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The Effect of Central Bank Transparency on Exchange Rate Volatility

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The increase in central bank transparency was one of the main developments in central banking in the last two decades. This leads to the question of which effect central bank transparency has on the volatility of exchange rates. According to theoretical considerations, more information could either lead to more precise forecasts or to more noise trading. This raises the need for an empirical estimation of the relationship. The study shows that the effect of central bank transparency on exchange rate volatility depends on the development of countries. While there is no effect of central bank transparency in the composite sample and for developing countries, transparency increases exchange rate fluctuations in developed countries.

Keywords: Central Bank Transparency · Exchange Rate Volatility · Monetary Policy
JEL: E24 · E42 · E58 · F31

1 Introduction

One of the main goals of most central banks is to stabilise the economy and reduce economic fluctuations. This includes a reduction in inflation volatility, output variation, and also exchange rate volatility (ERV). The latter variable is of utmost importance for monetary policy for various reasons. Firstly, exchange rate volatility could negatively affect trade as a plethora of studies shows (e.g. Chowdhury, 1993; Arize et al., 2000; Chit et al., 2010). Secondly, there is some evidence that strong variations in exchange rates are related to lower private investments in developing countries (Bleaney and Greenaway, 2001; Servén, 2003). Thirdly, higher ERV can induce lower labour productivity where the effect is lower for financially developed countries (Aghion et al., 2009). Accordingly, ERV has a negative productivity effect up to a certain threshold level. According to Bagella et al. (2006), higher volatility of the real effective exchange rate reduces GDP growth. Fourthly, there is some concern that ERV leads to higher unemployment. Belke and Setzer (2003) present a theoretical model that hypothesises that ERV makes firms reluctant to hire workers which would result in higher unemployment. Belke and Gros (2002a) confirm this presumption by showing that the variability of the Euro-Dollar exchange rate

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significantly increases unemployment in the US and the Eurozone. Belke and Gros (2002b) also show that the variability of the domestic exchange rate with respect to the US Dollar and the Euro is significantly related to higher unemployment rates in Brazil and Argentina. Those points together emphasise the economic relevance of ERV. In the after Bretton-Woods era, ERV is particularly relevant for central banks in countries with flexible exchange rates. Mussa (1979) already stated around 40 years ago that periods of high and low fluctuations in exchange rates can mainly be explained by uncertainty over monetary policy. According to Scholl and Uhlig (2008), 10 % of the volatility of the US-German, US-UK, and US-Japanese exchange rates can be explained by monetary policy shocks.[1] Bouakez and Normandin (2010) analyse the effects of monetary policy shocks in six countries and show that they account for around 40 % (medium-term) or 30 % (long-term) of exchange rate fluctuations.[2] This demonstrates the impact of monetary policy on ERV. However, monetary policy is nowadays not only about changing key interest rates but also about communication. The increase in central bank transparency (CBT)[3] was among the main developments in central banking in the last two decades. This raises the question of how ERV is affected by the increased information provision of central banks. This question is especially relevant as many exchange rate theories put a strong focus on the news channel. Thus, more information could either increase or decrease fluctuations in prices of assets. This raises the need for an empirical estimation of the relationship. Given the lack of studies on this topic, the present study tries to fill the gap and analyse the relationship between central bank transparency and ERV both from a theoretical and an empirical point of view. Thereby, it contributes to the existing literature that analyses the effects of central bank transparency on macroeconomic variables like inflation or GDP growth volatility. The main findings can be summarised as follows: while there is not much evidence that CBT affects ERV in the case of the composite sample, we find clear evidence for an ERV increasing effect of CBT in the case of developed countries. In the case of developing countries, CBT only leads to fewer exchange rate fluctuations if we do not control for the fact that CBT reduces inflation volatility.

The paper is structured as follows: section 2 presents the theoretical background of the role of information on foreign exchange (forex) markets. Section 3 explains how central bank communication affects financial markets. Section 4 summarises previous studies on causes of ERV. Section 5 describes the data set and estimation approach. Section 6 shows the main estimation results. Section 7 addresses the question of whether the effect of transparency is different during times of high uncertainty. Section 8 concludes.

2 Theoretical Considerations

The role of information is central in asset pricing theory. The impact of news is especially emphasised by the Efficient Market Hypothesis (EMH). The main hypothesis of this theory is

[1] These estimates seem to be rather low compared to the studies of Eichenbaum and Evans (1995), Rogers (1999), or Farrant and Peersman (2006). However, Faust and Rogers (2003) argue that the effect of monetary policy shocks on ERV is rather low where the proportional effect could be anything between 8 and 53 percent.

[2] Kim and Roubini (2000) find that in the long run (48 months) between 4.6 % (Germany) and 45.3 % (Canada) of exchange rate fluctuations can be explained by monetary policy shocks. For the other countries in the sample (Japan, UK, France, and Italy), the ratio lies between 10 and 20 % and is insofar a bit lower than the estimate of Bouakez and Normandin (2010).

[3] Rough and ready definitions of the concepts central bank transparency and independence are that central bank transparency refers to the overall information provision by the central bank whereas central bank independence (CBI) means that the central bank can take its decision without direct influence from the government. More sophisticated definitions of the concepts can be found in Section 5.1 where we show how the two concepts are operationalised.

summarised in equation (1):

$$P_t = E_{t-1}(P_t|\Omega_{t-1}) + \epsilon_t \tag{1}$$

The equation says that the price of an asset P_t is determined by the expectation for P_t given the information set Ω_{t-1} available at the previous period plus an error term ϵ_t. The expectations were built in the previous period. The EMH assumes that all information available at period $t-1$ is already taken into account in period t-1 even if some events only occur in period t. An example would be a scenario in which it became public in period $t-1$ that a company violated certain rules and will be fined. Then the market participants build expectations about how hefty this fine will be. The asset of this company would already lose value in period t. If it turns out in period t that the fine is much heftier than expected, then there will likely be a further drop in the asset value. However, we would not expect a price reaction if the fine is exactly as high as everybody expected before as information available at time $t-1$ is already priced in at this time. Actual news is captured by ϵ_t. The EMH assumes that the error term is, on average, zero and it is not possible to forecast this error. And if a shock occurs (news hits the market), the market price changes immediately. This is a reasonable assumption as it should not be possible to predict news (information that really comes out of the blue). Consequently, the EMH predicts that fluctuations of asset prices are the result of news that affects financial markets. Clearly, the higher the information content of news, the stronger the effect of news is.

There is a vast amount of literature that tests the EMH empirically. However, we are interested in the effect of news on particular assets, namely the exchange rates. Following Frenkel's (1981) seminal work, we know about the effect of news on exchange rates. A simple formulation of the news model of exchange rates based on Moosa and Bhatti (2010) looks like this.

$$\Delta s_{t+1} = (i - i^*) + (\Delta s_{t+1} - \Delta s^e_{t+1}) \tag{2}$$

In this equation, Δs_{t+1} is the change in the spot range from period t to period $t+1$ that can be explained by differences in interest rates between the home country and the foreign country $(i - i^*)$ plus the difference between the expected exchange rate and the actual exchange rate $\Delta s_{t+1} - \Delta s^e_{t+1}$. Following covered interest rate parity, the difference between the forward rate and the spot rate is determined by the differences in interest rates:

$$f_t - s_t = (i_t - i^*_t) \tag{3}$$

Replacing $(i - i^*)$ in equation (2) with the forward premium $(f_t - s_t)$ leads to the following equation:

$$\Delta s_{t+1} = (f_t - s_t) + (\Delta s_{t+1} - \Delta s^e_{t+1}) \tag{4}$$

Now if we interpret $(\Delta s_{t+1} - \Delta s^e_{t+1})$ as the news component, we end up with:

$$\Delta s_{t+1} = (f_t - s_t) + news_t \tag{5}$$

Thus, this equation says that changes in the spot rate are the result of the swap rate plus unexpected news. As the swap rate is common knowledge, only news can affect exchange rates in this theory which makes it consistent with the EMH.

A multitude of studies has tested the effect of news about macroeconomic variables like money supply or trade balance on the exchange rate as Melvin and Yin (2000) show in their paper. Among the studies providing evidence for the effect of news on exchange rates are those by

Andersen et al. (2003), Faust et al. (2007), and Andersen et al. (2007). Almeida et al. (1998) confirm in the case of the DEM-USD exchange rate that both German and US announcements affect the exchange rate where the effect of US announcements is stronger. Thereby, it takes longer until German news is fully incorporated into the exchange rate. Prast and De Vor (2005) provide evidence for the USD-EUR exchange rate that news about the US real economy leads to an appreciation of the Dollar while political news of the Euro area induces a depreciation of the US Dollar vis-à-vis the Euro. Bad economic news regarding the US and good political events for the Euro area lead to a depreciation of the US Dollar while good economic news and good political events for the US induce an appreciation of the US Dollar. Ehrmann and Fratzscher (2005) confirm this result for the USD-EUR/DEM using real time data. Accordingly, the exchange rate significantly reacts to news about fundamentals. Announcements have a stronger impact if the exchange rate was higher than its sample average in the previous trading week (month, year). However, it is not necessarily the case that news is interpreted in the same way by all participants. Following Evans and Lyons (2005), news has two components: one part that everyone agrees on and one part where opinions vary (this effect works through order flows). One theoretical explanation for this phenomenon might come from Kondor (2012) who shows that disagreement among investors might be induced by news. As market participants have to learn about the interpretation of their fellow traders (analysing order flows)[4], exchange rates do not adjust to news immediately but take some time (Evans and Lyons, 2005). Love and Payne (2008) look at three exchange rates (USD-EUR, GBP-EUR, and USD-GBP) and reveal that macroeconomic news (e.g. on M3) affect both returns of exchange rates and order flows. Using a bivariate VAR model, they show that around one third of the reaction of exchange rates to macroeconomic news goes through order flows (trading). However, the reaction happens within two minutes so the foreign exchange market seems to be reasonably information efficient. In another study (Evans and Lyons, 2008), they even find that two thirds of the effect of exchange rates to macroeconomic news goes through order flows (trading). The study by Dominguez and Panthaki (2006) adds that it is not only news about fundamentals but also non-fundamental news (scheduled and non-scheduled) that shakes exchange rates.[5] Overall, they show that news tends to be more influential in times of high amount of news and in times of uncertainty. However, the effect of news is not restricted to spot exchange rates but also applies to futures (Chen and Gau, 2010).

This leads to the question of which variables affect exchange rates. A long time ago, Friedman (1953) argued that flexible exchange rates are not necessarily more volatile than fixed exchange rates. He said that the instability of exchange rates is a result of the instability of economic variables. Flood and Rose (1999) present a theoretical model that shows that the exchange rate depends on differentials of money, output, interest rates, and shocks. Empirically, they compare the standard deviation (SD) of the exchange rate with the SD of macroeconomic fundamentals like differences in money growth, differences in GDP growth, and variations in interest rates. However, the result of their cross section analysis is that those variables are only poorly related.[6]

[4]The effect of news on trading activity is confirmed by Chaboud et al. (2008). For the case of the US, macroeconomic announcements significantly affect trading volume in the foreign exchange market. There is still an effect on trading volume if the announcements do not contain any surprise.

[5]This phenomenon can be explained by the theoretical model of Bacchetta and Van Wincoop (2006). Their theoretical model shows that fundamentals are mainly relevant in explaining exchange rate volatility in the long-term. In the short-run and medium-run, fundamental values are of low importance.

[6]Devereux and Engel (2002) provide a theoretical model explaining this phenomenon. Under certain conditions, ERV has little or no effect on the economy. Therefore, the exchange rate can fluctuate to a much larger extent than the macroeconomic fundamentals.

