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Exchange rate pass-through in emerging countries: Do the inflation environment, monetary policy regime and central bank behavior matter? *

Antonia López-Villavicencio[†]

Valérie Mignon[‡]

August 30, 2017

Abstract

In this paper, we estimate the exchange rate pass-through (ERPT) to import and consumer prices for a sample of 14 emerging countries over the 1994Q1-2015Q3 period. To this end, we augment the traditional bivariate relationship between the nominal effective exchange rate and inflation by accounting for monetary stability proxied by the inflation environment, monetary policy regime and central bank behavior. We show that both the level and volatility of inflation, as well as adopting an inflation target or the transparency of monetary policy decisions clearly reduce ERPT to consumer prices. However, uncertainty about domestic monetary policy seems less relevant in explaining the pass-through to the price of imports.

JEL Classification: E31; E52; F31.

Keywords: exchange rate pass-through; inflation; emerging countries; monetary policy.

* *Corresponding author:* Valérie Mignon, EconomiX-CNRS, University of Paris Nanterre, 200 avenue de la République, 92001 Nanterre cedex, France. Phone: + 33 1 40 97 58 60. Email: valerie.mignon@parisnanterre.fr. We would like to thank Sébastien Jean and two anonymous referees for helpful remarks and suggestions.

[†]GATE-CNRS and University Lumière Lyon 2, France. Email: lopez@gate.cnrs.fr.

[‡]EconomiX-CNRS, University of Paris Nanterre, and CEPPII, Paris, France. Email: valerie.mignon@parisnanterre.fr.

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1 Introduction

Traditional monetary theory regards high money creation as a common source of instability in both the exchange rate and the price level. Accordingly, in the presence of large monetary shocks, price inflation and exchange rate depreciation should be closely linked. Indeed, the relation between nominal exchange rate changes and price inflation—the exchange rate pass-through, ERPT from now on¹—can be important in an unstable monetary environment in which nominal shocks fuel both exchange rate depreciation and high inflation.

However, the bulk of the empirical literature finds that prices do not fully reflect exchange rate movements, meaning that ERPT is incomplete or partial.² Two main approaches have been proposed to explain this phenomenon:³ a macroeconomic approach (Monacelli (2003)) in which the incompleteness comes from nominal rigidities leading to unresponsiveness in prices in the short run, and a microeconomic approach linking the incomplete ERPT to an increasing degree of pricing-to-market behavior of firms (Betts and Devereux (2000)). This literature also argues that ERPT has been declining in many industrialized countries following a dramatic change in inflation environment during the 1990s. In particular, ERPT seems to be very low over the past decades for a broad group of countries that have pursued stable and predictable monetary policies.⁴

A common explanation for the declining ERPT is that expectations of inflation have become much more solidly anchored in recent years. In the context of a stable and predictable monetary policy environment, nominal shocks play a vastly reduced role in driving fluctuations in

¹Strictly speaking, ERPT corresponds to the degree to which changes in the nominal exchange rate impact trade prices—especially import prices—and, in turn, other domestic prices. The original definition has been extended to address the effects of exchange rate changes on consumer or producer prices. The level of transmission corresponding to the original definition is referred to as “the first-stage ERPT”, while the one corresponding to the extended definition is referred to as “the second-stage ERPT”.

²See Menon (1995) and Engel (2002) for a survey, and Campa and Goldberg (2005), Marazzi and Sheets (2007), Bouakez and Rebei (2008), Gust, Leduc, and Vigfusson (2010), Forbes, Hjortsoe, and Nenova (2015) and Auer and Schoenle (2016) for more recent empirical studies. These two latter papers are particularly interesting regarding the most recent literature on ERPT. In assessing how exchange rate changes affect prices, Forbes, Hjortsoe, and Nenova (2015) propose to incorporate the underlying shocks that cause such variations and find evidence that the relationship between exchange rate changes and prices depends on the cause of exchange rate variations. Their study provides an original framework to explain the time-varying nature of ERPT. Auer and Schoenle (2016) rely on U.S. import price micro data to investigate firm-level pricing behavior with regard to ERPT. They show that the response of import prices to exchange rate changes is U-shaped in their proxy for market share, and hump-shaped with regard to competing importers’ prices.

³For more details, see the survey by Aron, MacDonald, and Muellbauer (2014).

⁴See Gagnon and Ihrig (2004), Bailliu and Fujii (2004), Ihrig, Marazzi, and Rothenberg (2006), Marazzi and Sheets (2007), Bouakez and Rebei (2008), Dong (2012), and Carriere-Swallow, Gruss, Magud, and Valencia (2016).

prices and in the exchange rate (Taylor (2000)). Thus, a stable monetary policy environment—supported by an institutional framework that allows the central bank to pursue a credible and independent policy—contributes to explaining why even sizeable depreciations of the nominal exchange rate have exerted small effects on prices: when the inflation environment is more stable, firms resist passing exchange rate changes on to prices. Likewise, in Devereux, Engel, and Storgaard (2004), uncertainty about monetary policy can affect whether producers decide to determine their prices in domestic or foreign currency. As uncertainty about domestic monetary policy escalates, it becomes more likely that foreign producers will choose to price their goods in foreign currency. This, in turn, strengthens the pass-through to the price of imports and consumer goods. A similar argument is developed in Devereux and Yetman (2010), where the size of pass-through is a function of the stance of monetary policy as it affects the degree of price stickiness. When firms can adjust their frequency of price changes, loose monetary policy (associated with high inflation) leads to higher ERPT. In this sense, ERPT would be endogenous to a country’s inflation performance. Note, however, that low ERPT will persist only so long as monetary authorities continue with a credible monetary policy.

Falling into this strand of the literature, this paper aims at estimating ERPT to import and consumer prices for a sample of 14 emerging countries over the 1994Q1-2015Q3 period. The case of emerging countries is particularly interesting since these economies have undergone major changes in the last two decades: adoption of inflation targeting, adoption of floating exchange rate regimes, elimination of capital controls, etc. Consequently, these countries may face higher imported inflationary pressures and exchange rate volatility. Besides, given that many of them have also reached low and quite stable inflation levels by the end of the 1990s, it is likely that they have experienced the declining ERPT observed for advanced economies. In their survey, Aron, MacDonald, and Muellbauer (2014) put forward the very different estimates obtained for ERPT, and emphasize that frequent misspecifications are at play in the empirical literature.

Being aware of this issue, we go further than previous literature by paying attention to various key elements in investigating ERPT in emerging countries. First, most of the empirical literature either relies on a single country or on a panel of economies by imposing country homogeneity.⁵ Here, we consider country-by-country estimations and thus account for heterogeneity through

⁵For a survey, see Aron, MacDonald, and Muellbauer (2014).

not imposing the same ERPT coefficients for all countries. Second, we augment the usual bivariate relationship between inflation and change in the nominal exchange rate by including various variables and interaction terms. Specifically, in addition to control variables, we account for the inflation environment, monetary policy, and monetary policy behavior in terms of independence, transparency and credibility. Third, regarding the choice of the price series, numerous studies—especially those belonging to the microeconomic approach—focus on import prices and put forward the importance of pricing-to-market (PTM) behavior. In this paper, we pay particular attention to the inflationary environment, in line with Taylor (2000)’s view highlighting that ERPT depends on the monetary policy regime—a credible low inflation regime implying a low ERPT. Investigating how monetary policy affects import pass-through is important to better understand PTM and production chains. However, relying on import prices to assess this approach may be misleading because pass-through to import prices reflects the behavior of foreign firms which is not necessarily linked to the domestic inflationary environment.⁶ For this reason, in addition to import prices, we also consider consumer prices to appraise the importance of inflation environment in explaining the declining ERPT.

Our main results can be summarized as follows. We emphasize that the choice of the price—import or consumer—series is crucial in estimating ERPT: (i) in line with the dynamics of the transmission of exchange rate changes along production chains, ERPT to consumer prices is lower than to import prices, and (ii) consumer prices are more appropriate than import prices to assess the impact of inflation environment. Indeed, even if some previous literature suggests that uncertainty about domestic monetary policy strengthens the pass-through to the price of imports, we show that this is not the case, at least for our sample of emerging countries. In the case of consumer prices, we show that inflation environment matters in the sense that declining ERPT is evidenced with more stable and anti-inflationary environment. Equally, adopting inflation targeting regime leads to a significant decline in ERPT for most countries. We also find evidence that transparency of monetary policy decisions clearly reduces ERPT to consumer prices, while it is not the case for central bank independence.

The rest of the paper is organized as follows. Section 2 describes our various ERPT specifications, as well as the methodology. Section 3 presents the sample of countries and data, together with

⁶See, e.g., Choudhri and Hakura (2006).

some stylized facts. Section 4 is devoted to the estimation results and related comments, as well as to various robustness checks. Finally, Section 5 concludes the paper.

2 ERPT specifications and methodology

The baseline equation used to estimate ERPT relies on the generic specification proposed by Goldberg and Knetter (1997):⁷

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \theta \Delta e_t + \epsilon_t \quad (1)$$

where p_t denotes either import or consumer prices in period t , e_t is the nominal effective exchange rate,⁸ p_t^* corresponds to prices of competing goods, and the demand shifter is measured by the gross domestic product (GDP) at constant prices y_t . ϵ_t is an independent and identically distributed error term.⁹ All the variables are expressed in logarithms.

2.1 Accounting for the inflation environment

As stressed above, various theoretical and empirical studies emphasize that the degree of ERPT may depend on inflation uncertainty and the conduct of monetary policy. Indeed, in his seminal work, Taylor (2000) proposes that the declining pass-through in industrialized countries is the result of the low inflation environment experienced by these economies during the 1990s, in contrast to the high inflation rates recorded for previous decades.¹⁰ Taylor (2000) explains the link

⁷The ERPT equation is usually specified in first differences because the underlying series are generally found to be integrated of order one and non-cointegrated (see, e.g., Campa and Goldberg (2005)). Our results issued from the application of unit root and cointegration tests are in line with those findings. Indeed, we fail to reject the null hypothesis of (i) unit root in the series that enter in ERPT equation, and (ii) no cointegration for the huge majority of countries (see Tables A2 and A3 in the online appendix).

