to decline in ERPT levels in emerging market countries, it has not lead to a statistically significant change in the ERPT levels of industrial countries. This might be due to low levels of ERPT in industrial countries before adoption of IT regime. Besides the estimation results indicate that with the significant and substantial decline in ERPT of emerging market countries, the gap in ERPT levels between industrial and emerging market countries lessens.

Domestic Demand Conditions and ERPT

Domestic demand conditions are essential in the pricing behavior of firms. Such that in strong domestic demand periods it will be easy for firms to reflect changes in the exchange rate to domestic prices while in weak demand periods firms are less willing to pass through exchange rate changes on prices. In literature, as a proxy for domestic demand conditions output gap is used. Following pass through literature, we choose output gap as a proxy for domestic demand conditions. Since firms have different pricing behavior in strong and weak demand periods, we divide output gap series into two parts according to their signs. As a proxy for strong demand conditions we take positive output gap and for weak demand conditions we take the output gap series which have negative sign. Into our base model we include output gap series and its CSM. Moreover, in order to determine the response of ERPT coefficient in different demand conditions we interact positive and negative output gap with change in the exchange rate series. Then for industrial and emerging market countries, we estimate the following model:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + \gamma_{2i} o\_gap_{it} + \alpha_4 o\_gap_{it}^{+} * \Delta e_{it} + \alpha_5 \, o\_gap_{it}^{-} * \Delta e_{it} + c_1 csm\_\Delta p_t + c_2 csm\_\Delta e_t + c_3 csm\_o\_gap_t + u_{it} \quad (5)$$

where o_gap_{it} is output gap, $o\_gap_{it}^{+}$ and $o\_gap_{it}^{-}$ define positive and negative output gap respectively. Moreover, $csm\_ o\_gap_{it}$ shows the CSM of output gap series and α_4 and α_5 coefficients show the effects of 1 % increase in positive and negative output gap on ERPT coefficient respectively. Therefore, we expect α_4 to be positive and α_5 to be negative. The estimation results for industrial and emerging market groups are presented in Table IV.15 Column (o_gap). Estimation results reveal that in industrial countries while output gap is a significant

determinant of inflation it is insignificant for emerging market countries. Besides, in industrial countries positive output gap has not been effective on the level of ERPT coefficient whilst negative output gap has a declining effect on ERPT coefficient. Such that 1 % more negative output gap leads to 0.7 % decline in the ERPT level. For emerging market countries both positive and negative output gap coefficients are statistically significant and have the expected sign. For emerging market countries estimation results indicate that 1 % increase in the positive output gap leads to 1.6 % increase in ERPT coefficient whilst 1 % more negative output gap brings 2.2 % decline in the ERPT coefficient. This result shows that ERPT coefficient in emerging market countries is more sensitive to negative output gap.

Table IV.15: Determinants of ERPT in Industrial and Emerging Market Countries

1990:1-2009:1	**IT**		**o_gap**		**OPEN**		**ERR**	
	IND	EME	IND	EME	IND	EME	IND	EME
constant	-1.41E-6 (0.000)	0.004** (0.001)	-0.00 (0.00)	0.003* (0.001)	-0.001 (0.001)	0.036* (0.016)	-6.38E-6 (0.000)	0.061* (0.028)
Δe_{it}	0.032** (0.006)	0.702** (0.010)	0.025* (0.006)	0.416** (0.018)	0.020* (0.006)	0.566** (0.017)	0.039** (0.009)	0.791** (0.029)
IT*Δe_{it}	0.010 (0.007)	-0.536** (0.038)						
o_gap_{it}			0.076** (0.012)	0.056 (0.030)				
$o\_gap^{+}_{it}$ *Δe_{it}			-0.205 (0.314)	1.603** (0.496)				
o_gap^{-} *Δe_{it}			-0.701* (0.254)	-2.219** (0.152)				
$OPEN_{it}$					1.59E-5 (1.69E-5)	0.000** (8.82E-5)		
$OPEN_{it}$* Δe_{it}					0.0001 (6.36E-5)	0.0008** (0.000)		
ERR_{it}							0.000* (7.71E-5)	0.004** (0.000)
ERR_{it}* Δe_{it}							-0.000 (0.000)	-0.012** (0.002)
csm_Δe_t	-0.035** (0.006)	-0.396** (0.038)	-0.031** (0.006)	-0.403** (0.038)	-0.031** (0.006)	-0.611** (0.040)	-0.037** (0.007)	-0.562** (0.037)
csm_Δp_t	0.999** (0.034)	0.570** (0.031)	0.914** (0.035)	0.699** (0.035)	0.966** (0.031)	0.701** (0.444)	0.999** (0.035)	0.750** (0.036)
csm_o_gap_t			-0.040* (0.020)	0.037 (0.041)				
csm_$OPEN_t$					1.06E-6 (1.45E-5)	-0.01** (0.000)		
csm_ERR_t							-0.000 (0.000)	-0.010** (0.003)
# of Count.	23	31	30	20	23	28	23	31
# of Obs.	1766	2273	1855	1470	1633	1728	1766	2273
R^2	0.434	0.745	0.737	0.468	0.45	0.744	0.437	0.735
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.								