Nonetheless, it is useful to consider a theoretical model first when analysing exchange rates.[7] The model that we use here is the flexible price monetary model which is also called the Frankel-Bilson approach. The version presented here is based on Moosa and Bhatti (2010). The flexible price monetary model is based on the following equation:

$$s_t = (m_t - {m_t}^*) - \alpha\,(y_t - {y_t}^*) + \beta\,(\Delta s_t^e) \tag{6}$$

In this equation, s_t refers to the spot rate (direct quote), m to money growth, y to GDP growth, and Δs^e to the expected change in the spot rate. Variables with asterisks refer to the foreign country. The basic equation says that the exchange rate between two currencies is determined by differences in money growth, differences in GDP growth, and the expected change in the spot rate.[8] Given the fact that this formula uses direct quotation for exchange rates, an increase in s refers to a depreciation of the local currency. Accordingly, the formula argues that ceteris paribus an increase in domestic money growth, a decrease in domestic GDP growth, and an increase in the expected spot rate change all lead to a depreciation of the domestic currency. The expected change in the spot rate is simply defined as:

$$\Delta s_t^e \equiv E_t\,(s_{t+1}) - s_t \tag{7}$$

This means that the expected change in the exchange rate at time t is the expected value of the spot rate at time t+1 minus the current spot rate (at time t). Everyone knows what the current exchange rate is. The only question is what people expect for the future exchange rate. If they believe the exchange rate at time $t+1$ to be different from this period's exchange rate, then Δs^e will be different from zero. However, such expectations are directly incorporated into current exchange rates according to equation (6). The only difference is that there is an adjustment process represented by the parameter β that tells us how fast the current exchange rate will react to expected changes. We can now use (7) to replace Δs^e in (6). This leads to:

$$s_t = \frac{1}{1+\beta}\,(m_t - {m_t}^*) - \alpha\frac{1}{1+\beta}\,(y_t - {y_t}^*) + \beta\frac{1}{1+\beta}E_t\,(s_{t+1}) \tag{8}$$

We know that the exchange rate in period $t+1$ will be:

$$s_{t+1} = \frac{1}{1+\beta}\,(m_{t+1} - {m_{t+1}}^*) - \alpha\frac{1}{1+\beta}\,(y_{t+1} - {y_{t+1}}^*) + \beta\frac{1}{1+\beta}E_{t+1}\,(s_{t+2}) \tag{9}$$

Now we can use this equation to replace $E_t\,(s_{t+1})$ in equation (8) which leads to:

$$\begin{aligned} s_t =& \frac{1}{1+\beta}\,(m_t - {m_t}^*) - \alpha\frac{1}{1+\beta}\,(y_t - {y_t}^*) \\ &+ \beta\frac{1}{1+\beta}E_t\left(\frac{1}{1+\beta}\,(m_{t+1} - {m_{t+1}}^*) - \alpha\frac{1}{1+\beta}\,(y_{t+1} - {y_{t+1}}^*) + \beta\frac{1}{1+\beta}E_{t+1}\,(s_{t+2})\right) \end{aligned} \tag{10}$$

Now we could replace $E_{t+1}\,(s_{t+2})$ and continue with this procedure by replacing the expectations about future exchange rates up to infinity. Doing so and simplifying the equation leads to:

$$s_t = \frac{1}{1+\beta}\sum_{i=0}^{\infty}\left(\frac{\beta}{1+\beta}\right)^i E[(m-m^*)_{t+i} - \beta(y-y^*)_{t+i}|\Omega_t] \tag{11}$$

[7] This simple model is only shown for illustrative purposes.

[8] In contrast to many studies that argue that monetary aggregates are irrelevant for exchange rates, Cerra and Saxena (2010) confirm the role of money in determining nominal exchange rates for a broad range of countries.

This is a rational expectations approach as the theory argues that all information available at time t (Ω_t) will be incorporated into prices in the current period. What this theory says is that the spot rate depends on current (realised) differences in money growth and GDP growth but also on expected variations in money and GDP growth in the future. Thus, fluctuations in the exchange rate can be the result of changes in macroeconomic variables or news.[9] Shifts in expectations about future money growth alone are sufficient to move the exchange rate. This hypothesis is confirmed in empirical studies. For instance, Fatum and Scholnick (2006) detect that changes in expectations about future US monetary policy – represented by swings in the Federal Funds Futures – have a direct impact on the exchange rate of the US Dollar to the German mark, the British Pound, and the Japanese Yen. Consistent with equation (11), they show that an anticipated expansionary move by the Fed (i.e. higher expected money growth in the future) is associated with a US Dollar depreciation.

Notably, the theory does not directly include inflation or differences in price levels. However, this is just due to the fact that this approach assumes that money growth is equivalent to inflation which is based on the equation of exchange.[10]

3 Central Bank Communication and Exchange Rates

This leads to the question of how monetary policy can affect exchange rate (changes). Firstly, the central bank can directly influence the money growth of the current period (m_t). Secondly, it can also affect expectations about future money growth (m_{t+i}). To put it differently, central banks can use both open market operations (actual monetary policy) and open mouth operations (verbal statements). As a result, central bank transparency can affect expectations about the future. Consequently, changes in actual money growth should only affect exchange rates or, in general, financial markets if this policy comes out unexpectedly. In fact, there is a vast amount of literature discussing the effects of monetary policy surprises on financial markets. The main result is that monetary policy shocks affect asset prices. The effect is very well documented for stock prices (e.g. Wang and Mayes, 2012) and stock market volatility (e.g. Bomfim, 2003). Chuliá et al. (2010) confirm that in the US monetary policy surprises induce a temporary increase in stock market volatility where the effect is stronger for contractionary monetary policy surprises (unexpected increases in the Federal Funds Rate). There is also overwhelming evidence that the same is true for exchange rates. Using the spot exchange rates between the US Dollar and the German mark, the British Pound, and Japanese Yen, Fatum and Scholnick (2008) elaborate that only monetary surprises affect exchange rates.

However, expectations about the future should also affect exchange rates as shown in the simple example in equation (11). Thus, another channel for central banks to influence exchange rates works through an expectations channel. There are, in fact, several ways through which central banks can influence public expectations. For instance, central banks can give hints about future monetary policy decisions. One way to provide information about future monetary policy decisions is forward guidance, which is part of the policy transparency. Thereby, one can distinguish between implicit or Delphic forward guidance and explicit or Odyssean forward

[9] Unfortunately, it is not possible to directly assess this hypothesis in this paper as we do not have data on expectations about money growth and GDP growth for several years into the future for a broad set of countries.

[10] Using logarithms, the Cambridge equation says: $m + v = p + y$. Accordingly, $p = m + v - y$ which means that the price level rises if money growth (m) goes up, the velocity of money (v) increases, or GDP growth (y) decreases. Holding v and y constant, a positive money growth rate translates one-to-one to the inflation rate. Clearly, empirical evidence questions the hypothesis that there is a proportional relationship between money growth and inflation (De Grauwe and Polan, 2005).

guidance. The former means that a central bank provides a non-conditional tie to a certain monetary policy stance.[11] Explicit forward guidance means that the central bank promises a certain monetary policy stance until a particular goal (e.g. a certain level of the unemployment rate) is achieved. More broadly speaking, central banks could publish their monetary policy rule or their strategy (i.e. procedural transparency). Assuming the (numeric) goals of monetary policy are common knowledge and the central bank publishes its policy rule, it is possible to predict future monetary policy by using forecasts for the respective macroeconomic variables that are present in the policy rule. This can easily be done in the case of Taylor rules. The work by Lange et al. (2003) is among the studies that confirms that central bank transparency contributes to a better understanding of future monetary policy. Rafferty and Tomljanovich (2002) show for the case of the Federal Reserve System (Fed) that higher policy transparency has increased market efficiency by improving forecasts.

In principal, the central bank can also affect forecasts of future output by publishing macroeconomic models and forecasts (i.e. economic transparency). If the public knows the monetary policy rule and the economic forecasts of the central banks, it is even easier to derive accurate guesses about the future monetary policy stance.[12] For instance, Fujiwara (2005) provides empirical evidence that forecasts of central banks do in fact influence private sector forecasts. Access to the forecasts of central banks is especially appealing as central banks might be better in forecasting macroeconomic variables. For instance, Faust and Wright (2009) as well as Gamber and Smith (2009) show that the Fed's forecasts on inflation published in the Green Book are superior to private sector forecasts. The GDP forecasts of the Fed are at least as good as those of the private sector (Gamber et al., 2014).

Not only might direct information about future monetary policy be helpful for forecasts but also other measures of central bank transparency like publishing of voting records. For instance, Gerlach-Kristen (2004) exemplifies for the case of the Bank of England that voting records can help predict future monetary policy decisions. Reeves and Sawicki (2007) confirm this result by showing that minutes and inflation forecasts of the Bank of England have an effect on short-term interest rates. Rosa and Verga (2007) approve the effect of central bank talk in the case of the European Central Bank. Furthermore, operational transparency can also be useful for forecasters. Balke and Petersen (2002) show, for example, that the Beige Book of the Fed – even though it only contains text and no data – can provide additional information about future economic activity. Based on this information, GDP forecasts can be improved.[13] The relevance of the Beige Book for predicting GDP and employment is confirmed by Armesto et al. (2009).

Overall, central bank transparency might lead market expectations to converge as forecasts become more synchronised (Bauer et al., 2006). This explains the impact of central bank transparency on exchange rates. Given the evidence that monetary policy surprises increase volatility (e.g. Farka, 2009), an increase in transparency that results in a better understanding of monetary policy should reduce monetary policy surprises and, thus, volatility of financial markets.

[11] For instance, the ECB's president Mario Draghi mentioned in the press conference in July 2013 that "the Governing Council expects the key ECB interest rates to remain at present or lower levels for an extended period of time". When asked about what an extended period of time means he said: "an extended period of time is an extended period of time: it is not six months, it is not twelve months – it is an extended period of time" (European Central Bank, 2013).

[12] On the other hand, providing economic forecasts by the central bank can also lead to a crowding out of private forecasts as Kool et al. (2011) demonstrate within a theoretical model.

[13] On the other hand, Zavodny and Ginther (2005) argue that the Beige Book does not provide further information for predicting interest rates in addition to other available information.

However, the effect of central bank transparency on exchange rate volatility is not clear-cut. On the one hand, more transparency could make expectations more precise leading to lower fluctuations in exchange rates. Let us assume that the central bank announces that it wants to take a more conservative approach towards monetary policy leading to more restrictive monetary policy both now and in the future. That means that the money growth rate in the current period decreases but also that future money growth will be lower. According to equation (11), there should be a direct reaction in the spot exchange rate as both current and upcoming money growth is expected to go down. If the central bank then announces in the next period that the money growth will remain at the lower level, this should not induce a strong reaction of exchange rates assuming that this information was already incorporated in the spot rate in the previous period. Clearly, it depends on how fast exchange rates react to changes in future values. However, if foreign exchange markets work like this, then there would only be a one-time change in the exchange rate until there is any further news. Overall, a decrease in variations about expected future values (i.e. more precise forecasts) would lead to a reduction in ERV.

On the other hand, there is a potential for a volatility increases as a result of central bank transparency. At a time when it was not yet usual for central banks to publish their operational targets (e.g. the Federal Funds Target Rate), several authors analysed the effect of publishing the operational targets from a theoretical point of view. Dotsey (1987) concludes that if the central bank is opaque regarding its goals, interest rates are less volatile. Lower policy transparency (in this case information about the targeted level for total reserves, borrowed reserves, and non-borrowed reserves) reduces the unconditional variance of the Federal Funds Rate but raises the variance of the forecast error. [14] Rudin (1988) adds that secrecy over the intentions of the central bank can reduce the variance of the forecast error of the interest rate if at least some banks watch the central bank's behaviour in order to gauge their reactions.