⁸We consider effective exchange rates rather than bilateral ones for various reasons. Using effective values avoids the choice of a numeraire—typically the US dollar—which is not an *anodyne* choice as notably shown by Bénassy-Quéré, Lahrière-Révil, and Mignon (2011). Although relying on the US dollar makes sense for countries whose international trade is mainly done in the US currency, this is not the case for countries—such as East Asian or East European emerging economies—for which other currencies are more relevant. Furthermore, whereas working with bilateral rates against the US dollar was in line with a two-tier international monetary system (i.e., the US dollar, the Deutschmark, the yen and the British pound on the one hand, and all other currencies on the other hand), corresponding exchange rates were a national or regional, not multilateral interest. Such approach based on this divide is no longer adequate due to the rising importance of emerging economies in the world since the mid-1990s. This evolution calls for taking into account a large number of currencies, which is precisely allowed by the use of effective (i.e., multi-country) exchange rate series.

⁹We include 4 lags of the inflation rate to better capture the observed inertial behavior of inflation (inflation persistence) and to avoid underestimating ERPT. In addition, it is worth mentioning that this generic equation could be augmented by accounting for other variables to improve the set of controls. As an example, the price of oil could be added as an additional variable to reflect changes in foreign prices (see, e.g., Bussiere (2013)).

¹⁰For a recent empirical investigation of Taylor's hypothesis, see Carriere-Swallow, Gruss, Magud, and Valencia (2016). Working on a sample of 62 advanced and emerging economies, the authors show that price stability and increased monetary policy credibility have significantly reduced ERPT to consumer prices. In particular,

between inflation and ERPT using a model of firm behavior based on staggered price setting and monopolistic competition. A key point in the model is how exchange rate shocks are perceived by importers and producers. If the increase in costs following a depreciation is perceived as transitory, agents can reduce temporarily their markups, save the menu costs of changing prices and simply wait until the shock reverts. On the contrary, if the shock is perceived as permanent or highly persistent, the price adjustment is inevitable. Since the economy will be subject to more persistent nominal shocks in high inflation regimes, the link between the level of inflation and the pass-through emerges. In the same line, importers and producers will find it easier to increase their prices more frequently in a high and unstable inflation environment (see Choudhri and Hakura (2006)).

Given that many emerging economies have reached low and stable inflation levels by the end of the 1990s, it is likely that they have also experienced the decline in the pass-through observed in the industrialized world. Under this scenario, we start by analyzing the impact of the inflation environment on ERPT. For this purpose, we consider two variables. First, we use the 8-period backward moving average of the inflation rate (denoted as $MA\ INF_t$) to account for the level—high or low—of inflation environment.¹¹ Second, we rely on the standard deviation backward moving average of the inflation rate (denoted as $SD\ INF_t$) to capture inflation stability and persistence. If the variance of inflation declines, its persistence also decreases while high variance is associated with high inflation persistence. Specifically, the corresponding two equations are given by:

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \theta \Delta e_t + \theta^{MA} (\Delta e_t \times MA\ INF_{t-1}) + \epsilon_t \quad (2)$$

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \theta \Delta e_t + \theta^{SD} (\Delta e_t \times SD\ INF_{t-1}) + \epsilon_t \quad (3)$$

where the variables $MA\ INF_t$ and $SD\ INF_t$ capture the past mean inflation and its stability, respectively.¹² It is worth mentioning that we do not include directly—i.e., in a non-interactive

monetary policy credibility plays a key role in diminishing ERPT to prices of domestically-produced goods and services. However, as their approach consists in regressing rolling coefficients on the level and volatility of some nominal variables—such as inflation—for a panel of countries, they fail at providing country-by-country estimates.

¹¹To avoid relying on a too short moving average length to characterize an inflationary environment, we also consider other lengths (i.e., 12- and 16-period) as robustness checks. The findings are very similar, and are available upon request to the authors.

¹²It should be noticed that these variables have been lagged to avoid endogeneity issues. Various lags have been

fashion—those two variables in the previous equations since they are obtained from past inflation and, in turn, are correlated with the lagged dependent variable. In Equations (2) and (3), we interpret a positive and significant coefficient θ^{MA} and θ^{SD} as evidence that ERPT is more important when inflation is higher in the first case, and more unstable in the second case. ERPT depending on the inflation environment, the total effect of the exchange rate on prices is given by:

$$\text{Total ERPT}_t = \frac{\partial \Delta p_t}{\partial \Delta e_t} = \theta + \theta^{MA} \overline{\text{MA INF}} \quad (4)$$

and

$$\text{Total ERPT}_t = \frac{\partial \Delta p_t}{\partial \Delta e_t} = \theta + \theta^{SD} \overline{\text{SD INF}} \quad (5)$$

where $\overline{\text{MA INF}}$ and $\overline{\text{SD INF}}$ are the mean of the inflation rate and the mean of its standard deviation over the whole period, respectively. We calculate the total effect of a one-unit increase in the exchange rate obtained using the estimates from the considered regression model (Equations (2) and (3)).

2.2 Accounting for monetary policy regime

An important monetary policy implication, especially for emerging markets, is that if the central bank manages to establish a credible low inflation regime, then ERPT should decline quickly. This hypothesis seems particularly relevant in countries that have adopted a monetary target (see, e.g., Taylor (2000)). Fatás, Mihov, and Rose (2007), for instance, identify transparent targets for monetary policy with quantitative targets. These targets are easily measured. Moreover, quantitative targets are transparent since they can be assessed without (much) debatable personal judgment. A formal commitment to a quantitative target is expected to influence (improve) the formation of inflation expectations and (reduce) inflation uncertainty (Mishkin (2007)).

In this paper, we pay particular attention to the case where central banks use inflation as a quantitative monetary target.¹³ The adoption of an inflation targeting regime is supposed to contribute to reductions in both the level and volatility of inflation (Vega and Winkelried (2005)).

The basic underlying idea is that adopting inflation targeting leads to credibility gains that are

tried, and we report here the results corresponding to the model finally retained using information criteria. The question of endogeneity will also be further addressed in the robustness section (see Section 4.4).

¹³Recall that in practice, three types of quantitative monetary targets are used by central banks (with varying degrees of success): inflation, exchange rates, and money growth rates.

responsible for keeping low inflation expectations following an exchange rate appreciation. Consequently, opting for an inflation target is a means to reduce ERPT since under this regime, (i) inflation is expected to be diminished and stabilized, and (ii) central banks are expected to gain credibility as inflation-fighters. In addition, as shown by Reyes (2007), under inflation targeting regime, central banks respond to an exchange rate appreciation by increasing the interest rate to impede that exchange rate changes feed into inflation. The exchange rate dynamics is in turn affected, weakening the ERPT to inflation.

To investigate the link between ERPT and monetary policy behavior, we add to the baseline regression the exchange rate variation interacted with a dummy variable (IT). The latter takes on the value one starting in the period in which the country adopted inflation targeting (and for all subsequent years), and zero otherwise (source: Fatás, Mihov, and Rose (2007)). The corresponding estimated model is the following:

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \theta \Delta e_t + \theta^{IT} (\Delta e_t \times IT_t) + \phi IT_t + \epsilon_t \quad (6)$$

The coefficient θ^{IT} associated with the interaction term captures any change in pass-through that occurs as a result of a transition to a new monetary regime. Specifically, in Equation (6) there are two coefficients of interest: the coefficient on the rate of change in the exchange rate (i.e., θ) and the coefficient on the interaction term described above (i.e., θ^{IT}). The former captures the average rate of short-run ERPT, whereas the latter captures any incremental effect due to a move to an inflation targeting regime. For instance, a non significant coefficient on the interaction term implies that ERPT in the presence of an inflation target is not statistically different from the overall ERPT. The total effect in this case is:

$$\text{Total ERPT}_t = \frac{\partial \Delta p_t}{\partial \Delta e_t} = \theta + \theta^{IT} \quad (7)$$

Equation (6) allows us to assess the effects of having declared an inflation target. However, we are interested not only in the effects of having formally adopted an inflation target (i.e., *de jure* inflation target), but also in the effects of having successfully hit the declared target. To assess the effect of having hit the target, we refer to central bank credibility. Specifically, we follow Bordo and Siklos (2014) and Bordo and Siklos (2015) and define central bank credibility—denoted as C_t —as the squared difference between the observed inflation and the declared target

for each t :

$$C_t = (\Delta p_t - \Delta \tilde{p}_t)^2 \quad (8)$$

where $\Delta \tilde{p}_t$ is the inflation objective for each quarter t . As seen, credibility does not depend on the level of inflation, it aims at focusing on inflation performance relative to the targeted level. Squaring the deviations is a natural definition that follows from the standard approach of assuming a quadratic form for losses in central bank objective functions. This approach says that credibility is dictated by how far inflation out-turns are from what the central bank, in principle, believes is the medium-term inflation objective.¹⁴ Given our definition of credibility, a loss of credibility takes place when the indicator rises and vice-versa. In other words, central bank credibility is inversely related to the credibility indicator defined in Equation (8). To evaluate the effect of credibility on ERPT, Equation (6) is rewritten as follows:

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \theta \Delta e_t + \theta^C (\Delta e_t \times C_t) + \phi C_t + \epsilon_t \quad (9)$$

2.3 Accounting for monetary policy behavior

Finally, there is also a large literature that has investigated the role of domestic institutions in the conduct of monetary policy, most of which focuses on the effects of central bank independence and transparency (e.g., Alesina and Summers (1993), Eijffinger and Geraats (2006), and Dincer and Eichengreen (2014)).¹⁵ Generally, good institutional quality is associated with a low level of inflation (see Cukierman (1992) and Aisen and Veiga (2008)). For instance, Cukierman (1992) underlines that central bank independence tends to decrease inflation volatility, while Aisen and Veiga (2008) put forward the role of political instability and low level of democracy and institutional environment in explaining inflation volatility.