Openness to Trade and ERPT

In pass-through literature, there is no common argument on the net effect of openness to trade on ERPT level. One might expect that a country which is more open to external trade, it has more response to exchange rate changes and therefore there might be a positive association between the degree of openness to trade and ERPT. Accordingly, in a country which is more open and smaller, ERPT will be higher. On the other hand, for a country more openness to trade might provide more competitiveness and thus low inflation levels. Through this channel one might expect that ERPT will be lower in more open countries. Therefore, openness to trade affects ERPT in two opposite ways. In order to determine the impact of the degree of openness to trade and ERPT, we use "OPEN" variable which is the percentage ratio of national currency values of export (X) plus import (M) to gross domestic product (GDP) ((X+M)*100/GDP) as a proxy for the degree of openness to trade. Into our base model we include OPEN series and its CSM and also interacted this variable with change in the exchange rate. For industrial and emerging market countries we estimate the following model:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + \gamma_2 OPEN_{it} + \alpha_6 OPEN_{it} * \Delta e_{it} + c_1 csm\_\Delta p_t + c_2 csm\_\Delta e_t + c_3 csm\_OPEN_t + u_{it} \quad (6)$$

where csm_OPEN_t is the CSM of OPEN series, α_6 shows the effect of 1 % change in openness to trade on ERPT coefficient. Since in literature there has not been a clear evidence for the effect of openness on ERPT coefficient, we could not determine an expected sign for this coefficient. However, since most of the emerging market countries are small and open economies, this coefficient might be expected to be positive for these countries. The estimation results for industrial and emerging market countries are given in Table IV.15 Column (OPEN). These results indicate that in industrial countries openness to trade does not have a significant impact on inflation and ERPT coefficient whilst it has significant and increasing impact on those of emerging market countries. However, the estimation results reveal that in emerging market countries the response of inflation and ERPT coefficient to changes in the degree of openness to trade is so small.

Exchange Rate Regime and ERPT

The basic idea behind the relationship between exchange rate regime and ERPT is indexation behavior which is a result of high and persistent inflation environment. Due to indexation behavior, under less flexible exchange rate regimes changes in the exchange rates are taken as permanent and directly reflected in prices. As a result of this, under less flexible exchange rate regimes ERPT will be higher. In order to give empirical evidence for this argument we used ERR as a proxy for exchange rate regime. We include this variable into our base model with its CSM and interact it with change in the exchange rate. Then for industrial and emerging market countries we estimate the following model:

$$\Delta p_{it} = \gamma_{0i} + \gamma_1 \Delta e_{it} + \gamma_2 \, ERR_{it} + \alpha_7 \, ERR_{it}^{*} \Delta e_{it} + c_1 csm\_\Delta p_t + c_2 csm\_\Delta e_t + c_3 csm\_ERR_t + u_{it} \quad (7)$$

where csm_ERR_t is the CSM of ERR. As shown in the data description part, since an increase in the value of "fine" code reflects adoption of more flexible exchange rate regimes we expect α_7 to be negative. The estimation results for industrial and emerging market countries are presented in Table IV.15 Column (ERR). The results show that in industrial countries since there is no indexation behavior in price setting process, ERPT coefficient is insensitive to changes in the exchange rate regime. On the other hand, in emerging market countries since indexation behavior is common; exchange rate regime is a significant determinant of both inflation and ERPT in these countries. Besides the interaction variable coefficient has the expected sign, and this reflects that in emerging market countries adoption of more flexible exchange rate regimes leads to decline in indexation behavior and thus in the ERPT level.