In general, more information provision could lead to more noise resulting in ever changing expectations about future monetary policy and future output growth. Van der Cruijsen et al. (2010) discuss the possibility of an "information overload" due to higher transparency that leads to confusion among market participants. In the case of the US stock market, Rosa (2011c) elaborates the importance of central bank communication. He finds that central bank announcements have a larger impact on stock prices than actual monetary policy does which supports the idea of a news channel in determining asset prices. Another stunning result of his analysis is that 90 percent of the volatility in stock prices, which is explainable and which is not purely due to random fluctuations, can be attributed to central bank communication. If the same applies to foreign exchange markets, then central bank transparency could lead to an increase in the variability of exchange rates. The effect of central bank speak is especially large in the time before formal monetary policy decisions are taken. In the case of the US, the sensitivity of short-term interest is up to four times higher before official Fed meetings (Ehrmann and Fratzscher, 2009). Moreover, there is a plethora of studies presenting evidence that policy transparency (e.g. communication of policy decisions) directly affects exchange rates. Sager and Taylor (2004) argue that announcements by the European Central Bank include new information which, as Conrad and Lamla (2010) show, significantly shape the Dollar-Euro exchange rate. Jansen and De Haan (2005) demonstrate that ECB communication has a direct impact on ERV. Rosa (2013) deduces that only surprises in the tone of the ECB's press conference, but not surprises in interest rate decisions, matter for Euro exchange rates. He refers to the exchange rates of the Euro against

[14] On the other hand, Tabellini (1987) criticises this finding and shows in his theoretical framework that opaqueness regarding the targets for the central bank's instruments increases both the unconditional variance and the conditional variance of the Federal Funds Rate.

the US Dollar, the British Pound, the Canadian Dollar, the Swiss Franc, and the Japanese Yen. In contrast, Rosa (2011a) shows that in the case of the Fed both expected announcements and surprise announcements alter the exchange rate of US Dollar towards the Euro and the other four currencies previously mentioned. Accordingly, monetary policy surprises lead to a temporary increase in the volatility of the US Dollar spot rate. In a further study, Rosa (2011b) points out that both monetary and news surprises significantly affect short and long-term interest rates in the US and the Eurozone. On the other hand, Beechey and Wright (2009) conclude in analysing five minute data on Treasury Inflation Protected Securities that monetary policy surprises only affect Treasury Inflation Protected Securities (5 years and 10 years) but not nominal yields. Hayo and Neuenkirch (2012b) affirm in the case of Canada that central bank communication affects both bond yields and daily stock market returns. Thereby, communication is more relevant for yields whereas newspaper coverage is more important for stock returns.

Apart from the communication of monetary policy decisions, central bank talk in general might move foreign exchange markets. Guthrie and Wright (2000) demonstrate that communication of the Reserve Bank of New Zealand has strong effects on the trade-weighted New Zealand Dollar. The effects are especially relevant in the very short-term. Such an effect is confirmed in the case of the Swiss National Bank (Ranaldo and Rossi, 2010). Accordingly, communication by the Swiss central bank significantly affects the exchange rate of the Swiss Franc towards the US Dollar. The results apply to official monetary policy statements but also to interviews and speeches of members of the Swiss National Bank.

Operational transparency (e.g. publishing of monthly bulletins) might also negatively affect financial markets. Sadique et al. (2013) reveal that both a positive and negative tone in the Fed's Beige Book are associated with higher stock market volatility while the frequency of words related to increases is negatively related to volatility. Jubinski and Tomljanovich (2013) use data on stock prices of 2,832 firms and find that minutes of the Fed increase the volatility of the stock prices in a small amount of companies where the magnitude of the effect is rather low.[15]

The discussion above makes it clear that the effect of increased information provision does not necessarily lead to lower fluctuations in exchange rates especially if there is enough noise trading (over)reacting to news with low information content.[16] Thereby, the effect of central bank communication or news in general might be contingent upon the development of a country. It might be the case that news plays a different role depending on whether a country has a full-fledged financial or currency market. If there are not many traders in a market and trading volume is low, there is a lower chance that news and central bank communication affect exchange rates compared to markets with high trading activity. McCauley and Scatigna (2011) show that the ratio of forex turnover to international trade (in goods and services) is positively related to

[15] The question of how stock prices and exchange rates are related is controversial in the literature. The Dornbusch and Fischer (1980) model assumes a causal effect from exchange rates on stock prices. Empirical studies find a significant long-term effect from stock prices on exchange rates (Ajayi and Mougouė, 1996), no long-term effect (Nieh and Lee, 2002), a causal effect from exchange rates to stock prices (Phylaktis and Ravazzolo, 2005; Abdalla and Murinde, 1997), a causal effect from stock prices to exchange rates (Granger et al., 2000), a bivariate relationship (Bahmani-Oskooee and Sohrabian, 1992), or no relation (Smyth and Nandha, 2003).

[16] Contrary to Friedman's hypothesis that the existence of rational speculators will help to reduce ERV and that only rational investors can stay in the market in the long-run, Carlson and Osler (2000) provide a theoretical model showing that rational speculation can lead to higher ERV if speculation is high. According to Hung (1997), an explanation for why rational traders (fundamentalists) do not act if exchange rates deviate from their "true" value is that also fundamentalists might not know the supposed correct exchange rate and that they might be concerned that future values of exchange rates are still influenced by noise traders.

GDP per capita.[17] That means that the portion of forex activity not related to the real economy is higher if a country is more developed. Consequently, more trading activity could be affected by news or non fundamentals in highly developed countries. Thus, the question is not only whether CBT has an effect on ERV but also whether the effect is contingent upon the level of development of a country. This urges the need for an empirical estimation of the overall impact of central bank transparency on ERV given that theory cannot deliver a clear-cut answer to this question.

Several studies are related to the present study. Some studies directly assess the impact of central bank talk on forex. Hayo and Neuenkirch (2012a) demonstrate that statements of both the Fed and the Bank of Canada have an impact on the spot exchange rate of the Canadian Dollar towards the Euro and the US Dollar. Thereby, communication of the Bank of Canada slightly helps to reduce the volatility of the Euro-Canadian Dollar exchange rate. Fratzscher (2008b) uses an event study approach and discovers for the USD-EUR and JPY-USD exchange rate that oral and actual interventions shape exchange rates. Oral interventions are very successful as they move exchange rates in the intended direction in more than three quarters of all interventions. Communication regarding exchange rates is especially successful if it is in line with the expected direction of the exchange rate and during times of high volatility. It also has a stronger impact if there are large deviations from PPP, if there are multiple interventions, and if oral interventions are combined with actual interventions. In two other studies, Fratzscher employs an EGARCH(1,1) model to analyse the effects of forex interventions (also USD- EUR and JPY-USD exchange rate). In Fratzscher (2006), both oral and actual forex interventions affect mean and conditional variance of the respective exchange rate. Cumulated impulse responses show that there is no significant long-term effect of interventions on exchange rates. The initial effect dies out after a few days. However, oral and actual interventions affect forex option contracts which can be seen as a proxy for forward exchange rates. Interestingly enough, oral interventions tend to reduce the volatility of forward exchange rates. In Fratzscher (2008a), only actual interventions affect the conditional variance (exception 1990-1999 period where oral interventions affect the JPY-USD volatility). Analysing the channels[18] through which interventions work, Fratzscher (2008a) demonstrates that there is no evidence for a signalling channel. The role of the coordination channel is supported by the fact that oral interventions have more impact if they happen during times of high uncertainty.

Other studies examine the effects of monetary policy strategies and CBT on ERV. Galí and Monacelli (2005) analyse within a small open economy model the effects of monetary policy strategies. They compare strict domestic inflation targeting, a Taylor rule (using CPI inflation), and an exchange rate peg. According to the model, strict domestic inflation targeting system leads to highest nominal ERV. The Taylor rule is in the middle between the other two strategies. Two studies directly assess the effect of Explicit Inflation Targeting (EIT) on ERV. Rose (2007) analyses nominal and real effective exchange rate over the period 1990 – 2005. As a measure for ERV he uses the SD of the logarithmised exchange rate over a certain time period (4 year spans, 8 year spans, and entire sample). In his sample, in 17 cases EIT has a significant negative effect on

[17] McCauley and Scatigna (2011) conduct regressions to estimate the effect of the level of development where the depend variable is the logarithmised ratio of froex turnover to international trade in the year 2007 and 2010, respectively. They find a non-linear relationship between GDP per capita and trading activity.

[18] According to Fratzscher (2008a), there are two main channels: a signalling channel and a coordination channel. The idea of the signalling channel is that central bank actions give the public information about future monetary policy. The coordination channel means that market participants might find it easier to converge their forecasts if the central bank intervenes on forex and deliver some sort of benchmark value for the respective exchange rate.

ERV, in 42 cases a negative (but not significant) effect and in 5 cases the effect is positive (but not significant). This study has been criticised by Lin (2010) for its empirical approach. In contrast, Lin (2010) uses matching estimators (propensity score matching) to evaluate the treatment effect of EIT. In the pooled sample (1985-2005), there is not much evidence for any effect of EIT. However, the picture changes when he distinguishes between developing and industrial countries. For industrial countries, he finds that NEER and REER volatility increases if countries introduce EIT. On the contrary, EIT is related to declines in NEER and REER volatility in developing countries. Berganza and Broto (2012) compare emerging countries conducting EIT with non-EIT countries. They also find that EIT contributes to higher exchange rate fluctuations.

Kuttner and Posen (2000) analyse the exchange rates between the US Dollar, the German mark, and the Japanese Yen. They attribute reductions in US Dollar volatility to increases in transparency of the Fed. Hau (2002) focuses on the role of trade openness in determining ERV. In his study, he finds that central bank independence helps to reduce exchange rate fluctuations in OECD countries. Tomljanovich (2007) analyses the effect of central bank transparency on interest rate determination. He finds that in most countries that increased central bank transparency interest rates over various ranges have become more predictable.[19] Furthermore, he shows that transparency helped to bring down conditional and unconditional interest rate volatility. Neuenkirch (2012, 2013) also confirms that central bank transparency can help to improve interest rate predictions where the result holds for industrial (Neuenkirch, 2012) and emerging countries (Neuenkirch, 2013). Papadamou et al. (2014) consider the effect of central bank transparency on stock market volatility. They find that an increase in transparency induces a reduction in stock market volatility. However, to the best of our knowledge, there has not been a study examining the effect of central bank transparency on ERV quantitatively. This motivates the present study.

4 Literature Review: Causes of Exchange Rate Volatility

Before we can continue with the empirical part of the study it is necessary to shortly revise the main literature on the determinants of exchange rate volatility. The rationale for that is that we could be plagued with spurious correlations if we just include central bank transparency but no other factors affecting ERV. For instance, it could simply be the case that countries with higher inflation volatility also have central banks with lower transparency. Given the fact that transparency seems to diminish inflation variability (Weber, forthcoming), the effect on ERV that is attributed to central bank transparency might be too large if we do not include inflation volatility in our regressions.

In order to better structure the overview of the determinants of ERV, we distinguish between three broad categories: news, macroeconomic factors, and variables related to the exchange rate system. We will discuss their role in influencing ERV in the next three subsections.