However, it should be mentioned that the findings are far from being unanimous. Campillo and

¹⁴Ideally, we would also consider the deviation of observed inflation with a forward-looking (for instance, a one year ahead Consensus forecasts) inflation. Indeed, while C_t is a simple and widely used measure for credibility, one main caveat has to be mentioned that would be notably relevant in the case where inflation is initially on target. If a temporary shock makes inflation deviating from the target, inflation will eventually return to the initial value after a certain delay. In this case, C_t will increase, even if central bank credibility is not really called into question. Using expectations of inflation will allow us to overcome this kind of drawback. However, we unfortunately lack for the required information for our sample of countries. For the sake of completeness, a robustness check to our credibility measure has however been implemented (see Section 4.2).

¹⁵Obviously, the construction of independence and transparency indicators involves debatable personal judgment.

Miron (1997) do not find evidence of a robust link between central bank independence and low inflation. These results are consistent with Posen (1995) showing that in countries characterized by a high level of inflation, an improvement in the quality of institutions is not associated with a decrease in the inflation rate.

Aiming at explaining the conflicting results found in the literature, Acemoglu, Johnson, Querubin, and Robinson (2008) argue that the effectiveness of economic policy reforms cannot be understood without investigating the political economy of distortionary policies, i.e. the political environment that leads to such policies in the first place. They state that distortionary policies are more likely to be adopted in cases where politicians face fewer constraints. Specifically, they show that in countries with weak constraints—i.e., weak institutions—reforms can be easily undermined, leading to their ineffectiveness. Similarly, when constraints are strong—i.e., in countries with strong institutions—policy is unlikely to have been distortionary to begin with. As a consequence, it is only in economies with intermediate levels of constraints that policy reforms might be most effective. The authors also emphasize that a potentially large gap between *de jure* and *de facto* reforms may exist, typically when political realities prevent the implementation of such reforms: *“only those policy reforms that the politically powerful beneficiaries of the distortionary policies cannot easily override, circumvent or ignore are likely to achieve their objectives. Whether or not these groups can thwart reform depends in turn on the constraints on politicians and on the policymaking process.”*

Focusing on reforms related to central bank independence, Acemoglu, Johnson, Querubin, and Robinson (2008) emphasize that such independence reduces inflation only in countries with medium, intermediate constraints. In economies with strong or weak constraints, central bank independence tends to have no or little effect on inflation performance. The underlying idea is that economies characterized by good political environment also have good institutions and low levels of inflation. In this case, there is little room for reforms to have major effects.¹⁶ In countries—such as many sub-Saharan African economies—characterized by the absence of mechanism for controlling Government’s action, inflation is determined irrespective of the central bank and, in turn, of its independence. Between these two extreme cases, the quality of

¹⁶To illustrate, Acemoglu, Johnson, Querubin, and Robinson (2008) take the example of the United Kingdom: inflation was already low in the 1990s before the Bank of England became independent in 1998, limiting the room for an important effect on inflation from central bank independence.

institutions may play a key role: constraints are weak enough to lead to bad policy, but not so weak that all reforms can be undermined.

Turning to methodological issues, one important concern relates to the relatively short time sample for which data on central bank independence and transparency are available. To maintain a maximum number of observations, we thus consider a panel data methodology more relevant than a country-by-country approach in that case. Moreover, since transparency and independence of the central bank of an individual country are in general quite stable over time, a panel data set approach increases the number of observations significantly, which allows us to formally estimate the role of the policy regime. Within this framework, we use two estimators to ensure the robustness of our findings. Specifically, we consider fixed effect and dynamic GMM panel-data estimators in equations where we interact the change in the effective exchange rate with either transparency or independence (see Equations (10) and (11) below). Although the GMM estimator does appear to be the most appropriate choice in our context, it should be mentioned that, as with any instrumental variable approach, it suffers from large finite-sample biases if the instruments are weak. Thus, if the lagged values of the endogenous variable are only weak instruments for subsequent first differences, the GMM estimator could be poorly behaved. We acknowledge this potential drawback and address it by reporting estimation results for the fixed-effect estimator. The corresponding two equations are given by:

$$\Delta p_{i,t} = \alpha_i + \beta_t + \sum_{j=1}^n \gamma_j \Delta p_{i,t-j} + \rho \Delta y_{i,t} + \lambda \Delta p_{i,t}^* + \theta \Delta e_{i,t} + \theta^T (\Delta e_{i,t} \times T_{i,t}) + \phi T_{i,t} + \epsilon_{i,t} \quad (10)$$

and

$$\Delta p_{i,t} = \alpha_i + \beta_t + \sum_{j=1}^n \gamma_j \Delta p_{i,t-j} + \rho \Delta y_{i,t} + \lambda \Delta p_{i,t}^* + \theta \Delta e_{i,t} + \theta^I (\Delta e_{i,t} \times I_{i,t}) + \phi I_{i,t} + \epsilon_{i,t} \quad (11)$$

where $i = 1, \dots, 14$ denotes the country, α_i and β_t are individual and time fixed effects, respectively, and T_t and I_t represent transparency and independence of the central bank.

3 Data and stylized facts

We consider a sample of 14 emerging countries that have adopted an inflation targeting regime between 1994Q1 and 2015Q3: Brazil, Colombia, Czech Republic, Hungary, Indonesia, South Korea, Mexico, Philippines, Poland, Romania, Slovak Republic, South Africa, Thailand and Turkey.¹⁷

We rely on the following variables at the quarterly frequency:¹⁸ (i) the import price index and consumer price index (P), (ii) the nominal effective exchange rate defined as domestic currency per unit of foreign currency (E), (iii) the GDP at constant prices (Y), and (iv) trade-weighted foreign prices (P^*).¹⁹ This last variable is derived using the definition of real effective exchange rates (rer) adopted by the BIS ($rer = E \times \frac{P^*}{P}$) as:

$$P^* = \frac{(rer \times P)}{E} \quad (12)$$

All the series are seasonally adjusted. We work with the year-to-year differences of the variables expressed in logarithmic terms.²⁰

The choice of the import price series deserves some comments. We consider the import price deflator extracted from the OECD database. It should be mentioned that numerous studies rely on import unit value indexes whose main caveat is to be biased in case of changes in the bundle of goods. In addition, they present some volatility due to frequent quantity adjustments that may change the indexes without any change in prices, and, as noticed by Knetter (1989) and Takagi and Yoshida (2001), unit values encounter important measurement errors, making them imperfect proxies for trade prices at the country level. Import prices do not suffer from these biases.²¹ They measure actual transaction prices of imported goods and account for major phenomena such as (i) price fluctuations and changes in the demand of comparable competi-

¹⁷Some emerging countries are not considered, either because of data availability issues (e.g., Peru) or because they have adopted inflation targeting before the beginning of our period under study (e.g., Chile which has adopted inflation targeting in 1990—but has really abandoned exchange-rate peg in September 1999).

¹⁸Data sources are presented in Table 9 in Appendix. Descriptive statistics and results of unit root tests are displayed in the online appendix in Tables A1 and A2, respectively.

¹⁹An increase in the nominal exchange rate implies a depreciation. Therefore, a positive relationship is expected between exchange rate change and inflation, since a depreciation of the currency should be followed by an increase in inflation.

²⁰Given that we are dealing with quarterly data, the year-to-year differences of a variable X are expressed as $X_t - X_{t-4}$.

²¹See, e.g., Marazzi and Sheets (2007) and de Bandt and Razafindrabe (2014).

tive goods over time, (ii) good's price determinants (quantity of units sold, change in quality, guarantee conditions, etc.), and (iii) modification in the composition of the bundle of imported goods of the considered country.

MA INF_t and SD INF_t are computed as the 8-period backward moving average and standard deviation of the inflation rate, respectively. Table 1 displays the averages over the 1994Q1-2015Q3 period of these two variables (based on both import and consumer prices) for the different countries. As expected, inflation of import prices generally exhibits lower mean values than CPI-based inflation, but is more volatile. This is consistent with the well-known fact that increasing import prices tend to accentuate CPI-based inflation due to imported inflation.

As seen, Turkey is clearly the country which exhibits the highest level of inflation over the whole period. This country has indeed experienced high and chronic inflation until the beginning of the 2000s, despite the several disinflation efforts backed by international organizations such as the IMF. Inflation has then registered a sharp decline since that period due to various reasons such as the commitment of the central bank to fight inflation, the adoption of an inflation target and tight fiscal policy implemented in 2001. However, despite those efforts, inflation still remains high in Turkey due to several factors as political instability, high public sector budget deficits, increasing money supply, etc.²²

Turning to the group of Latin-American countries, Colombia and Mexico display quite comparable CPI-based inflation levels; Brazil exhibiting a higher inflation rate especially due to the high values reached at the end of the sample resulting from various factors such as the weakening of the Chinese growth, the fall in commodity prices, and restrictive monetary policy. The group of Central and Eastern European Countries (CEECs) is quite heterogeneous, with Romania reporting a two-digit mean inflation rate (CPI-based) around 20%, while being around 3.5% in the Czech Republic. In this regard, an important feature in Romania is that it presents a high share of administered prices in the consumption basket, a fact that may also explain the high volatility characterizing the evolution of inflation in this country. It is also worth mentioning that such heterogeneity across the group of CEECs may come from several factors that have evolved during the transition process such as the stage of economic development, credibility of

²²See Kibritcioglu (2004) for a detailed study about the causes of inflation in Turkey.