To conclude, all the estimation results indicate that for industrial countries all the ERPT determinants excluding inflation performance are insignificant. This might provide us an important conclusion that recent decline in ERPT in industrial countries is due to the decline in inflation rates in these countries. On the other hand, for emerging market countries all the ERPT determinants are significant. For this reason, a decline in the ERPT level of emerging market countries might be explained by a strong monetary policy stance, weak demand conditions, and decline in the openness to trade and more flexible exchange rates. However if we want to explain the recent decline in ERPT levels weak demand conditions and decline in the openness to trade factors does not work since in recent years there

has been not only weak demand conditions but also strong demand conditions. Moreover as in the rest of the world, in emerging market countries with increase in globalization of economic activities openness to trade has increased in recent years. Therefore, a strong monetary policy stance, low inflation environment and flexible exchange rate might be accepted as the factors that lead to recent decline in ERPT levels of emerging market countries. However, the most important one that ensures recent decline in the ERPT level might be accepted as the adoption of IT regime that ensures a strong monetary policy stance. Since under IT framework, more flexible exchange rate regimes are implemented and also successful and credible implementation of IT regime might ensure low inflation environment, it might have played an important role in the recent low levels of ERPT coefficient in emerging market countries.

IV.2.3.3 ERPT and Inflation Targeting

In the previous section we have showed that in the IT period emerging market countries have lower ERPT than pre-targeting period whilst industrial countries have not experienced significant changes in ERPT level in this period. In this section we will attempt to determine whether or not the response of inflation to exchange rate changes has differed after the adoption of IT regime in the IT industrial and emerging market countries. For this purpose, we estimate the following model:

$$\Delta p_{it} = \gamma_0 + \gamma_1 \Delta e_{it} + c_1 csm\_\Delta p_t + c_2 csm\_\Delta e_t + \beta_1 IT*\Delta e_{it} + \beta_2 IT*csm\_\Delta p_t + \beta_3 IT*csm\_\Delta e_t + u_{it} \quad (8)$$

where IT is a dummy variable which takes the value of one at the time of IT is adopted and zero otherwise. Since IT regime is based on anchoring inflation expectations, under this regime inflation response to changes in the exchange rate, global inflation and global value of U. S. dollar will be less. Therefore, we expect β_1 and β_2 to be negative and β_3 to be positive. We estimate Eq. (8) for industrial and emerging market countries for whole sample and IT periods. As seen in Table IV.16, whole period estimation results indicate that in both industrial and emerging market countries with the adoption of IT regime ERPT declines. For industrial countries in the pre-targeting period ERPT coefficient is 0.178 whilst in the post-targeting period it declines at the amount of 0.147 that makes ERPT coefficient close to zero. On the other hand, in emerging market countries, in the pre-targeting period ERPT coefficient is 0.710 which is higher than pre-targeting level of

industrial countries. With the adoption of IT regime in emerging market countries ERPT coefficient has declined in the amount of 0.615 and converged to industrial countries' level. These results reveal that with the adoption of IT regime, the gap in the level of ERPT between industrial and emerging market countries closes. In other words, ERPT coefficients of emerging market countries have convergence to industrial IT countries with the adoption of IT regime. In addition, whole period estimation results also indicate that both industrial and emerging market countries' inflation rates have become less sensitive to changes in the global value of U.S. dollar. However, IT has not lead to a significant change in the response of domestic inflation to changes in the global inflation rate in industrial and emerging market countries.