4.1 News

Section 2 has already clarified the role that news plays in determining exchange rates. Accordingly, news can shake exchange rates. If news affect exchange rates, then it could also have an impact on ERV. In fact, Melvin and Yin (2000) confirm that information has a significantly positive effect on ERV where news is proxied by the number of news headlines related to the US, Japan,

[19] On the other hand, Ehrmann and Fratzscher (2009) analyse central bank talk of the Fed and find that communication right before meetings of the Federal Open Market Committee take place increase interest rate volatility whereas it diminishes volatility shortly after the meetings.

or Germany. The seminal work of DeGennaro and Shrieves (1997) reveals that both public and private news[20] affect ERV. Bauwens et al. (2005) employ an EGARCH(2,2) for five minute data of the USD-EUR exchange rate. They find that volatility increases before scheduled and non-scheduled announcements where the total effect of announcements is positive, in the case of scheduled announcements (including speeches of senior officials), but zero for non-scheduled announcements (barring special cases). Stanèík (2007) analyses the effect of news on ERV for five Eastern European countries. Accordingly, news does influence ERV but there is no difference between good and bad news. Furthermore, Barndorff-Nielsen and Shephard (2006) elaborate that jumps in foreign exchange markets are the result of the arrival of macroeconomic news. According to Laakkonen and Lanne (2009), the effect of macro news is especially large during good times. Surprisingly, the magnitude of the effect of bad news is contingent upon the state of the economy while this is not the case for good news. Bad news affects ERV more during good times. Cai et al. (2001) use the example of the JPY-USD exchange rate and provide evidence that both Japanese and US major announcements have a significant impact on ERV. Bonser-Neal and Tanner (1996) analyse the decisive factors in explaining volatility in the exchange rate of the US Dollar towards the German mark and the Japanese Yen with special focus on interventions on foreign exchange markets. They find that announcements, with respect to M1 and unemployment data, increase the implied volatility of the exchange rates. On the other hand, announcements about industrial production, consumer price inflation, and producer price inflation tend to decrease ERV although surprises in producer prices increase exchange rate fluctuations. Using GARCH(1,1) models, Dominguez (1998) detects the effects of central bank interventions on currency markets. Thereby, exchange rate policy news either increases ($-DM exchange rate over the time periods 1977-1994 and 1987-1994 and $-Yen exchange rate from 1987-1994) or decreases ERV (1985-1987 for the $-Yen exchange rate). It might look far-fetched to attribute a news effect to interventions, themselves. However, as Dominguez (1998) argues, interventions might work as a signal to the public that the central bank or the government has private information (e.g. about future money or economic growth). Congruently with this presumption, central bank interventions affect ERV according to Bonser-Neal and Tanner (1996) and Dominguez (1998). However, the direction of the effect is not unanimous. Whilst Fed (1985-1987), Bank of Japan, and Bundesbank interventions tend to reduce volatility, they seem to increase volatility in other cases (Fed interventions 1977-1994 and 1987-1994) following Dominguez (1998). Bonser-Neal and Tanner (1996) find that Bank of Japan interventions increase volatility. Secret interventions might appear ambiguous and confuse market participants. Consequently, they tend to increase ERV as Dominguez (1998) demonstrates.

Given the fact that news affects order flows, it is expected that it also affects ERV as the increasing effect of trading volume on ERV is well documented in the literature (e.g. Baillie and Bollerslev, 1991 or Dacorogna et al., 1993). In fact, Cai et al. (2001) confirm that order flows increase volatility. Following Payne (2003), 40 % of the permanent variation in the USD-DEM exchange rate can be attributed to the information content of trades which confirms the role of asymmetric information. Frömmel et al. (2008) demonstrate that it is not total order flows that matter. While order flows of commercial customers (liquidity trading) are unimportant, order flows of other banks and financial costumers (informed trading) induce higher ERV.

[20] Like in the study of Evans and Lyons (2002), they use the amount of overall market activity as a proxy for private information.

4.2 Macroeconomic Factors

After discussing the news effect on ERV we will now consider macroeconomic factors. We start with an overview of variables capturing the sheer (economic) size of a country. The logarithm of GDP per capita is routinely included in regressions analysing ERV (e.g. Hausmann et al., 2006). Other studies use GDP per capita (Devereux and Lane, 2003) or GDP (Hviding et al., 2004). The standard argument behind this is that GDP covers the economic development of a country where more advanced economies should have exchange rates with lower fluctuations.[21] The studies using (log) GDP per capita find a negative correlation between this variable and ERV. Surprisingly enough, Hviding et al. (2004), who use plain GDP, find this variable to be positively related to ERV. Devereux and Lane (2003) also conclude that the log of the sum of the GDP of the two countries involved is positively connected to average exchange rate fluctuations. Larraín et al. (2002) achieve the opposite result when using the log of the mean of the GDPs of the countries represented in the bilateral exchange rate. In the same manner, we might expect that countries with more mature financial markets also face lower ERV. According to Devereux and Lane (2003), the size of the financial sector is negatively related to ERV in the full sample and for developing countries where it is, to a small degree, positively correlated with exchange rate fluctuations for developed countries. Devereux and Lane (2003) explain this result with the fact that advanced economies with sound financial institutions can cope with higher variability of their exchange rates. On the other hand, financial markets other than currency markets might have spill over effects on foreign exchange markets. Thus, volatility on other financial markets might directly transfer to currency markets. This conjecture is approved by Kanas (2000, 2002) and Bonser-Neal and Tanner (1996).

The relation between trade activities and the exchange rate seems to be obvious given the need for currency exchange in the case of transnational trade. Obstfeld and Rogoff (2000) and Hau (2000) show theoretically that more open countries should experience lower ERV. Empirically, this presupposition is confirmed by the studies of Hau (2002) and Hausmann et al. (2006). According to Canales Kriljenko and Habermeier (2004), external trade to GDP has the same diminishing effect on ERV. The effect also holds for bilateral trade between the countries represented by the respective exchange rate (Larraín et al., 2002) and the overall trade activity of the involved countries (Devereux and Lane, 2003). Furthermore, regional trade agreements, which are expected to boost trade, seem to diminish exchange rate fluctuations (Rose and Engel, 2002). Surprisingly, Rose and Engel (2002) also show that the logarithmised distance between two countries reduces ERV although the variable is negatively related to trade as the gravity model suggests.[22] Interestingly enough, the role of export similarity is inconclusive. Hausmann et al. (2006) find the concentration of exports to be positively correlated with ERV while Rose and Engel (2002) demonstrate that export dissimilarity induces higher exchange rate fluctuations.

Apart from trade of goods and services, capital flows have a major impact on exchange rates. As a result, indebted countries probably are partly dependent on external sources. A country with large external debt might be in danger of sudden outflows of capital which could trigger substantial exchange rate fluctuations. Canales Kriljenko and Habermeier (2004) and Hviding et al. (2004) provide empirical evidence for this idea showing that the fiscal deficit to GDP ratio raises the volatility of exchange rates. Moreover, external debt to GDP has the same effect

[21] This hypothesis is also confirmed by Canales Kriljenko and Habermeier (2004) who compare the ERV of developing and transition economics and discover that emerging markets tend to have exchange rates with lower price variation.

[22] Engel and Rogers (2001) argue that violations of the law of one price are more likely the more distant two countries are.

(Hviding et al., 2004). On the other hand, external finance (claims against other countries) seems to diminish ERV[23] while the interaction between external finance and the size of the financial sector increases volatility (Devereux and Lane, 2003). A measure to decrease the probability of experiencing sudden stops or to reduce borrowing costs might be to hold high foreign exchange reserves. In line with this idea, Hviding et al. (2004) show that the inverse of the reserve ratio of a country increases the volatility of the exchange rate where the effect is stronger for countries with flexible exchange rates. According to Poirson (2001), the ratio of total foreign securities in the country's currency to total foreign securities issued by the country is also positively related to ERV. She argues that a larger amount of securities helps countries to hedge against exchange rate risks.

Apart from that, business cycle effects might affect price variation. According to equation (11), GDP growth should have a direct impact on the exchange rate. An increase in economic growth makes a currency more attractive leading to an appreciation of the currency. Although this would lead to temporary fluctuations in the exchange rate we might expect that countries with higher GDP growth are more attractive to investors and should experience lower fluctuations in capital outflows. In fact, empirical studies confirm that GDP growth reduces ERV (Hviding et al., 2004; Canales Kriljenko and Habermeier, 2004). Consequently, bilateral exchange rate should fluctuate more if the involved countries have different business cycles. The volatility decreasing effect of business cycle asymmetry is confirmed by Rose and Engel (2002) for all studied countries and by Devereux and Lane (2003) for industrial countries only. In actual fact, business cycle asymmetry reduces ERV according to Devereux and Lane (2003) when analysing the sum of all countries. On the other hand, inflation is less desirable as nominal exchange rates of countries with higher price increases are expected to depreciate according to Purchasing Power Parity (PPP). Thus, inflation might make investors nervous and lead to capital outflows. Canales Kriljenko and Habermeier (2004) confirm empirically that inflation is related to higher exchange rate fluctuations. Inflation might have an additional effect as Filbien and Labondance (2013) show in the case of returns of the DJ Eurostoxx50 that inflation might make investors uncertain leading to abnormal returns in the sense of Fama et al. (1969).

It is also reasonable to assume that fluctuations of macroeconomic variables play a role. Gonzaga and Terra (1997) demonstrate the case of Brazil where inflation volatility (SD of inflation) positively contributes to ERV. Furthermore, Hviding et al. (2004) show that the SD of broad money growth increases ERV.

4.3 Factors Related to the Exchange Rate System

In contrast to Friedman's hypothesis, Mussa (1986) demonstrated three decades ago that ERV does differ with respect to the exchange rate system. The hypothesis that floating exchange rates are more volatile than fixed exchange rates is widely accepted and empirically approved by Canales Kriljenko and Habermeier (2004) as well as Klein and Shambaugh (2008). Furthermore, Canales Kriljenko and Habermeier (2004) show that countries with intermediate exchange rate systems or crawling bands tend to have less volatile exchange rates.[24] Obviously, forming a currency union also helps to reduce real effective exchange rate volatility (Hau, 2002).

[23] In the case of industrial countries, external finance increases ERV.

[24] The decision to adopt a certain exchange rate regime might itself be determined by macroeconomic variables as Alesina and Wagner (2006) show. For instance, countries with higher liabilities in foreign currency tend to prefer pegged exchange rate systems. Levy-Yeyati et al. (2010) analyse factors contributing to the decision about the exchange rate system and find, for instance, that more open economies have a larger tendency to adopt fixed exchange rates.

It is reasonable to assume that restrictions on capital transfers might reduce ERV as this prevents countries from being faced with highly volatile capital flows or capital bonanzas. On the other hand, there are also theoretical arguments stating that restrictions could increase exchange rate fluctuations. Following Lyons (1997), investors might be tempted to reduce their outstanding claims and withdraw money from countries with capital restrictions which then might increase ERV. The majority of empirical studies supports the former mentioned hypothesis. Accordingly, countries with no restrictions on capital transfer and multiple currency prices face higher ERV (Canales Kriljenko and Habermeier, 2004). Furthermore, Canales Kriljenko and Habermeier (2004) prove that restrictions regarding holding domestic notes and restrictions regarding denominating nonfinancial contracts in domestic currency reduce ERV. In the same manner, limits regarding the net foreign exchange open positions are beneficial in exchange rate stability. Apparently, not all restrictions have a calming effect on financial markets. Having ratified Article VIII of the IMF decreases exchange rate fluctuations, Article XIV increases volatility. Article VIII refers to general obligations of members and includes regulations regarding restrictions of capital transfer. Article XIV deals with transitional arrangements. However, the latter article might just be relevant for emerging and developing countries which tend to have more fluctuating currencies. In contrast, Edwards and Rigobon (2009) finds in the case of Chile that capital controls are related to a higher unconditional variance of the exchange rate.