Table 1: Inflation environment. Import and consumer prices

Country	Import Price Index (IPI)		Consumer Price Index (CPI)	
	Mean	S.D.	Mean	S.D.
Brazil	14.11	18.28	13.56	8.98
Colombia	2.55	5.99	7.36	1.05
Czech Republic	0.42	3.15	3.46	1.43
Hungary	5.41	5.14	7.34	1.59
Indonesia	9.94	10.94	9.81	5.14
Korea	2.12	9.78	3.13	0.94
Mexico	6.24	6.84	7.97	1.59
Philippines	3.56	5.49	4.78	1.37
Poland	4.25	4.53	5.34	1.50
Romania	15.16	8.66	19.94	6.26
Slovak Republic	2.07	2.85	4.87	1.67
South Africa	7.20	6.31	5.55	1.78
Thailand	2.84	6.16	3.01	1.52
Turkey	22.46	12.62	25.21	3.88

Notes: “Mean” refers to the mean backward moving average inflation (IPI or CPI), and “S.D.” to the standard deviation backward moving average inflation (IPI or CPI) over the whole period (1994Q1-2015Q3).

national central banks, nature of the exchange rate regime, etc. Finally, South Asian countries form a low-inflationary group which exhibits one-digit mean inflation rates, ranging from 3 (Thailand) to 9.8% (Indonesia). Those cross-country differences regarding mean inflation values and their corresponding volatility could be attributed to various factors, among which the type of monetary regime or central banks’ practices, as we will investigate further.

Table 2 presents the default start date for the adoption of (*de jure*) inflation targeting for each country in our sample, as well as the mean value of our credibility measure C_t over the whole period.²³ As shown and consistent with common wisdom, countries which exhibit the highest values for C_t —i.e. which are the less credible in terms of monetary policy—are also those characterized by the highest inflation levels: Turkey, Brazil, Indonesia and Romania. Figure 1, in turn, depicts the evolution of the inflation rate after the adoption of the target *vis-à-vis* the inflation target. As shown, the adoption of the target has generally led to a reduction in the effective inflation rate in most countries, with however important heterogeneity across economies. Start-

²³For the sake of robustness, we have considered two adoption dates for each country. Our benchmark case corresponds to the date reported in Table 2, i.e., the date when countries started some form of inflation targeting, typically by simply announcing numerical targets for inflation or by stating that they were switching to inflation-targeting regime. Alternatively, we use dates of full-fledged inflation targeting adoption, namely, an explicit adoption as publicized by central banks and implying numerical targets for inflation together with the absence of nominal anchors other than the inflation target. With the exception of Korea and Mexico, the soft and full-fledged dates coincide (all the dates are available upon request to the authors). Consequently, for those two countries we have redone our estimations using the full-fledged dates. The obtained results—available upon request—are very similar to those reported in the paper.

Table 2: Inflation targeting countries (default start date) and average central bank credibility regarding inflation objectives

Country	Date	Credibility
Brazil	June, 1999	9.761
Colombia	September, 1999	2.441
Czech Republic	January, 1998	4.588
Hungary	June, 2001	5.637
Indonesia	July, 2005	13.042
Korea	April, 1998	1.876
Mexico	January, 1999	1.938
Philippines	January, 2002	3.621
Poland	September, 1998	3.743
Romania	August, 2005	6.203
Slovak Republic	January, 2005	2.631
South Africa	February, 2000	7.899
Thailand	May, 2000	4.235
Turkey	January, 2006	14.406

Notes: This table reports (i) the default start date for the adoption of *de jure* inflation targeting (source: Fatás, Mihov, and Rose (2007)), and (ii) the average value of the credibility measure defined in Equation (8).

ing in the early 2000s, many countries indeed reduced their inflation rates and entered a period of relative price stability—inflation variability indeed decreasing. It is worth mentioning that the two countries exhibiting the highest mean levels of inflation, namely Romania and Turkey, are also those which have adopted inflation targeting regime later. Although several factors are thought to have contributed to this declining trend, it is generally agreed that a shift towards more credible monetary policy regimes played an important role.

Turning to the role of institutions, Eijffinger and Geraats (2006) develop a central bank transparency index, which is an aggregate of subindices relating to (i) political, (ii) economic, (iii) procedural, (iv) policy, and (v) operational transparency. This index has recently been extended and updated for a large set of countries by Dincer and Eichengreen (2014). The data is annual and covers the period from 1998 to 2014. The resulting index is defined over a range from 0 to 15 (min = 0, max = 15). Equally, Dincer and Eichengreen (2014) present a central bank independence index that reflects the independence of the chief executive officer of the central bank, its independence in policy formulation, its objective or mandate, and the stringency of limits on its lending to public sector. This index, scoring from 0 (min) to 1 (max), is available for a large set of countries for the 1998-2010 period. Mean values over the whole period are

Figure 1: Evolution of actual inflation relative to official targets after the adoption of inflation targeting

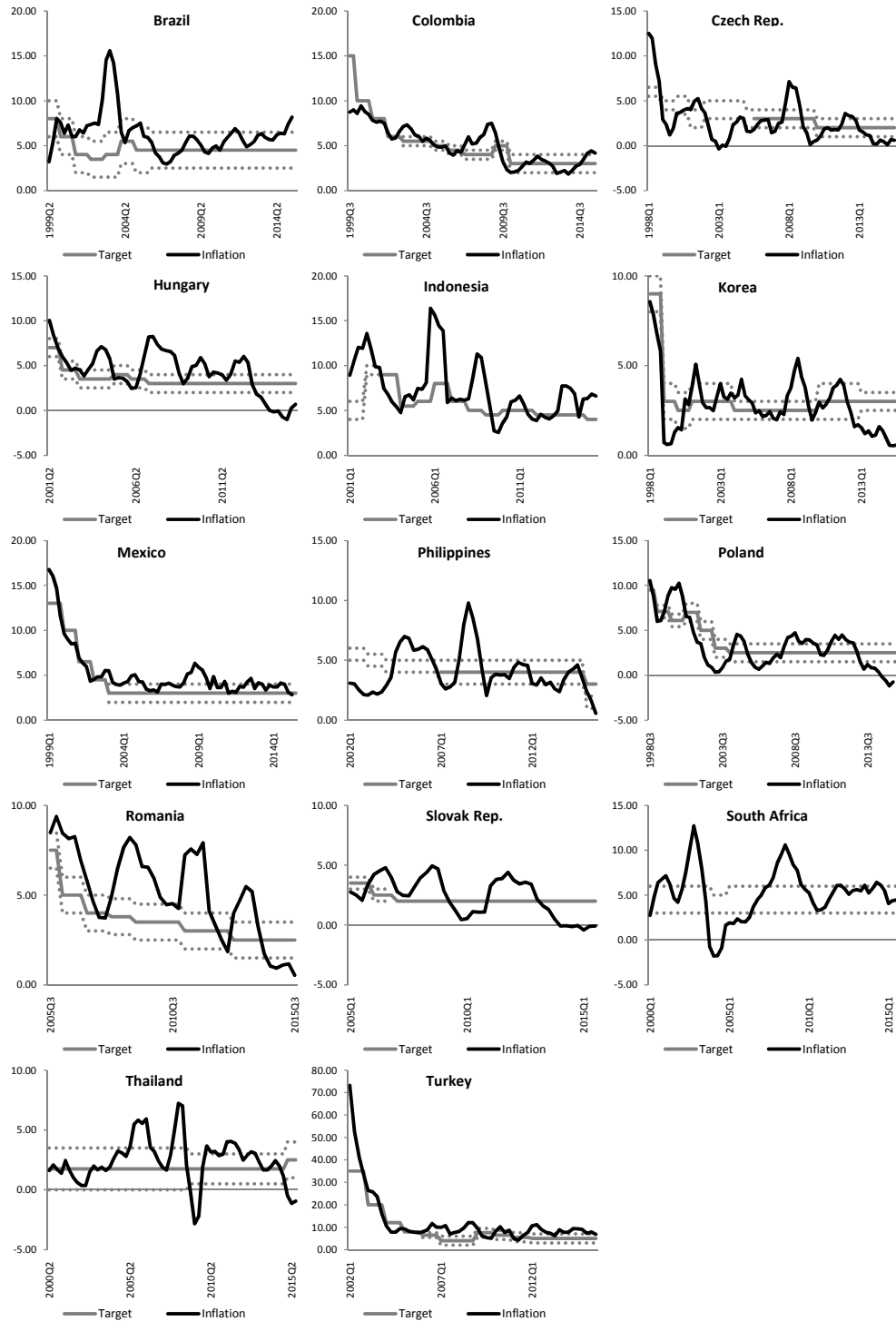


Table 3: Average independence (1998-2010) and transparency (1998-2014) indexes

Country	Independence			Transparency		
	Whole period	Pre-inflation targeting	Post-inflation targeting	Whole period	Pre-inflation targeting	Post-inflation targeting
Brazil	NA	NA	NA	7.86	4.09	8.20
Colombia	0.29	0.29	0.29	6.26	3.4	6.60
Czech Republic	0.65	NA	0.65	12.29	NA	12.29
Hungary	0.71	NA	0.71	10.24	NA	10.24
Indonesia	0.73	NA	0.73	7.24	NA	7.24
Korea	0.32	0.32	0.32	8.53	6.50	8.56
Mexico	0.63	0.63	0.63	5.50	4.50	5.56
Philippines	0.29	NA	0.29	8.62	NA	8.62
Poland	0.32	0.32	0.32	7.97	3.00	8.17
Romania	0.70	NA	0.70	5.68	NA	5.68
Slovak Republic	NA	NA	NA	5.13	NA	5.13
South Africa	0.15	NA	0.15	8.44	NA	8.44
Thailand	0.14	NA	0.14	7.65	NA	7.65
Turkey	0.56	NA	0.56	8.15	NA	8.15

Notes: (a) The central bank transparency index ranges from 0 (min) to 15 (max). (b) The central bank independence index ranges from 0 (min) to 1 (max). Data source: Dincer and Eichengreen (2014).

presented in Table 3, as well as for pre- and post-inflation targeting.