Table IV.16: ERPT and IT in Industrial and Emerging Market Countries

	IT_IND		**IT_EME**	
	1980Q1-2009Q1	**1990Q1-2009Q1**	**1980Q1-2009Q1**	**1990Q1-2009Q1**
constant	-0.000 (0.000)	1.95E-05 (0.000)	0.007** (0.002)	0.004 (0.002)
Δe_{it}	0.178** (0.015)	0.018 (0.018)	0.710** (0.010)	0.660** (0.012)
csm_Δe_t	-0.177** (0.021)	-0.012 (0.026)	-0.492** (0.047)	-0.460** (0.057)
csm_Δp_t	1.018** (0.039)	1.018** (0.061)	0.566** (0.036)	0.562** (0.041)
IT*Δe_{it}	-0.147** (0.023)	0.027 (0.020)	-0.664** (0.046)	-0.615** (0.043)
IT*csm_Δe_t	0.148** (0.029)	-0.033 (0.028)	0.423** (0.079)	0.394** (0.081)
IT*csm_Δp_t	0.019 (0.091)	-0.033 (0.066)	-0.141 (0.174)	0.080 (0.168)
# of Count.	8	8	16	16
# of Obs.	923	616	1716	1190
R^2	0.573	0.457	0.811	0.793
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.				

On the other hand, if we make our analysis for the IT period (1990:Q1-2009:Q1), we find striking results. As seen in Table IV.16, the estimation results show that in this period for industrial countries global inflation developments is the only significant determinant for domestic inflation, ERPT coefficient becomes insignificant and adoption of IT regime does not make any significant changes in the ERPT coefficient. This result may be due to low ERPT levels in the 1990s in the industrial IT. In the 1980 period due to high inflation environment ERPT coefficient was higher, for this reason when we compare 1980s ERPT level with

the IT period we have find decline in ERPT level. However since in pre-targeting period industrial countries have experienced low ERPT levels due to 1990s low inflation environment, adoption of IT regime has not lead to a significant change in the industrial countries. This result is parallel to the findings of Mishkin and Schmidt Hebbel (2004). In their study for the period of 1989-2004 they argue that in industrial IT countries the adoption of IT regime has not made any difference to their ERPT coefficients. Moreover, our findings also explain why Edwards (2006) have found decline in ERPT coefficients of two industrial countries in their sample with the implementation of IT regime. Since Edwards (2006) makes his analysis for 1985-2005 period, he finds decline in ERPT level of industrial IT countries. However if the sample period began in 1990s, the results would be completely different. To conclude, the argument of that IT leads to decline in ERPT coefficient in industrial countries, depends on the sample selection, it is not a robust result. On the other hand if we make our comparison for emerging market countries for both whole and IT period estimation results shows that adoption of IT regime ensures decline in ERPT level in these countries.

IV.2.3.4 Domestic Demand and ERPT under Inflation Targeting

During the recent financial turmoil although in both industrial and emerging market countries domestic currency depreciated in large amounts inflation levels have stayed at low levels. The reason of this situation has shown as tight demand conditions in that period. This statement is consistent with our finding since in the previous section we have showed that negative output gap has declining effects on ERPT coefficient in both industrial and emerging market countries.

Table IV.17: Domestic Demand and ERPT under Inflation Targeting

	IT_IND	**IT_EME**
constant	-0.000 (0.000)	0.002* (0.001)
Δe_{it}	0.028* (0.013)	0.043** (0.013)
o_gap_{it}	0.029 (0.028)	0.004 (0.035)
$o\_gap_{it}^{+}*\Delta e_{it}$	2.255* (0.928)	-1.160 (1.351)
$o\_gap_{it}^{-}*\Delta e_{it}$	-1.845** (0.466)	-0.133 (0.394)
$csm\_\Delta e_t$	-0.056** (0.011)	-0.051** (0.017)
$csm\_\Delta p_t$	0.974** (0.071)	0.596** (0.068)
$csm\_o\_gap_t$	0.022** (0.050)	0.071 (0.054)
# of Countries	8	16
# of Obs.	436	532
R^2	0.396	0.360
Notes: Standard errors are in parentheses. (**) and (*) denote significance at the 1 % and 5 % levels respectively.		