Furthermore, Canales Kriljenko and Habermeier (2004) elaborate that a decentralised foreign exchange market, established electronic trading, and the existence of a dealer's association are related to lower ERV.

Hence, this section has shown that there are various variables that we have to examine in our empirical analysis. Not doing so could distort our results.

5 Data and Empirical Strategy

5.1 Data

After discussing the main factors which explain differences in ERV, we will now briefly describe the data employed in the empirical part. The macroeconomic data is mainly taken from the World Bank Development Indicators (WDI). We also use data from International Financial Statistics (for monthly data), Worldwide Governance Indicators (WGI), Global Financial Development Database, Polity IV, OECD, and Freedom House. The information about which countries have adopted EIT comes from Hammond (2012). Finally, we use the data of Dincer and Eichengreen (2014) on CBT and CBI. There are several ways of measuring those two variables. The most commonly used index for CBT is the Eijffinger-Geraats-Index (Eijffinger and Geraats, 2006). This index has five dimensions: political transparency, economic transparency, policy transparency, operational transparency, and procedural transparency. Each of these dimensions has three categories. In each category, a central bank can reach a maximum value of one. Thus, the maximum value per dimension is three. This explains the range of the index (0-15). We use both the composite index and the five sub-indices in our estimations. The measure for CBI is Cukierman's unweighted index of de jure central bank autonomy (for detailed information see Cukierman, 1992). The index has four dimensions focussing on the selection of personnel, the right to conduct monetary policy, the objectives of the central bank, and rules on government financing. The range of the index is zero to one where one means maximum autonomy.

Now we come to our measures for the dependent variable. In general, one can distinguish between ex ante measures and ex post measures of ERV (Dominguez, 1998). Ex ante measures

are based on exchange rate option prices. Ex post measures are the SD of the exchange rate or volatility measured by GARCH type models of spot exchange rates or effective exchange rates. In this study, we analyse only ex post measures of ERV.

The previous studies employ nominal exchange rates (Devereux and Lane, 2003), real exchange rates (Rose and Engel, 2002), nominal effective exchange rates (Canales Kriljenko and Habermeier, 2004), and real effective exchange rates (Hau, 2002 and Hausmann et al., 2006) for measuring ERV. We follow these studies and use two types of exchange rates. Firstly, we focus on bilateral exchange rates. The exchange rate data comes from the IMF's International Financial Statistics and from Thomson Reuters Data Stream. The exchange rate is measured as the local currency of the respective country per US Dollar. We use both monthly and daily data. The use of nominal exchange rates including the US Dollar is justified by the fact that the US Dollar is by far the most important currency in the world. In the years of our observation period, the US Dollar was involved in around 85 percent of all currency trades (Bank for International Settlements, 2016).[25] Secondly, we use data on effective exchange rates. Here we have two sources. Darvas (2012) provides data on effective exchange rates for 178 countries. Furthermore, we use the effective exchange rate indices provided by the Bank for International Settlements (BIS). Both datasets deliver nominal and real effective exchange rates on a monthly basis.

When it comes to measuring volatility, there are two different approaches. An unconditional volatility measure is the SD of a variable and the conditional volatility measure would be based on ARCH-type models. For the monthly bilateral exchange rates, the nominal and real effective exchange rates, we compute the SD of month-to-month exchange rate growth rates per year. Furthermore, we compute the SD of the yearly exchange rate growth rates for the monthly bilateral exchange rates. For the daily bilateral exchange rates, we use both the SD of continuously compounded growth rates of the exchange rate as an unconditional volatility measure plus a conditional volatility measure. The latter one is based on the following model where exchange rate growth is modelled as an AR(1) process:

$$\varsigma = \eta + \varphi_1 \varsigma_{t-1} + \epsilon_t \tag{12}$$

In this equation ς_t is the log difference of the spot rate against the US Dollar. Then we estimate the conditional variance based on a GARCH(1,1) process:

$$h_{i,t} = \omega^{'} z_{i,t} + \kappa_1 (|\epsilon_{i,t-1}|)^2 + \mu_1 h_{i,t-1} \tag{13}$$

Here $h_{i,t}$ is the conditional variance of exchange growth of country i in month t. In all cases, ω is defined as $\bar{\omega}$ minus $\sqrt{2/\pi} \cdot \sum_{i=1}^{q} \kappa_i$ (Lucchetti and Balietti, 2011). Then we save the estimated conditional standard deviations and compute the average per year. All other studies employing panel data mentioned in section 4 only use measures based on the SD of exchange rate changes. Thus, it is another contribution of this article to employ an alternative measure for ERV.

Apart from that, we use two data sets for data on exchange rate systems and capital controls. Ilzetzki et al. (2017) provide data on exchange rate regimes.[26] They categorise the different exchange rate regimes into categories. Based on coarse classification codes, we can build six dummy variables for different exchange rate system. The regimes are: peg, crawling peg, crawling band, freely floating, freely falling, and dual market. The measure by Ilzetzki et al. (2017) focuses

[25] To be precise: the share was between 84.9 % in 2010 and 89.9 % in 2001 (Bank for International Settlements, 2016).

[26] Furthermore, Levy-Yeyati and Sturzenegger (2005) and Shambaugh (2004) also provide data sets on *de facto* exchange rate systems. However, both data sets only deliver data until 2004. Thus, they are too short for our data set.

on *de facto* exchange rate regimes and is, thus, superior to the standard IMF *de jure* exchange rate classifications.[27] Fernández et al. (2016) deliver information about capital control measures. In our estimations, we mainly refer to the overall restrictions index (covering both inflow and outflow restrictions). The range of the index goes from 0 (no restrictions) to 1 (maximum restrictions). In addition, we also employ data from the Fraser Institute. The Fraser Institute publishes an annual report on economic freedom of the world (Gwartney et al., 2014). These data are available on an annual basis from 2000 to 2010 and contain variables on credit market regulation and capital controls but also on the SD of inflation over the past five years. Table 17 in section 9 presents the summary statistics of the main variables in the study. Table 18 and 19 present the summary statistics for developed and developing countries, respectively.

The time period under study is 1998 to 2010. We use annual data. We checked whether the variables have a unit root. Here we used the Maddala and Wu (1999) Fisher test that uses an ADF test for panel data. According to the results of the tests, we are not plagued with non-stationary data. Thus, we can stick with standard panel data models and do not have to check for cointegration.

5.2 Empirical Strategy

Now we can turn to the question of which methodology we should use. Several studies assess the effect of central bank talk in particular countries based on GARCH type models. However, we want to examine the overall impact of central bank transparency in a cross-country study in the fashion of studies that analyse the determinants of ERV with panel data (see subsections 4.2 and 4.3). Thus, we stick to panel data estimations. In this case, we use fixed effects regressions:

$$ERV_{i,t} = \vartheta_i + \tau_t + \beta_0 + \beta_1 CBT_{i,t-1} + \beta_2 CBI_{i,t-1} + \sum_{k=3}^{m} \beta_k X_{k,i,t} + \epsilon_{i,t} \tag{14}$$

In our case, the dependent variables of our analysis ERV_{it} is the exchange rate volatility measure (i.e. the SD of the exchange rate growth rate or the average conditional variance of the local currency against the US Dollar or the SD of the nominal or real effective exchange rate) of country i in year t. ϑ_i represent country fixed effects and τ_t time fixed effects. The main variables of interest are $CBT_{i,t-1}$ and $CBI_{i,t-1}$, which are the CBT index and the CBI index, respectively. X_{kit} are other explanatory variables that we control for. When it comes to deciding between random and fixed effects, the critical question is whether there are time-invariant factors that might be endogenous but which are not observable. In order to avoid problems due to non observable time-invariant factors, we stick to fixed effects estimations in our study.

In order to avoid simultaneity bias, the main explanatory variables (central bank transparency and independence) are only included as lagged variables. Thus, we basically measure whether changes in information provision in the last year had any impact on the volatility of the exchange rate in this year. Using this approach should protect us from being plagued with endogeneity problems as this year's exchange rate volatility *ipso facto* cannot have an influence on the central bank's decision about its transparency in the last period.[28]

[27] For instance, Calvo and Reinhart (2002) confirm that there are large discrepencies between *de jure* and *de facto* exchange rate regimes.

[28] It has to be emphasised that we use an index for overall transparency of central banks. The index does not tell how often central bankers talk to the media which could blur the results. Furthermore, Fratzscher (2005) shows for the central banks of Japan, the US, and Germany that ERV does not significantly affect oral interventions on the forex market. Thus, endogeneity should not be a problem for our estimations.

Dominguez and Panthaki (2006) and Fratzscher (2008a) argue that news and central bank communication have more impact during times of high uncertainty. We try to disentangle the "pure" effect of CBT by including interaction terms. Here we use two approaches. In the first instance, we include an interaction term between CBT and the SD of inflation. The second test is to analyse whether CBT has a stronger effect if ERV was relatively high in the previous year.

When implementing the interaction effect, we follow the instructions by Balli and Sørensen (2013). They argue that one should not use simple interaction terms between metric variables (here CBT and the SD of inflation (φ) or ERV) but rather interactions between differences from country means for the respective variables. Let us suppose $CBT_{i,t}$ is the amount of CBT in country i in year t. Then $\overline{CBT_i}$ is the average CBT of country i over the entire estimation period. $\left(CBT_{i,t} - \overline{CBT_i}\right)$ is, therefore, the difference of CBT from its mean over time in a particular country i. We use the same approach for the SD of inflation ($\varphi_{i,t}$) and the SD of exchange rate growth (ERV). Thus, we use the following equation when including the interaction term between CBT and the SD of inflation:

$$ERV_{i,t} = \vartheta_i + \tau_t + \ \beta_0 + \beta_1 \varphi_{i,t} + \beta_2 CBT_{i,t-1} + \beta_3 \left(\varphi_{i,t-1} - \overline{\varphi_i}\right) \left(CBT_{i,t-1} - \overline{CBT_i}\right) + \sum_{k=4}^{m} \beta_k X_{k,i,t} + \epsilon_{i,t} \quad (15)$$

According to Balli and Sørensen (2013), this is the preferable specification needed to prevent spurious regressions. The second approach is to test whether CBT has a stronger effect if ERV was relatively high in the previous year. Thus, we have to estimate a model in the following fashion:

$$ERV_{i,t} = \vartheta_i + \tau_t + \ \beta_0 + \beta_1 ERV_{i,t-1} + \beta_2 CBT_{i,t-1} + \beta_3 \left(ERV_{i,t-1} - \overline{ERV_i}\right) \left(CBT_{i,t-1} - \overline{CBT_i}\right) + \sum_{k=4}^{m} \beta_k X_{k,i,t} + \epsilon_{i,t} \quad (16)$$

For this second approach we have to stick to a different econometric technique given that we have to include the dependent variable as a lagged independent variable. An estimation of such a dynamic panel data model within a fixed effects framework would lead to inconsistent estimations due to Nickell's (1981) well known "dynamic panel bias". In this instance, the coefficient for the lagged variable would be underestimated. The bias decreases with the number of time periods. However, with only 13 years in the sample the bias is substantial and we cannot use an FE estimator. Thus, we have to employ a panel GMM model in the sense of Arellano and Bond (1991). The proposition by Kiviet (1995) to use an FE model and correct it for the bias is not appropriate in this context for two reasons. Firstly, we would need an unbalanced panel which we do not have. Secondly, this approach does not correct the potential problem of correlation between the lagged variable and other explanatory variables. Thus, we stick with the Blundell and Bond (1998) system GMM approach and treat the respective lagged ERV measure as endogenous and use lagged levels of these variables as instruments. For system GMM we need two conditions to hold. The first one is about serial and cross-section correlation between the lagged dependent variable and the change in the error term:

$$E\left(ERV_{i,t-w} \Delta \epsilon_{i,t}\right) = \ 0 \quad \forall i, t \ and \ w = 2, ..., T \quad (17)$$

The basic idea of the Arellano and Bond approach is to instrument the lagged dependent variable with further lags of the dependent variable. In our case, we instrument the lagged ERV measure with the ERV measure from two years ago. The assumption made in equation (17) can be tested with the Arellano and Bond (1991) test. For this specific case there does not have to be AR(2) serial correlation because then the second lag of the ERV measure could not work as an appropriate instrumental variable. System GMM requires another assumption:

$$E\left(\Delta ERV_{i,t-w}[\vartheta_i + \epsilon_{i,t}]\right) = 0 \quad \forall i, t \; and \; w = 2, ..., T \tag{18}$$

This assumption basically says that lagged changes of the dependent variable do not have to be correlated with the country specific fixed effects. There is no straightforward test for this assumption so we have to use our intuition. We suppose that the current level of volatility of the exchange rate is not clearly related to changes in ERV. For instance, it is not necessarily the case that countries with higher ERV compared to the other countries will constantly achieve reductions in the variability of their exchange rate. Take, for example, countries with fully floating currencies. These countries might not be willing to intervene on the forex market to reduce ERV. Thus, it seems that this assumption should be satisfied.