As shown by figures which are available on both pre- and post-inflation targeting periods, the central bank transparency index has increased after the adoption of an inflation target. As argued by Dincer and Eichengreen (2014), transparency is a key element in assessing whether the actions of central banks are in line with their mandate. Central bank independence is frequently viewed as a means to insulate monetary from short-term political forces, and pressure for transparency is particularly exacerbated when central banks have to achieve quantifiable verifiable targets as the rate of inflation. In this sense, transparency may be considered as reflected a *de facto* position whereas central bank independence mainly refers to a *de jure* vision. Although central bank independence and transparency generally tend to go together, some discrepancy may appear due to the afore mentioned²⁴ potentially large gap between *de jure* and *de facto* reform: “*de jure reform may not translate into de facto reform*” (see Acemoglu, Johnson, Querubin, and Robinson (2008)).

4 Estimation results

Estimates of the baseline pass-through from exchange rate to import and consumer prices (Equation (1)) for our 14 emerging market countries are presented in Table 4.²⁵

²⁴See Section 2.3.

²⁵Before estimating our various ERPT specifications and after having implemented unit root tests (Table A2), we have proceeded to the application of cointegration tests. As shown by the results displayed in Table A3 in the online appendix, the Johansen test fails to reject the null hypothesis of no cointegration in all countries, but

As seen, incomplete ERPT is a general result, confirming the findings obtained for advanced countries. In addition, ERPT to consumer prices is lower than ERPT to import prices. This result is consistent with the dynamics of the transmission of exchange rate changes along production chains, i.e. from import prices to consumer prices. Indeed, as underlined by Obstfeld and Rogoff (1995) among others, imports are considered as intermediate goods that have to be used in the production process before being consumed by households. As a consequence, the production chain tends to weaken the effect of exchange rate changes, explaining the low ERPT to consumer prices.

Abstracting away the effects of the inflation environment on the average pass-through, in all countries but Colombia, the results show that the pass-through estimates present the expected positive and significant sign: an increase in the nominal effective exchange rate translates into a depreciation of the currency and should normally be followed by an increase in prices. The notable exception is Colombia for which no significant ERPT is detected. As shown in Table 1, this country is characterized by a quite stable inflation environment, as illustrated by the low CPI-based inflation volatility level reached by this economy. On the contrary, ERPT to consumer prices is particularly high in Romania and Turkey—the two countries exhibiting the highest mean inflation rates—and, to a less extent, in Indonesia—the inflation-prone country in the low-inflationary Asia Pacific region—and the Czech Republic. As for advanced countries, ERPT to consumer prices is thus quite heterogeneous across individual emerging market countries. Such heterogeneity is also observed for ERPT to import prices, with values ranging from 0.087 for the Slovak Republic—a country exhibiting low inflation of import prices—to 0.88 for Turkey—the economy displaying the highest import prices-based inflation rate. However, despite this heterogeneity, the general result that emerges from our analysis is that countries which have experienced high levels of inflation even after the end of the 1990s are those for which ERPT is found to be higher, as expected. This suggests that the inflation environment matters in explaining the size of ERPT. Let us now address this hypothesis.

Colombia (consumer prices) and Thailand (import prices). For the latter cases where the null of no cointegration is rejected, an error-correction model is estimated (i.e., each concerned estimated ERPT specification is augmented by a long-run error-correction term). Finally, note that diagnostic tests have been applied on the various estimated models. A summary of the results is presented in Tables A4 and A5 in the online appendix.

Table 4: ERPT estimated coefficients. Import and consumer prices. 1994Q1-2015Q3

	Import prices θ Coeff. (t -stat)	Consumer prices θ Coeff. (t -stat)
Brazil	0.801 (17.59)	0.039 (5.77)
Colombia	-0.042 (-0.31)	-0.040 ^(a) (-1.22)
Czech Rep.	0.365 (6.34)	0.109 (2.54)
Hungary	0.138 (2.29)	0.033 (1.99)
Indonesia	0.384 (8.77)	0.090 (4.89)
Korea	0.834 (13.16)	0.056 (7.10)
Mexico	0.604 (18.11)	0.038 (2.75)
Philippines	0.425 (4.08)	0.029 (2.18)
Poland	0.380 (5.81)	0.026 (2.41)
Romania	0.547 (2.75)	0.197 (2.29)
Slovak Rep.	0.087 (1.91)	0.076 (2.35)
South Africa	0.376 (8.50)	0.036 (4.38)
Thailand	0.218 ^(a) (3.11)	0.054 (3.57)
Turkey	0.880 (11.99)	0.170 (6.16)

Notes: This table reports the estimated value of θ in Equation (1). Corresponding t -statistics are given between parentheses. (a): the estimated specification includes an error-correction term.

4.1 ERPT and the inflation environment

To assess the role played by the inflation environment, Table 5 reports the estimation results of Equations (2) and (3).

Regarding first the backward mean inflation (Equation (2)), the results show that, in general, the higher the inflation, the higher the ERPT to consumer prices. Indeed, for most countries, a significant interactive effect between exchange rate changes and mean inflation is detected, implying that the effects of exchange rate movements on consumer prices increase as the mean inflation rises. In other words, ERPT appears to be endogenous to the country's inflation performance, in line with previous findings obtained on industrialized countries (see, e.g., Choudhri and Hakura (2006)). This result is interpreted as evidence supporting that a lower inflation environment determines a lower pass-through than a high inflation regime.

Table 5: ERPT coefficients and inflation environment. Import and consumer prices. 1994Q1-2015Q3

	Import prices						Consumer prices					
	Mean inflation			S.D. inflation			Mean inflation			S.D. inflation		
	θ Coeff. (t -stat)	θ^{MA} Coeff. (t -stat)	Total effect $\theta + (\theta^{MA} \times \overline{MA})$ Coeff. (t -stat)	θ^{SD} Coeff. (t -stat)	θ Coeff. (t -stat)	Total effect $\theta + (\theta^{SD} \times \overline{SD})$ Coeff. (t -stat)	θ Coeff. (t -stat)	θ^{MA} Coeff. (t -stat)	Total effect $\theta + (\theta^{MA} \times \overline{MA})$ Coeff. (t -stat)	θ^{SD} Coeff. (t -stat)	θ Coeff. (t -stat)	Total effect $\theta + (\theta^{SD} \times \overline{SD})$ Coeff. (t -stat)
Brazil	1.104 (10.97)	-0.053 (-3.32)	0.379 (2.84)	0.913 (13.28)	-0.067 (-2.16)	0.316 (1.38)	0.011 (0.74)	0.005 (2.13)	0.082 (3.86)	0.044 (3.79)	-0.003 (-0.52)	0.015 (2.32)
Colombia	0.485 (3.31)	0.015 (0.53)	0.592 (7.22)	0.692 (9.17)	-0.162 (-2.49)	0.529 (9.60)	-0.014 (-0.66)	0.003 (1.46)	0.010 (1.03)	0.005 (0.36)	0.008 (0.74)	0.008 (0.74)
Czech Rep.	0.375 (4.08)	0.006 (0.38)	0.396 (6.68)	0.462 (5.52)	-0.044 (-0.94)	0.400 (7.16)	-0.010 (-0.26)	0.022 (2.92)	0.067 (3.01)	0.082 (2.04)	0.005 (0.22)	0.090 (4.07)
Hungary	-0.645 (-3.23)	0.076 (3.20)	-0.089 (-1.02)	-0.647 (-2.75)	0.380 (2.67)	-0.047 (-0.53)	0.048 (1.08)	-0.002 (-0.36)	0.033 (2.01)	0.036 (0.85)	-0.002 (-0.08)	0.033 (1.97)
Indonesia	0.372 (6.18)	0.001 (0.04)	0.374 (7.51)	0.358 (7.67)	0.006 (1.29)	0.390 (8.30)	0.050 (2.14)	0.005 (2.46)	0.100 (5.06)	0.072 (3.65)	0.003 (1.98)	0.090 (4.69)
Korea	0.553 (3.13)	0.077 (1.77)	0.794 (11.37)	0.861 (9.95)	-0.025 (-0.30)	0.838 (12.17)	-0.045 (-2.17)	0.027 (5.17)	0.040 (5.30)	0.066 (5.34)	-0.013 (-0.99)	0.054 (6.56)
Mexico	0.653 (11.11)	-0.004 (-0.74)	0.624 (15.74)	0.656 (12.13)	-0.018 (-0.86)	0.627 (15.73)	-0.029 (-1.61)	0.008 (4.75)	0.039 (3.43)	-0.009 (-0.55)	0.029 (4.14)	0.038 (3.19)
Philippines	-0.122 (-0.38)	0.116 (2.01)	0.431 (3.86)	0.548 (2.49)	-0.053 (-0.36)	0.475 (4.21)	-0.016 (-0.36)	0.008 (1.40)	0.025 (1.86)	0.013 (0.51)	0.014 (0.74)	0.032 (2.26)
Poland	0.364 (4.23)	0.003 (0.21)	0.378 (6.33)	0.355 (2.95)	0.015 (0.21)	0.377 (6.36)	0.036 (2.02)	-0.003 (-0.75)	0.023 (1.96)	0.038 (1.99)	-0.009 (-0.53)	0.024 (2.14)
Romania	0.141 (0.47)	0.016 (1.80)	0.450 (2.19)	0.245 (0.90)	0.029 (1.65)	0.429 (2.03)	0.071 (0.33)	0.006 (0.81)	0.188 (1.91)	0.038 (0.19)	0.021 (1.35)	0.168 (1.07)
Slovak Rep.	0.580 (2.68)	-0.116 (-2.60)	0.013 (0.19)	0.091 (0.65)	-0.037 (-0.38)	0.030 (0.37)	-0.071 (-0.82)	0.031 (1.93)	0.079 (2.46)	0.158 (2.63)	-0.085 (-1.63)	0.018 (0.41)
South Africa	0.237 (1.87)	0.029 (1.16)	0.396 (8.40)	0.252 (3.24)	0.085 (2.40)	0.403 (8.90)	0.026 (0.76)	0.001 (0.24)	0.035 (3.63)	0.005 (0.28)	0.015 (1.86)	0.032 (3.83)
Thailand	0.801 (5.45)	-0.039 (-1.52)	0.683 (7.92)	0.579 (4.72)	0.019 (0.23)	0.608 (8.42)	0.012 (0.28)	0.008 (0.98)	0.038 (1.85)	0.030 (0.87)	0.016 (0.76)	0.055 (3.50)
Turkey	0.851 (6.85)	0.001 (0.29)	0.869 (10.19)	0.859 (9.05)	0.004 (0.37)	0.874 (11.30)	-0.008 (-0.22)	0.006 (6.71)	0.155 (6.75)	0.176 (4.78)	-0.001 (-0.14)	0.174 (5.78)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (2) (Column "Mean inflation") and Equation (3) (Column "S.D. inflation"). (b) Corresponding t -statistics are given between parentheses.