In order to give empirical evidence for this argument in IT industrial and emerging market countries we estimate Eq. (5) for IT period in these countries. As seen in Table IV.17, the estimation results indicate that output gap is an insignificant determinant for domestic inflation rates in IT countries. ERPT appears to be more sensitive to positive output gaps in IT industrial countries whilst it does not have such a response to positive or negative output gap in IT emerging market countries.

CHAPTER V

CONCLUSION

High level of ERPT is a constraint to implement independent monetary policy regimes. For this reason, ERPT is accepted among the main reasons of “fear of floating” (Calvo and Reinhart, 2002) and an effective constraint for the success of an IT policy regime (Mishkin, 2004) in emerging market countries. On the other hand, Taylor (2000) argues that in low and stable inflation environment ERPT tends to be lower. Consistent with this argument ERPT might decline endogenously with the success of IT regime even in emerging market countries. Consequently, a high ERPT might be accepted as not a binding constraint for the adoption of IT as it tends to decline with the success of monetary policy regime.

In this study, we aim to determine the impact of IT regime on ERPT level. However, since IT was widely adopted during a favourable global economic environment and disinflation, it may not be straightforward to identify the marginal contribution of IT regime on the changes in ERPT level. For instance, since the mid-1990s, many industrialized and emerging market countries have experienced low and stable inflation environment. Following Taylor’s argument, global inflation environment might have ensured low level of ERPT in IT countries. For this reason in order to determine the marginal contribution of IT regime, we compare ERPT performances of a large number of country groups. By considering cross-sectional dependence in our country groups we use the Common Correlated Effects Pooled (CCEP) estimation method by Pesaran (2006). For every country groups excluding Euro area countries, we find that ERPT declined substantially during the recent global disinflation period. The decline in the ERPT is, however, much higher in IT countries especially in emerging market ones. On the other hand, in the same period non-IT countries have not achieved such a good performance in ERPT. Consequently, our estimation results reveal that in contrast to Mishkin and Schmidt-Hebbel (2007), IT countries have done better in terms of ERPT than non-IT countries.

Since during the recent global disinflation period, IT countries have showed the best ERPT performance in our country groups, we make our analysis also for IT period (1990Q1:2009Q1). By this way, we also aim to filter our analysis from the effects of global disinflation period. Our results strongly suggest that, for both IT and non-IT periods, ERPT is significantly higher in emerging market countries than industrial countries. Accordingly, we try to determine the factors that lead to this difference in ERPT level between these countries. We find that for industrial countries the level of ERPT is invariant to macroeconomic factors excluding inflation performance. Moreover, since they have low ERPT levels due to low inflation environment in the pre-targeting period, adoption of IT regime has not lead to a statistically significant change in the ERPT levels of these countries. On the other hand, our estimation results reveal that a strong monetary policy stance, inflation environment and exchange rate regime might be accepted as the important determinants of ERPT level in emerging market countries. However, the most important one that points recent decline in the ERPT level might be accepted as the adoption of IT regime that ensures a strong monetary policy stance. Since under IT framework, more flexible exchange rate regimes are implemented and also successful and credible implementation of this regime might ensure low inflation environment, it might have played an important role in the recent low levels of ERPT coefficient in emerging market countries. Moreover, this supports the endogenous response of ERPT to monetary policy credibility and price stability. In this study, we also compare the impacts of IT regime on ERPT coefficient in industrial and emerging market IT countries. We show that for industrial IT countries the net effect of IT adoption is sensitive to sample period selection. We find that in low and stable inflation environment IT adoption has not lead to a significant change in ERPT levels in industrial IT countries. On the other hand, for emerging market countries adoption of IT regime ensures decline in ERPT level in all inflation environments. In addition, our estimation results also reveal the convergence of ERPT coefficients of emerging market countries to industrial IT countries with the adoption of this regime.

Finally, in this study we also investigate the responsiveness of ERPT to changes in the domestic demand conditions under IT regime. This may be challenging as inflation levels have remained at low levels in spite of high level of currency depreciations in many IT countries during the recent global financial turmoil. Our results strongly suggest that ERPT appears to be more sensitive to

positive output gaps in IT industrial countries whilst it does not have such a response to positive or negative output gap in IT emerging market countries.

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