6 Estimation Results

After discussing the theoretical background and the related literature, we can now turn to the empirical results of the study. As we explained above, the empirical approach is fixed effects panel estimations. The section is divided into several parts devoted to the different measures of ERV.

6.1 Nominal Effective Exchange Rates

We start by analysing the volatility of the NEER based on the Bruegel measure of the NEER (Darvas, 2012). The main results are presented in Table 1. Robustness checks are shown in Table 20. In the basic setting, CBT, CBI and the SD of inflation are included as explanatory variables. In this estimation, only the coefficient of inflation volatility is significantly different from zero. On the other hand, CBT is irrelevant in this estimation.

Then we continue by including further explanatory variables based on the insights from section 4.2 starting with the SD of M2 growth, GDP per capita, and GDP growth. When we only include the variability of money growth, CBT has a significant positive impact.[29] However, if we include further explanatory variables, this effect disappears. Interestingly enough, the variable capturing central bank independence has either no effect or an increasing effect on ERV. This is in sharp contrast to Hau (2002) who finds that central bank independence is related to lower ERV. We then continue by using further control variables capturing macroeconomic effects like inflation, money growth, and the absolute exchange rate growth. The latter variable measures how much the exchange rate depreciated or appreciated in absolute terms in a given year. We would expect that higher changes in the exchange rate are also related to higher fluctuations in the monthly growth rate. The estimations confirm this conjecture. Inflation induces higher fluctuations of exchange rates which is in line with the theoretical considerations. Furthermore, we check for the impact of GDP growth, GDP per capita, trade openness, net foreign assets, banking crises,

[29] The estimations are not directly comparable as the number of observations changes most of the time when we include a further explanatory variable. This is simply due to the fact that the number of observations for specific variables differs.

government debt, and credit market regulation. An increased GDP growth should c.p. be related to a stronger domestic currency. What we find in most estimations is that GDP growth induces lower ERV. Concerning trade openness, the main result is that openness is accompanied by higher ERV. This is in contrast to the study of Hau (2002) but might be explained from the point of view of countries that are more open to trade are also more receptive to shocks coming from abroad.[30] Higher real interest rates make the domestic currency more attractive. This might help to keep investors holding investments in that particular country. At the same time, it makes (portfolio) investments in foreign countries less attractive for domestic savers. According to the estimations, there is some evidence for this view showing that higher real interest rates are related to lower exchange rate fluctuations. We also check whether it matters how large the amount of net foreign assets is. If net foreign assets are large in absolute terms, there will be constant income transfers (interest rate payments and dividends) which could affect exchange rates. In fact, net foreign assets tend to be negatively related to ERV. According to the arguments in section 4.2, government debt is crucial as higher rates of debt in countries might concern investors. Most estimations confirm that government debt raises exchange rate fluctuations. On the other hand, some of the hypotheses mentioned in section 4.2 are not confirmed. For instance, the total reserves as a percentage of total external debt is of no relevance. According to Poirson (2001), the share of manufacturing in value added is related to higher exchange rate fluctuations. Thus, we also control for this variable. The relevance of this variable is non-existent and does not influence the effect of CBT. We also check the finding of Hau (2002) that countries that export oil face higher ERV as they might be faced with large swings in demand from abroad. Our approach is to include oil rents as percentage GDP to control for this effect. However, we do not find much evidence that oil producing countries have more volatile exchange rates.

Finally, we tackle the effect of two other variables following the arguments from section 4.3. These are capital controls and credit market regulations. There are two conflicting hypotheses regarding capital controls. On the one hand, capital controls should help to reduce sudden stops in capital flows. On the other hand, increases in capital controls can induce investors to withdraw their money resulting in higher exchange rate changes. The empirical evidence supports the former conjecture. Furthermore, some estimations confirm that credit market regulations can also help reducing ERV. However, in most of these estimations we still do not find a significant effect of CBT on ERV.

Up to this point we did not check for the exchange rate system. It could well be the case that it is central banks with floating exchange rates that are more transparent. Thus, it is necessary to include variables capturing the exchange rate system. The surprising result is that including dummy variables for different exchange rate regimes does not matter much. In fact, the result throughout all estimations in the paper is that if a dummy variable for the exchange rate system (peg, crawling peg, crawling band, free falling) is included as an explanatory variable together with other determinants of ERV, then the dummy variable has either no effect or an increasing effect on ERV. However, when we regress just the exchange rate system dummies on the various ERV measures, it turns out that peg, crawling peg, crawling band, and freely floating are related to lower volatility of the NEER and the REER while they do not have any impact on the volatility of bilateral exchange rates. However, we still do not find any significant effect of CBT on ERV even when we include those various explanatory variables.

Overall, the estimations can only partly explain the behaviour of actual ERV. This comes as

[30] Another explanation might be that the measures for trade openness differ. While Hau (2002) uses the mean of export and import share over 19 years as the measure for trade openness, we use sum of imports and exports as a percentage of GDP on an annual basis.

Table 1: Determinats SD NEER - All Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13	fe14
CBT	0.00066	0.00082 **	0.00090 **	0.00003	0.00031	0.00036	0.00018	0.00062 *	0.00072 **	0.00062	0.00036	0.00007		
CBI	-0.00125	0.00128	-0.00036	0.00512	0.00374	0.00293	0.01558	0.01186	0.01158	0.00022				
SD Inflation (yearly)	0.00289 ***	0.00125 ***	0.00134 ***	0.00111 ***	0.00079 ***	0.00097 ***	0.00117 ***	0.00122 ***	0.00111 **	0.00101 ***	0.00143 ***		0.00013 ***	
SD M2 Growth (monthly)		0.00117 ***												
SD M2 Growth (yearly)			0.00030 **		0.00029 **									
SD GDP Growth (yearly)				0.00093 ***										
GDP per Capita					0.00000									
GDP Growth					-0.00057 ***	-0.00036 ***								
Inflation					0.00010	-0.00014 **	-0.00019 **	0.00022 *	0.00018	-0.00014 **				
Trade Openness					0.00011 ***									
Peg											-0.01339 **	-0.03590 ***	-0.02992 ***	-0.03625 ***
Crawling Peg											-0.01722 ***	-0.04186 ***	-0.03224 ***	-0.04034 ***
Crawling Band											-0.01373 ***	-0.03451 ***	-0.02845 ***	-0.03516 ***
Free Floating											-0.01394 *	-0.01528 ***	-0.01312 *	-0.01909 ***
Absolute Exchange Rate Growth						0.00038 ***	0.00038 ***	0.00039 ***	0.00036 ***	0.00039 ***				
Real Interest Rate						-0.00027 ***	-0.00026 ***	-0.00005	-0.00006	-0.00023 ***				
Capital Flow Restrictions							-0.00624							
Capital Controls								0.00021						
Credit Market Regulations									-0.00128 **					
Banking Crisis										0.00560 ***				
Explicit Inflation Targeting													0.00094	0.00109
Constant	0.00769 **	0.00659 *	0.00812 **	0.00769 **	-0.00232	0.01214 ***	0.00854	0.00035	0.01236 **	0.00954 **	0.02667 ***	0.05244 ***	0.04420 ***	0.05151 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	833	581	576	394	556	732	462	601	601	732	1007	1167	2212	2448
Countries	71	56	56	36	55	66	40	60	60	66	95	103	154	162
F	144.8	30.0	27.2	10.2	18.0	119.8	94.7	10.8	11.8	120.0	11.5	19.2	28.1	28.9
Adj. R^2	0.303	0.095	0.080	0.005	0.129	0.512	0.572	0.015	0.027	0.512	-0.032	-0.010	0.004	-0.009
R^2	0.391	0.182	0.176	0.077	0.011	0.527	0.562	0.106	0.141	0.528	0.100	0.074	0.143	0.096
AIC	-4893.0	-3647.3	-3608.4	-2689.3	-3495.6	-4498.5	-2756.8	-4017.4	-4024.3	-4499.3	-5568.9	-6168.1	-9895.2	-10934.4
BIC	-4874.1	-3625.5	-3586.6	-2669.5	-3456.8	-4461.8	-2723.7	-3982.2	-3989.1	-4462.6	-5534.5	-6137.7	-9855.3	-10899.5
CBT_1	0.00273 ***	0.00520 ***	0.00606 ***	0.00192	0.00692 ***	0.00226 **	0.00244	0.00469 ***	0.00490 ***	0.00263 **	0.00082	-0.00233 *		
CBT_2	0.00064	0.00195 *	0.00186	-0.00022	0.00005	0.00029	0.00078	0.00208 **	0.00209 **	0.00169 **	0.00035	-0.00086		
CBT_3	0.00256 **	0.00480 ***	0.00508 ***	0.00265 *	0.00376 **	0.00182	0.00131	0.00259 **	0.00263 **	0.00215 *	0.00067	-0.00101		
CBT_4	0.00066	0.00102	0.00131	-0.00077	-0.00043	0.00047	0.00047	0.00135 *	0.00141 *	0.00133 *	0.00088	0.00075		
CBT_5	0.00063	0.00110	0.00114	-0.00064	0.00051	0.00050	-0.00058	0.00128	0.00152	0.00224 **	0.00072	-0.00220 *		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

no surprise as the empirical literature shows that the exchange rate is not only a shock absorber but also has immanent shocks (Farrant and Peersman, 2006; Artis and Ehrmann, 2006).

Thus, the interim result is that there is no evidence for an effect of CBT on ERV in the composite sample. Now we follow the approach by Lin (2010) who splits the sample of countries into two groups when he estimates the impact of EIT on ERV. This is also plausible from the standpoint of Hausmann et al. (2006) who show that long-run REER volatility is about five times higher in developing countries and that there is still a difference in the variability of exchange rate changes between industrial and developing countries when controlling for a plethora of variables. Therefore, we split the sample based on the World Bank Classification. We use two broad categories. Low income and lower middle income countries are classified as developing countries. Upper middle income and high income countries are defined as developed countries. We take the respective country ranking in every year. Thus, countries can switch from developing to developed country and vice versa throughout the estimation period. The attribution of countries to the categories is based on the WDI measure of GNI per capita in USD (Atlas methodology). For each class, there are certain threshold levels. The threshold income level is adjusted annually.