It is worth mentioning that this interactive effect between exchange rate changes and mean inflation is lower when considering import prices. In the latter case, θ is higher and significant in the majority of countries, in contrast with the results obtained using consumer prices. These findings are particularly interesting and consistent with the weakening effect exerted by the production chain. Indeed, the direct effect of exchange rate changes on import prices is higher than on consumer prices, while the inflationary situation strongly matters in the case of consumer prices which are more appropriate than import prices to account for the domestic inflation environment. Turning to the total effect of a one-percent increase in the exchange rate, calculated using the estimates from the regression model evaluated at the average inflation rate, its corresponding estimate is almost always positive, as expected. It is significant in most countries, and higher than the estimated value of θ in the case of consumer prices, confirming that the inflation environment strongly matters: a higher level of inflation is associated with a larger ERPT. An illustration is given by Turkey, the country of our sample exhibiting the highest mean level of CPI-based inflation rate which is also characterized by the largest size of ERPT. Similarly, in addition to Colombia, one of the lowest ERPT degree—even non-significant—is observed for Thailand, the economy of our panel of countries marked by the most anti-inflationary environment.

Consider now the effect of the inflation environment in terms of stability and persistence (Equation (3)). As seen, the total effect is significant in the huge majority of countries, the main exceptions being Slovak Republic and, to a lesser extent, Hungary for both price series, and Colombia for consumer prices. As shown in Table 1, these three countries exhibit quite low inflation volatility, confirming the relevance of the inflation environment in impacting ERPT. Apart from these special cases, the total effect is generally higher than the consumer prices ERPT abstracting from the inflation environment, i.e. $\theta + \theta^{SD} \times \overline{SD} > \theta$, meaning that ERPT tends to be higher in more unstable periods. As for the level of inflation (Equation (2)), this inequality is less frequently observed in the case of import prices, confirming that consumer prices are more appropriate to capture the main characteristics of the domestic inflation environment. Inflation volatility is thus positively associated with a higher ERPT, in line with Bussiere (2013). The most striking illustration is again provided by Turkey, a country characterized by a highly volatile CPI-based inflationary environment, which displays the most sizeable ERPT.

Overall, two main conclusions can be deduced from this analysis. First, the choice of the price series is crucial in assessing the effect of the inflation environment on ERPT, consumer prices being preferable to import prices to account for the domestic inflation characteristics. Second, the inflation context strongly matters in explaining the degree of ERPT: countries which exhibit higher inflation level and volatility are those characterized by the most sizeable ERPT.

4.2 ERPT and monetary policy regimes

As previously mentioned, it is commonly accepted that a policy regime that clearly commits to a nominal anchor can help promote price stability and stabilize inflation expectations, and should therefore help to lower inflation uncertainty (Mishkin (2007)). Accordingly, the degree of ERPT is expected to be lower in a monetary policy regime with an explicit inflation target. To test this hypothesis, we estimate Equation (6) and report the corresponding results for both import and consumer prices in Table 6.²⁶

As shown, the estimated ERPT in Table 6 tends to be lower than that reported in Table 4 for most countries, meaning that ERPT weakens when inflation targeting is accounted for. This is confirmed by comparing the values of $\theta + \theta^{IT}$ and θ in Table 6: after introducing inflation targeting, ERPT declines in all countries but Brazil, Hungary and Poland, and becomes even insignificant for the majority of economies in the case of consumer prices. Note, however, that ERPT to import prices seem to be independent to the adoption of a monetary target, the coefficient θ being also significant and close in value to the total effect in most cases.

Our findings are in line with Mendonça and Tostes (2015) showing that the pass-through to consumer prices is significant in the Brazilian economy after more than ten years of adoption of inflation targeting. In Brazil, inflation target is jointly decided by the Government and central bank, constituting a means for the Government to commit to the fiscal discipline necessary to achieve the target (Eichengreen (2006)). However, credibility of the economic policy is quite low in Brazil, particularly the fiscal policy. This reason may explain why ERPT is still significant in this country (see Mendonça and Tostes (2015)). Turning to South Korea which also exhibits a quite high ERPT degree, it is worth mentioning that it has adopted inflation targeting just

²⁶As a robustness check, as high inflation rates tend to be more volatile, we have also applied a scale correction to our credibility measure by using percent deviations from target inflation (and not just the absolute deviation). Results (available upon request to the authors) show that the total effect remains quite similar to the impact obtained without accounting for the interaction term, especially for import prices.

Table 6: ERPT coefficients, inflation rate target. Import and consumer prices. 1994Q1-2015Q3

	Import prices			Consumer prices		
	Equation (6)			Equation (6)		
			Total effect			Total effect
	θ Coeff. (t -stat)	θ^{IT} Coeff. (t -stat)	$\theta + \theta^{IT}$ Coeff. (t -stat)	θ Coeff. (t -stat)	θ^{IT} Coeff. (t -stat)	$\theta + \theta^{IT}$ Coeff. (t -stat)
Brazil	0.821 (8.82)	-0.028 (-0.26)	0.793 (14.83)	0.022 (1.24)	0.019 (0.98)	0.041 (5.76)
Colombia	---	---	---	0.057 (1.53)	-0.075 (-1.75)	-0.018 (-0.018)
Czech Rep.	0.367 (2.54)	0.025 (0.17)	0.392 (6.09)	0.294 (3.07)	-0.228 (-2.46)	0.066 (1.50)
Hungary	1.185 (4.89)	-1.490 (-5.58)	-0.304 (-2.73)	-0.027 (-0.41)	0.064 (0.84)	0.037 (1.62)
Indonesia	0.430 (9.26)	-0.280 (-2.39)	0.150 (1.42)	0.103 (5.53)	-0.112 (-2.68)	-0.009 (-0.22)
Korea	0.968 (10.34)	-0.200 (-2.01)	0.768 (10.38)	0.078 (6.15)	-0.039 (-2.82)	0.038 (4.57)
Mexico	0.530 (6.85)	0.081 (0.08)	0.611 (16.08)	0.106 (3.15)	-0.091 (-2.56)	0.015 (1.03)
Philippines	0.576 (4.97)	-0.279 (-1.88)	0.297 (2.36)	0.031 (1.92)	-0.025 (-1.21)	0.005 (0.31)
Poland	-0.023 (-0.04)	0.385 (0.68)	0.362 (5.29)	0.017 (0.17)	0.009 (0.09)	0.026 (2.34)
Romania	0.665 (2.44)	-0.463 (-1.25)	0.203 (0.76)	0.454 (2.09)	-0.480 (-1.70)	-0.025 (-0.14)
Slovak Rep.	-0.178 (-1.47)	0.362 (2.14)	0.184 (1.87)	0.107 (2.48)	-0.110 (-1.87)	-0.003 (-0.060)
South Africa	0.278 (3.05)	0.119 (1.18)	0.397 (8.09)	0.050 (2.12)	-0.015 (-0.61)	0.035 (4.06)
Thailand	0.525 (7.26)	0.160 (1.65)	0.685 (6.52)	0.058 (3.46)	-0.038 (-1.27)	0.020 (0.69)
Turkey	0.945 (12.03)	-0.157 (-1.26)	0.788 (6.48)	0.233 (7.89)	-0.187 (-4.01)	0.047 (1.18)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (6). (b) Corresponding t -statistics are given between parentheses.

Table 7: ERPT, central bank credibility (panel estimation). Import and consumer prices

	Import prices			Consumer prices		
	Equation (9)			Equation (9)		
	θ	θ^C	Total effect $\theta + (\theta^C \times \bar{C})$	θ	θ^C	Total effect $\theta + (\theta^C \times \bar{C})$
	Coeff. (<i>t</i> -stat)	Coeff. (<i>t</i> -stat)	Coeff. (<i>t</i> -stat)	Coeff. (<i>t</i> -stat)	Coeff. (<i>t</i> -stat)	Coeff. (<i>t</i> -stat)
Fixed effects	0.407 (16.90)	−0.001 (−1.58)	0.399 (15.07)	0.031 (7.48)	−0.001 (−2.88)	0.028 (5.95)
GMM	0.569 (6.33)	−0.003 (−0.58)	0.553 (4.92)	0.035 (2.67)	0.000 (−0.68)	0.034 (2.33)
Sargan test		0.777			0.312	
AR(2)		0.628			0.507	

Notes: (a) This table reports the panel estimated ERPT coefficients from Equation (9), $\bar{C}$ being the mean credibility measure over the whole period for our panel of countries. (b) Corresponding *t*-statistics are given between parentheses. (c) The fixed effects and the GMM models include both cross-section and period fixed effects. (d) GMM refers to estimations carried out with the Arellano-Bond one-step dynamic panel-data robust estimator using lagged values of the dependent variable, dummies and lagged values of the rate of depreciation as instruments. (e) The number of lags of the dependent variable is selected according to a general-to-specific approach. (f) The Sargan test reports the p-value of the over-identifying restrictions. The null hypothesis is that the over-identifying restrictions are valid. (g) AR(2) is the second-order serial correlation test of the differenced residuals. The null hypothesis is no second-order autocorrelation in the errors of the equation in first differences.

after its main currency crisis in 1997-98, i.e. just five months after the Korean won devaluation. As a consequence, inflation targeting regime is characterized by a very high inflation variability, larger than pre-inflation targeting regime. In general, our findings clearly illustrate that adopting inflation targeting plays a key role in explaining the declining ERPT in emerging countries.

To investigate whether adopting inflation targeting is more or less important than reaching the target, Table 7 reports the estimation results of Equation (9). As shown, whatever the estimation procedure, the total effect is quite similar to the effect obtained without accounting for central bank credibility. In other words, what matters is the adoption of inflation targeting, regardless of whether the central bank keeps its goal. This is the case for both import and consumer prices.

4.3 ERPT and central bank behavior

Finally, we address the relationship between ERPT and the inflation environment through central banks practices. As stressed above, we concentrate on two subjective indicators, namely transparency of monetary policy decisions and independence of the central bank.

To provide a first insight, Figure 2 in Appendix presents a scatter-plot of the ERPT coefficient

in the benchmark equation and the mean value over the 1998-2010 period of our two subjective indicators. As seen, particularly for consumer prices, whereas transparency seems to be negatively related to ERPT, countries with important central bank independence degree present high ERPT coefficients.

We proceed to formally analyze the impact of institutional quality on ERPT by relying on panel data models that interact our two indicators with the rate of depreciation (Equations (10) and (11)). Results are presented in Table 8 below.

As seen, our estimation results confirm the previous graphical intuition since transparency clearly reduces ERPT to consumer prices, while central bank independence tends to increase it. The results are more nuanced when considering import prices in the sense that estimated values are quite similar whether institutional quality is or not accounted for.²⁷ Again, this confirms that import prices are less appropriate compared to consumer prices to account for domestic monetary policy characteristics. Overall and as stressed above, the inflation environment strongly matters when investigating the link between quality of institutions and ERPT to consumer prices. As shown by Posen (1995), the assumption of exogeneity of monetary institutions is false in the sense that differences in the degree of central bank independence across countries has to be related to differences in financial sector opposition to inflation. Specifically, his main argument is that central bank independence has to be supported by the financial sector for being an effective means to decrease inflation: *“the granting of central bank independence where neither the financial sector nor some other political force is ready to defend it in times of costly disinflation is unlikely to have the intended counter-inflationary effect.”*

²⁷To be more precise, note that our robustness tests show that transparency of the central bank reduces ERPT to import prices, but only with a certain delay (see Section 4.4.3).

4.4 Some robustness checks

4.4.1 Endogeneity issues

A crucial challenge when dealing with ERPT estimation concerns the potential endogeneity existing between exchange rate depreciation and inflation. Indeed, the rate of depreciation may not be exogenous and correlated with the error term. Structural VAR models estimated at the country level in the exchange rate literature offer only a partial solution to the problem since identification is mainly reached through short-run restrictions on the contemporaneous coefficients (i.e., recursive identification by Cholesky decomposition; see Ca' Zorzi, Hahn, and Sánchez (2007)). However, as pointed out by Edwards (2006), this type of identification scheme makes assumptions on the timing of the effects of exchange rate changes on prices that are often too restrictive. As highlighted by Meese and Rogoff (1983) and Edwards (2006), finding a good instrument for the rate of depreciation is also complicated because most exogenous variables are not correlated with the exchange rate. Consequently, the majority of studies on exchange rate pass-through rely on the usual OLS methodology. Going further than this literature, in this section we address more comprehensively endogeneity issues and estimate the models by the generalized method of moments (GMM) as a robustness check.

Results of the GMM estimation of our models are reported in Tables A6 and A7 in the online appendix. As shown, when inflation environment is not accounted for (Equation (1)), the results are very similar to those previously obtained. ERPT is found to be positive and incomplete for the huge majority of countries, with comparable order of magnitude and significance. In particular, the highest ERPT to consumer prices is again observed for Turkey—the country characterized by the highest mean inflation rate. Romania, which exhibits a high mean inflation rate, display an important ERPT degree as well. Controlling for the inflation environment through the introduction of interaction terms (Equations (2) and (3)) also leads to similar results. In particular, (i) the interactive effect between exchange rate changes and mean inflation tends to be lower with import prices than when considering consumer prices, (ii) the direct impact of exchange rate variations on import prices is higher than on consumer prices, in line with the weakened effect exerted by the production chain, and (iii) countries which are characterized by high inflation levels and volatility exhibit the highest ERPT degrees. Turning to the influence of inflation targeting, our previous findings also appear robust as ERPT tends to decrease when a

monetary target is adopted. Overall, comparing GMM estimations in Tables A6 and A7 to our above results puts forward the robustness of our conclusions with regard to endogeneity issues.

4.4.2 Accounting for gradual adjustments of prices

It is worth mentioning that our previous findings mainly rely on short-run ERPT, i.e., ERPT after one quarter. However, to provide a complete picture and to ensure that ERPT is not missing at such a short-term perspective, we now investigate the robustness of our results to longer horizons.

We allow for the possibility of a gradual adjustment of consumer and import prices to exchange rate changes by considering richer lag structures in both exchange rate variations and the various interaction terms. This formulation implies that a sustained rate of depreciation could take some period to be fully reflected in inflation. Specifically, to examine pass-through after two quarters (6 months), a year, and a year and a half (18 months), we rewrite Equation (1) as follows:

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \sum_{m=0}^k \theta_m \Delta e_{t-m} + \epsilon_t \quad (13)$$

for $k = 2, 4$ and 6 , and the equations that include interaction terms to account for the inflation environment (Equations (2) and (3)) as:

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \sum_{m=0}^k (\theta_m + \theta_m^X X_{t-m}) \Delta e_{t-m} + \epsilon_t \quad (14)$$

for $k = 2, 4$ and 6 , where the variable X_t corresponds to our variable for inflation environment (either MA INF_{*t*} or SD INF_{*t*}). Finally, Equations (6), (9), (10), and (11) are rewritten as follows:²⁸

$$\Delta p_t = \alpha + \sum_{j=1}^n \gamma_j \Delta p_{t-j} + \rho \Delta y_t + \lambda \Delta p_t^* + \sum_{m=0}^k (\theta_m + \theta_m^Z Z_{t-m}) \Delta e_{t-m} + \phi Z_t + \epsilon_t \quad (15)$$

where, depending upon the considered case, the variable Z_t corresponds to our variable for in-

²⁸In the case of panel estimations (Equations (10) and (11)), the index i denoting the country has been dropped for simplification purposes.

flation targeting (IT_t), credibility (C_t), transparency (T_t) and independence (I_t) of the central bank. In Equations (13)-(15), the sum of coefficients $\sum_{m=0}^k \theta_m$ reflects the impact that previous changes in the exchange rate have on inflation over time, and is therefore considered as representing long-run ERPT. Indeed, whereas the short-term pass-through is the immediate reaction of inflation to a change in the real exchange rate, the long-term pass-through is the overall response of inflation to a real exchange rate shock. Equally, the sum of coefficients $\sum_{m=0}^k \theta_m^X$ (or $\sum_{m=0}^k \theta_m^Z$) represents the long-run effect when monetary policy or central bank behavior is taken into account.

Tables A8 to A13 in the online appendix present the corresponding estimation results for $k = 2, 4$ and 6. Regarding our benchmark specification (Equation (13)), the main finding is that ERPT remains positive and incomplete, even in the long run. In addition, the “ordering” of countries in terms of ERPT degree is still valid as Turkey and Romania are the countries which exhibit the highest ERPT level to consumer prices. Accounting for interaction terms, our previous results obtained at short term remain valid on longer horizons. Indeed, regarding the interaction term that accounts for inflation environment (Equation (14)), even if its significance tends to decrease with horizon—meaning that there is no gradual adjustment of prices to exchange rate changes—results go in the same direction as for the short run: the inflation environment matters in explaining the degree of ERPT. Similarly, results related to the estimation of Equation (15) are very close to those obtained without enriching the lag structure. On the whole, this comparison between short-run and long-run ERPT estimates does not support the existence of a strong gradual adjustment of import and consumer prices to exchange rate changes, and puts forward the robustness of our results.

4.4.3 Enriching the lag structure of all variables

As a final step, we investigate whether our results remain valid when lags of the right-hand side variables in the various estimated specifications are accounted for. Specifically, as full adjustment to a current exchange rate change or foreign price shock may appear after some time and not during the current period, we reestimate our equations by introducing lags in Δp_t , Δy_t , Δp_t^* , Δe_t and the interaction terms. Considering those lags allows us to account for the fact that adjustment takes a certain time to be effective—a characteristic that cannot be observed at short lags. In line with this possible delay, it should be mentioned that domestic costs such as

unit labor costs may affect the speed of adjustment to exchange rate changes. In particular, as emphasized by Aron, MacDonald, and Muellbauer (2014), omitting such costs—which are slow to adjust to changes but eventually respond to imported inflation—may result in an underestimation of the long-run ERPT degree. Specifically, in countries where unions are important, the exchange rate impact on domestic inflation may be overestimated when domestic labor costs are neglected, due the unions’ action that creates domestic wage-push shocks leading to an exchange rate depreciation. Investigating the impact of unit labor costs through the action of unions is particularly relevant, but requires a thorough analysis of the trade union power in our different countries; we leave this avenue for future research as a possible extension of the present paper.

We report in Tables A14 and A15 in the online appendix the results of the estimated long-run ERPT corresponding to the case where 4 lags have been retained for all variables.²⁹ As shown, these results are fully in line with our precedent findings, highlighting the robustness of our conclusions. In particular, when no interaction term is introduced, ERPT remains incomplete and its estimated value is general quite close to those previously obtained. Turning to the coefficients of the interaction terms, their values are also globally consistent with our preceding estimated levels.

5 Conclusion

The recent literature on ERPT tends to show that sizeable depreciations of the nominal exchange rate exert fairly small effects on prices. Moreover, these impacts have declined over the past two decades. This evidence of a weaker relationship between exchange rate fluctuations and prices is attributed to a more credible monetary policy that has focused on stabilizing inflation. However, little is known about the role of the inflation environment in emerging economies.