Thus, we replicate the estimations presented in Table 1 for the two subsets of developing and industrial countries. The results of these estimations are shown in Tables 2 and 3[31]. The results could not be more diverse between developing and industrial countries. For the latter group, the estimations reveal that CBT has an increasing effect on ERV if we employ the same regressions as for Table 1. This matches the story of Lin (2010) who shows that EIT does not have a composite effect on ERV when analysing all countries at once but it increases ERV when only industrial countries are considered. On the other hand, CBT does not affect ERV in developing countries according to the estimations.

Let us consider the role of the exchange rate system again. If we include just the exchange rate system dummies plus CBT, then the coefficient is not significantly different from zero in the composite sample but is significantly positive for developed countries and negative (but not significant) for developing countries.[32] However, the results change slightly when we include the SD of inflation as a further explanatory variable. While the results for the composite sample and for developed countries does not change substantially, the coefficient of CBT loses its significance in the case of developing countries.[33] This matches the story of Weber (forthcoming) who shows that CBT can help in reducing inflation volatility. That means that CBT can only reduce ERV in developing countries if we do not check for the fact that CBT reduces inflation volatility.

In addition, the tables include the results for separate estimations of the effects of the five dimensions of the Eijffinger-Geraats-Index on ERV. The results for these sub-indices are shown at the bottom of each table. For the sake of brevity, the results for the control variables are not included. What we find is that both for the composite sample and the sub-sample of developed countries, political transparency (CBT_1) and procedural transparency (CBT_3) are in most estimations significantly correlated with higher ERV. The result regarding the latter variable is astonishing as procedural transparency deals with the publication of minutes and voting records.

[31] Tables 21 and 22 present the robustness checks.

[32] If we conduct an estimation with only CBT as explanatory variable, then the effect for developed countries is significantly positive and for developing countries significantly negative while there is no effect for the composite sample.

[33] This result cannot be attributed to low variation in CBT among developing countries. The SD of CBT is 3.37 among developed countries and 2.13 among developing. Thus, there is considerable variation in the main explanatory variable in both groups. The same applies to CBI where the SD is 0.22 for developed and 0.19 for developing countries, respectively.

Table 2: Determinats SD NEER - Developed Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	0.00153 ***	0.00173 ***	0.00176 ***	0.00082 **	0.00159 **	0.00090 *	0.00097 *	0.00104 *	0.00096 *	0.00148 ***	0.00169 ***		
CBI	0.00307	0.00235	0.00053	0.01093 *	0.00948	0.00967	0.01264	0.00704	0.00801				
SD Inflation (yearly)	0.00315 ***	0.00308 ***	0.00294 ***	0.00071	0.00103	0.00071	0.00263 **	0.00197 **	0.00114 *	0.00344 ***		0.00015 ***	
SD M2 Growth (monthly)		0.00098 **											
SD M2 Growth (yearly)			0.00045 **		0.00039								
SD GDP Growth (yearly)				0.00205 ***									
GDP per Capita					0.00000								
GDP Growth					-0.00045 **	-0.00040 ***							
Inflation					0.00064 **	0.00097 ***	0.00062 **	0.00035	0.00091 ***				
Trade Openness					0.00011 *								
Peg										-0.06566 ***	-0.09919 ***	-0.03110 ***	-0.03713 ***
Crawling Peg										-0.06764 ***	-0.10787 ***	-0.03219 ***	-0.04113 ***
Crawling Band										-0.06907 ***	-0.10564 ***	-0.03026 ***	-0.03785 ***
Free Floating										-0.05727 ***	-0.10149 ***	-0.00799	-0.02629 ***
Absolute Exchange Rate Growth						0.00037 ***	0.00028 **	0.00028 ***	0.00037 ***				
Real Interest Rate						-0.00018 *	-0.00014	-0.00012	-0.00014				
Capital Flow Restrictions							-0.00906						
Credit Market Regulations								-0.00153 **					
Banking Crisis									0.00466 **				
Explicit Inflation Targeting												0.00525	0.00509
Constant	-0.00089	-0.00277	-0.00171	-0.00294	-0.00924	-0.00162	-0.00144	0.01221	-0.00338	0.06751 ***	0.10786 ***	0.04296 ***	0.05105 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No
N	452	335	338	256	328	400	277	363	400	503	594	1665	1826
Countries	70	55	55	33	54	62	39	58	62	60	67	146	154
F	20.1	13.0	12.7	9.6	8.2	18.6	5.2	6.4	18.2	22.7	30.7	20.8	15.0
Adj. R^2	-0.027	-0.019	-0.022	0.010	0.014	0.135	-0.033	-0.057	0.130	0.125	0.122	-0.016	-0.048
R^2	0.111	0.116	0.126	0.056	0.026	0.268	0.092	0.188	0.269	0.187	0.107	0.144	0.073
AIC	-2924.2	-2084.1	-2103.9	-1837.9	-2042.0	-2625.2	-1796.1	-2446.7	-2623.1	-3303.7	-3648.3	-7363.2	-8090.7
BIC	-2907.7	-2065.0	-2084.8	-1820.2	-2007.8	-2593.3	-1767.1	-2415.6	-2591.2	-3274.1	-3622.0	-7325.3	-8057.6
CBT_1	0.00470 ***	0.00916 ***	0.00974 ***	0.00222	0.00771 ***	0.00355 **	0.00627 ***	0.00330 **	0.00396 ***	0.00411 **	0.00396 **		
CBT_2	0.00250 **	0.00280 **	0.00318 ***	0.00103	0.00078	0.00194 **	0.00249 **	0.00282 ***	0.00240 ***	0.00259 ***	0.00210 *		
CBT_3	0.00689 ***	0.00759 ***	0.00756 ***	0.00506 ***	0.00471 **	0.00505 ***	0.00480 ***	0.00548 ***	0.00461 ***	0.00573 ***	0.00583 ***		
CBT_4	0.00224 **	0.00263 *	0.00287 **	0.00123	-0.00010	0.00158 *	0.00193 *	0.00108	0.00188 **	0.00179	0.00146		
CBT_5	0.00587 ***	0.00583 ***	0.00624 ***	0.00479 **	0.00485 **	0.00299 *	0.00218	0.00494 ***	0.00381 **	0.00495 **	0.00136		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 3: Determinats SD NEER - Developing Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	-0.00017	-0.00004	0.00018	-0.00101 *	-0.00049	-0.00035	-0.00088	0.00018	0.00012	-0.00055	-0.00130		
CBI	-0.01188	0.00049	-0.00313	-0.01190	0.00160	-0.01052	0.02126	0.00842	-0.01314				
SD Inflation (yearly)	0.00289 ***	0.00086 ***	0.00115 ***	0.00128 ***	0.00083 ***	0.00091 ***	0.00128 ***	0.00049	0.00092 ***	0.00108 ***		0.00055 **	
SD M2 Growth (monthly)		0.00215 ***											
SD M2 Growth (yearly)			0.00015		0.00010								
SD GDP Growth (yearly)				-0.00001									
GDP per Capita					0.00001 *								
GDP Growth					-0.00065 ***	-0.00025							
Inflation					0.00008	-0.00018 **	-0.00025 **	0.00018	-0.00017 **				
Trade Openness					0.00009								
Peg										-0.01082	-0.03005 ***	-0.03563 ***	-0.04726 ***
Crawling Peg										-0.01711 **	-0.03339 ***	-0.04402 ***	-0.05297 ***
Crawling Band										-0.00944	-0.02163 ***	-0.03679 ***	-0.04322 ***
Free Floating										-0.01344	-0.00185	-0.03386 ***	-0.01945 **
Absolute Exchange Rate Growth						0.00039 ***	0.00038 ***	0.00039 ***	0.00040 ***				
Real Interest Rate						-0.00033 ***	-0.00042 **	-0.00004	-0.00030 ***				
Capital Flow Restrictions							0.01703						
Credit Market Regulations								-0.00102					
Banking Crisis									0.00559				
Explicit Inflation Targeting												-0.00743	-0.00795
Constant	0.01653	0.00999	0.01557	0.02346 ***	0.00195	0.02404 **	0.00342	0.01675	0.02110 **	0.03139 ***	0.05183 ***	0.05759 ***	0.06703 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No
N	381	246	238	138	228	332	185	238	332	504	573	547	622
Countries	42	33	33	20	31	38	21	33	38	56	61	56	61
F	84.6	25.6	19.0	5.5	12.6	83.5	58.1	4.3	83.9	4.8	8.8	15.6	21.1
Adj. R^2	0.356	0.213	0.144	-0.008	0.218	0.620	0.674	-0.038	0.621	-0.069	-0.039	0.056	0.061
R^2	0.463	0.274	0.249	0.073	0.041	0.634	0.642	0.157	0.635	0.087	0.105	0.172	0.180
AIC	-2087.5	-1626.5	-1555.1	-916.6	-1498.8	-1957.4	-1022.5	-1598.0	-1958.4	-2559.3	-2792.4	-2672.6	-2954.7
BIC	-2071.8	-1609.0	-1537.7	-901.9	-1468.0	-1926.9	-996.7	-1570.2	-1928.0	-2529.7	-2766.3	-2642.4	-2928.1
CBT_1	0.00243	0.00320	0.00484	0.00238	0.00833 *	0.00181	-0.00364	0.01060 *	0.00154	-0.00007	-0.00552 ***		
CBT_2	-0.00273 *	-0.00245	-0.00322	-0.00296	-0.00474	-0.00222	-0.00268	0.00029	-0.00002	-0.00195	-0.00405		
CBT_3	-0.00041	0.00029	0.00020	-0.00114	0.00060	0.00034	-0.00113	0.00030	0.00107	-0.00156	-0.00377		
CBT_4	-0.00135	-0.00199	-0.00132	-0.00389 *	-0.00395	-0.00144	-0.00282	-0.00043	-0.00037	-0.00106	-0.00161		
CBT_5	-0.00154	-0.00177	-0.00140	-0.00391 **	-0.00255	-0.00122	-0.00392 **	-0.00003	0.00097	-0.00188	-0.00410 **		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

This supports the idea that publishing verbatim records or voting results can leave room for interpretation which leads to more and not less consensus among market participants about future monetary policy. It is only for developing countries that economic transparency (CBT_2) also has a dominant effect on exchange rate fluctuations. As this sub-index covers the publishing of macroeconomic data, models, and forecasts, this result does not lend much support to the idea that publishing relevant economic data leads to more anchored or more accurate expectations among market participants that results in lower fluctuations of exchange rates.

Finally, we assess the question of whether the effect attributed to CBT is simply showing the impact of introducing Inflation Targeting. CBT is an integral part of EIT. Thus, we test the importance on EIT by regressing both the dummies for the exchange rate systems, the SD of inflation, and the dummy variable capturing whether a country has introduced on the SD of NEER growth. The result is that there is no evidence for any effect of EIT in the composite sample (*fe13* and *fe14* in Table 4) no matter whether the SD of inflation is included as an additional explanatory variable or not. The same is true for the subsamples of developed countries (*fe12* and *fe13* in Table 2) and developing countries (*fe12* and *fe13* in Table 3). Thus, it seems that the effect of CBT is not confounded with the effect of EIT.

When replicating the estimations with the NEER data from the BIS, the results for the full sample are virtually the same. For the case of developing countries we find the coefficient on CBT to always be negative. Sometimes the coefficient is even significantly negative. However, the number of estimations is in some estimations very low. Thus, we put more trust in the results based on the Bruegel measure of the NEER. When it comes to developed countries, the results mainly confirm what we have seen before. CBT increases ERV in developed countries.