We fill this gap by estimating ERPT to import and consumer prices and assessing its dynamics for a sample of 14 emerging countries over the 1994Q1-2015Q3 period. In the case of consumer prices, we show that inflation level and volatility matters in the sense that a declining ERPT is evidenced with more stable and anti-inflationary environment. With regard to the role of monetary policy, adopting inflation targeting regime leads to a significant decline in ERPT to consumer prices for most countries, while reaching the announced target does not strongly mat-

²⁹Other lagged specifications have been estimated and lead to similar results.

ter. Consistent with the fact that import prices do not necessarily reflect domestic inflation environment, we show that pass-through to import prices is less affected than consumer prices by uncertainty about domestic monetary policy. Also, we find evidence that transparency of monetary policy decisions clearly reduces ERPT to consumer prices, while it is not the case for central bank independence. Nevertheless, despite the overall declining tendency of ERPT, exchange rate fluctuations can still have an effect on inflation in some countries.

On the whole, our findings show that emerging economies tend to share the characteristics observed for advanced countries in terms of declining pass-through once inflation is controlled for. Three main policy implications can be deduced from our results. On the one hand, as the exchange rate elasticity of trade prices determines the potential role of exchange rates in absorbing global imbalances, our findings imply that the use of the exchange rate as a means to improve the trade balance is expected to be less effective. On the other hand, the economies would be less concerned about the potential inflationary consequences of exchange rate fluctuations. Finally, the declining ERPT also has implications regarding the transmission of shocks across emerging countries which display high levels of intraregional trade.

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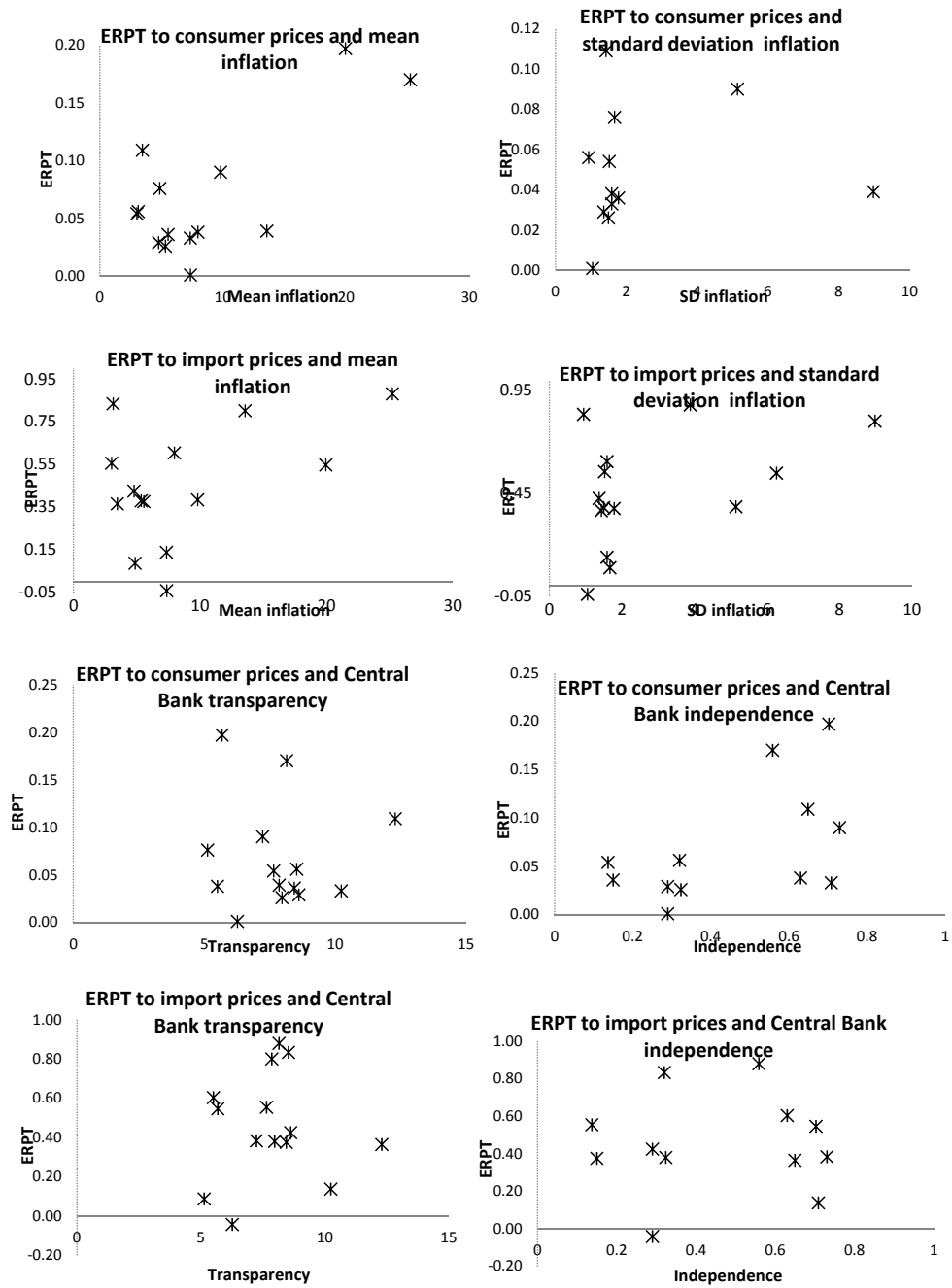
Appendix

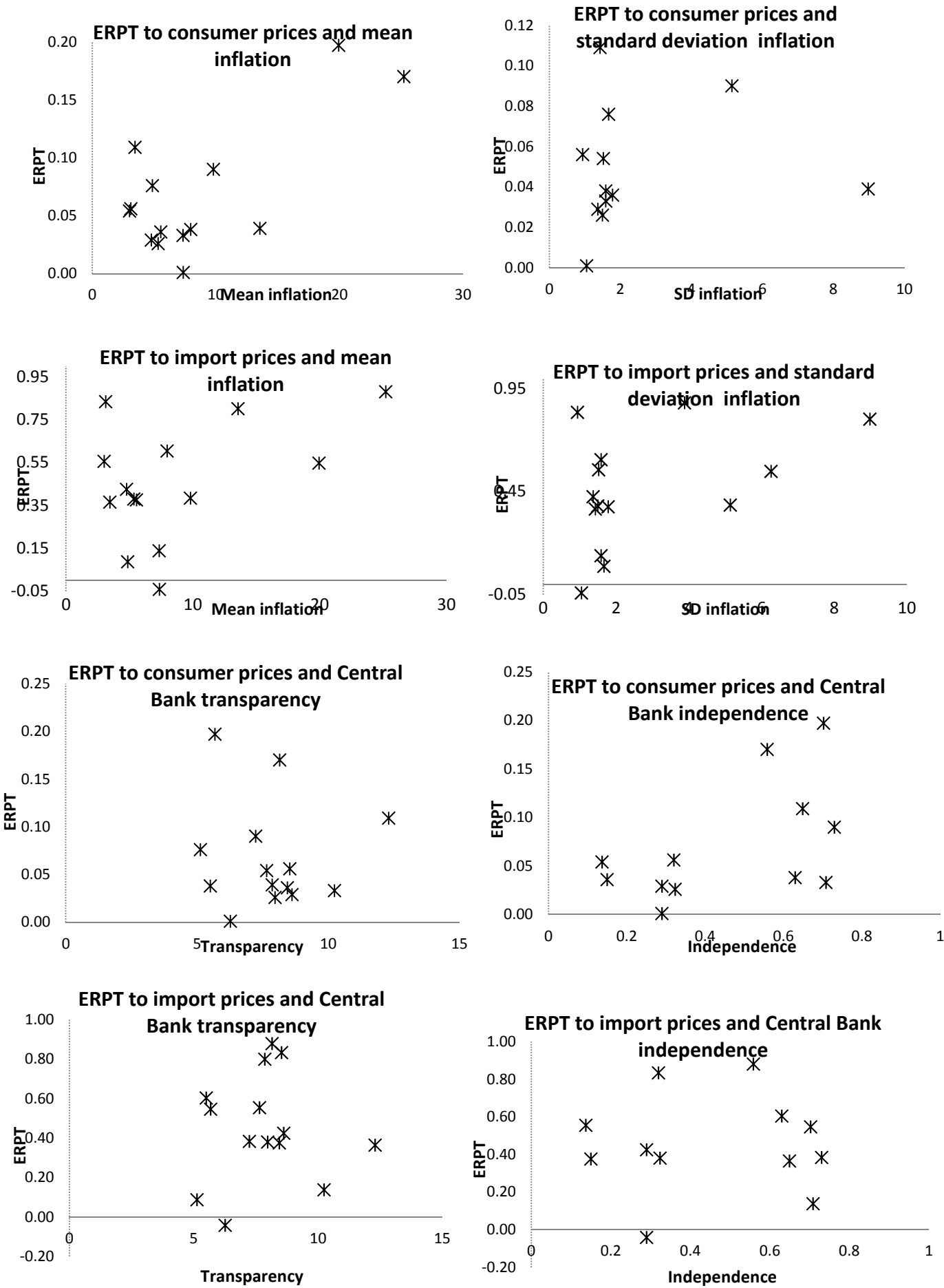
Table 9: Data sources

Series	Notation	Source
Import / consumer price index	p (in log.)	OECD
Import price deflator	mp (in log.)	
Consumer price index	cpi (in log.)	IFS (IMF)
Nominal effective exchange rate	e (in log.)	BIS
GDP at constant prices	y (in log.)	Macrobond
Trade-weighted foreign prices	p^* (in log.)	See Equation (12)

Notes: IFS: International Financial Statistics.

Figure 2: ERPT, inflation environment and central bank indicators





Figure(s)
[Click here to download Figure\(s\): IT_DF_Q.pdf](#)