6.2 Real Effective Exchange Rates

Before we assess the effect of central bank transparency on the volatility of the REER it is useful to think briefly about the difference between nominal and real exchange rates. Under PPP the real exchange rate should be stationary over time. Thus, PPP would also imply stationarity of the REER (Bahmani-Oskooee, 1995). Bahmani-Oskooee (1993) tests this hypothesis for 25 developing countries over the period 1973 – 1988. On the grounds of the effective exchange rate, PPP is rejected for all countries. In some cases, there is a cointegration relationship between the domestic price level and the product of the foreign price level and the exchange rate but the slope deviates from value one in these cases which is not in line with PPP. In Bahmani-Oskooee (1995), the null hypothesis of stationarity of the REER is rejected for 16 out of 19 cases (1970-1990).[34] At the same time, a cyclical component in the REER is evident (Sarantis, 1999). Thus, it is plausible to include measures of the SD of inflation as an explanatory variable in the estimation. Although real exchange rates are corrected for inflation, it might still be a relevant determinant of real exchange rates in the short-term if the fluctuations in the inflation rate are not fully absorbed by the nominal exchange rate. This is what Rogoff (1996) showed in his seminal work: it takes some time until real exchange rates adjust to price changes.[35] For instance, Gonzaga and Terra (1997) provide – in the case of Brazil – a theoretical model and some empirical evidence

[34] Wallace et al. (2014) criticise that the REER should not be used for tests of PPP as the null hypothesis will be rejected as long as one real exchange rate series is non-stationary.

[35] This refers to the idea of a mean reversion of real exchange rates back to their equilibrium levels. The time for returning to the equilibrium level is called half life process. Estimates of the time to come back to equilibrium vary from around 2 to 3 years (Taylor, 2002; Lothian and Taylor, 2008) to 3 to 5 years (Frankel and Rose, 1996; Rogoff, 1996) for developed countries and 1.2 to 2.1 years for the case of Latin American countries (Astorga, 2012). This is longer than the annual time span that we use so it makes sense to control for nominal variables also in the case of REER.

for the hypothesis that inflation volatility is a significant determinant of REER volatility. The same logic applies to other nominal variables like money growth. As money does not affect real variables in the long-run, it should also not affect real exchange rates in the long-run. However, there is some evidence that the SD of money growth does affect ERV (Hviding et al., 2004) when monthly data is used. Thus, we still include measures for the variability of inflation and money growth in our estimations.

We run the same regressions for the volatility of REER that we used for NEER. The results of these are estimations presented in Table 4.[36] Overall, the results are similar to those from section 6.1. The composite effect of CBT covering all countries is virtually zero. There are two exceptions: if we just include CBT, the SD of inflation and the SD of M2 growth alone or together with the dummies for the exchange rate regimes, transparency has a significant positive impact on ERV. However, this effect disappears if we exclude the SD of money growth. It is noteworthy that we find that the SD of inflation and money growth still play a role when using REER. The rationale for this was explained above. Based on the presumption that the effect of CBT might depend on the soundness of financial markets, we also tried to include different types of measures for the development of the financial sector (Bank Assets, bank deposits, stock market capitalisation, stocks traded (all as a percentage of GDP)) and also interaction terms between CBT and these variables which do not alter the result that in the complete data set there does not seem to be an effect of CBT on ERV.[37]

Given the result that there is no composite effect of transparency we apply the same approach as in section 6.1 and split the sample in developing and developed countries. Tables 5 and 6 show the estimation results for the sub-samples.[38] The main result is essentially the same as for NEER. For the case of developed countries, CBT has an increasing effect on ERV. This result remains stable when controlling for various explanatory variables. For the case of developing countries, we find in most estimations a negative coefficient for CBT. However, there is only one case where the effect is significant. When we just include the dummies for the exchange rate system and CBT, then CBT has no effect in the composite sample but a significant negative effect in the case of developing countries and a significant positive effect for developed countries. Again the significant effect for developing countries disappears if we include the SD of inflation as a further explanatory variable. Regarding the sub-indices, we find once more that political transparency (CBT_1) and procedural transparency (CBT_3) are related to higher ERV in the full sample and among developed countries. In the case of developed countries, operational transparency (CBT_5) is also of relative importance.

Again, we check the impact of EIT. In the composite sample (*fe12* and *fe13* in Table 4) and in the subsample of developed countries (*fe12* and *fe13* in Table 5), there is no effect of EIT. On the other hand, EIT significantly decreases the variability of REER growth. This confirms the results of Lin (2010). However, this the only instance in which EIT has any significant effect on ERV in our estimations.

As before we replicate the estimations with the REER data from the BIS. The results are very similar when we employ this measure. For the entire data set we find no significant effect of CBT in most estimations. As in the case of NEER, the coefficient on CBT is always negative in the sample consisting only of developing countries where the negative effect is sometimes significant. When re-running the regressions for developed countries, we find a significant increasing effect of CBT on ERV in all cases.

[36] The robustness checks are presented in Table 23.
[37] These results are not shown in the Table but are available upon request.
[38] Further estimations are shown in Tables 24 and 25.

Table 4: Determinats SD REER - All Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	0.00046	0.00067 *	-0.00002	0.00012	0.00011	0.00004	0.00057	0.00036	0.00060 *	0.00028	0.00013		
CBI	0.00162	0.00273	0.00693	0.00612	0.00528	0.01540	0.01153	0.00289					
SD Inflation (yearly)	0.00293 ***	0.00148 ***	0.00131 ***	0.00102 ***	0.00118 ***	0.00152 ***	0.00173 ***	0.00123 ***	0.00130 ***	0.00135 ***		0.00012 ***	
SD M2 Growth (yearly)		0.00027 **		0.00026 **					0.00038 ***				
SD GDP Growth (yearly)			0.00078 **										
GDP per Capita				0.00000									
GDP Growth				-0.00054 ***	-0.00037 ***								
Inflation				0.00008	-0.00014 **	-0.00021 ***	0.00013	-0.00014 **					
Trade Openness				0.00008 **									
Peg									-0.01579 ***	-0.01391 **	-0.03271 ***	-0.03105 ***	-0.03702 ***
Crawling Peg									-0.01844 ***	-0.01779 ***	-0.03918 ***	-0.03318 ***	-0.04056 ***
Crawling Band									-0.01724 ***	-0.01488 ***	-0.03422 ***	-0.03009 ***	-0.03693 ***
Free Floating									-0.02067 ***	-0.01479 **	-0.03255 ***	-0.01530 **	-0.02765 ***
Absolute Exchange Rate Growth					0.00035 ***	0.00035 ***	0.00032 ***	0.00036 ***					
Real Interest Rate					-0.00028 ***	-0.00030 ***	-0.00011 *	-0.00024 ***					
Capital Flow Restrictions						-0.00648							
Credit Market Regulations							-0.00122 **						
Banking Crisis								0.00493 ***					
Explicit Inflation Targeting												0.00062	0.00094
Constant	0.00855 **	0.00902 **	0.00782 ***	0.00044	0.01359 ***	0.01048 *	0.01362 **	0.01089 ***	0.02789 ***	0.02901 ***	0.05194 ***	0.04717 ***	0.05423 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No
N	833	576	394	556	732	462	601	732	733	1007	1,145	2198	2395
Countries	71	56	36	55	66	40	60	66	78	95	103	153	161
F	171.5	36.7	13.5	22.8	133.5	100.0	12.9	132.7	17.9	11.9	18.6	28.2	31.1
Adj. R^2	0.347	0.133	0.037	0.178	0.541	0.586	0.039	0.540	0.054	-0.029	-0.012	0.005	-0.004
R^2	0.429	0.212	0.110	0.019	0.549	0.577	0.151	0.553	0.160	0.100	0.073	0.147	0.100
AIC	-5016.2	-3696.4	-2734.0	-3580.2	-4605.0	-2793.2	-4045.4	-4602.3	-4720.9	-5645.6	-6304.1	-9946.8	-10880.4
BIC	-4997.3	-3674.7	-2714.2	-3541.3	-4568.3	-2760.1	-4010.2	-4565.5	-4684.1	-5611.2	-6273.9	-9906.9	-10845.7
CBT_1	0.00297 ***	0.00613 ***	0.00208	0.00694 ***	0.00228 **	0.00262	0.00507 ***	0.00261 **	0.00195	0.00141	-0.00021		
CBT_2	0.00082	0.00207 *	-0.00008	0.00034	0.00037	0.00081	0.00207 **	0.00172 **	0.00152	0.00056	-0.00064		
CBT_3	0.00214 *	0.00443 ***	0.00264 **	0.00308 *	0.00127	0.00126	0.00243 **	0.00158	0.00100	0.00067	-0.00109		
CBT_4	0.00053	0.00145	-0.00068	-0.00019	0.00019	0.00024	0.00116	0.00102	0.00134	0.00067	0.00049		
CBT_5	0.00084	0.00144	-0.00041	0.00093	0.00055	-0.00033	0.00147	0.00222 **	0.00163	0.00101	-0.00193 *		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the REER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 5: Determinats SD REER - Developed Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	0.00140 ***	0.00159 ***	0.00162 ***	0.00089 **	0.00115 *	0.00083 *	0.00099 *	0.00105 *	0.00088 *	0.00135 ***	0.00158 ***		
CBI	0.00347	0.00275	0.00101	0.00944	0.00603	0.00930	0.01061	0.00508	0.00762				
SD Inflation (yearly)	0.00252 ***	0.00242 ***	0.00228 ***	0.00108 *	0.00104	0.00075	0.00301 **	0.00272 ***	0.00118 *	0.00281 ***		0.00013 ***	
SD M2 Growth (monthly)		0.00084 **											
SD M2 Growth (yearly)			0.00041 **		0.00038 *								
SD GDP Growth (yearly)				0.00180 ***									
GDP per Capita					0.00000								
GDP Growth					-0.00045 ***	-0.00040 ***							
Inflation					0.00034	0.00062 ***	0.00058 *	0.00035	0.00056 ***				
Trade Openness					0.00009 *								
Peg										-0.06693 ***	-0.09647 ***	-0.03526 ***	-0.04188 ***
Crawling Peg										-0.06884 ***	-0.10496 ***	-0.03573 ***	-0.04501 ***
Crawling Band										-0.06926 ***	-0.10227 ***	-0.03367 ***	-0.04177 ***
Free Floating										-0.06050 ***	-0.09981 ***	-0.01263	-0.02973 ***
Free Falling													
Absolute Exchange Rate Growth						0.00030 ***	0.00026 **	0.00024 ***	0.00029 ***				
Real Interest Rate						-0.00016 *	-0.00016	-0.00015	-0.00011				
Capital Flow Restrictions							-0.00895						
Credit Market Regulations								-0.00133 *					
Banking Crisis									0.00476 **				
Explicit Inflation Targeting												0.00482	0.00481
Constant	0.00094	-0.00046	0.00048	-0.00214	-0.00643	0.00138	-0.00038	0.01137	-0.00033	0.07053 ***	0.10603 ***	0.04864 ***	0.05701 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No
N	452	335	338	256	328	400	277	363	400	503	585	1651	1787
Countries	70	55	55	33	54	62	39	58	62	60	67	145	153
F	17.1	11.1	10.9	9.5	6.8	13.9	5.2	7.0	13.6	23.0	33.9	19.9	18.2
Adj. R^2	-0.048	-0.043	-0.045	0.008	-0.020	0.069	-0.031	-0.043	0.064	0.127	0.144	-0.019	-0.039
R^2	0.085	0.092	0.103	0.069	0.020	0.223	0.090	0.185	0.220	0.184	0.111	0.153	0.092
AIC	-3022.7	-2158.9	-2180.1	-1863.9	-2112.1	-2694.3	-1803.2	-2460.3	-2692.2	-3424.2	-3688.2	-7335.6	-7952.9
BIC	-3006.3	-2139.9	-2161.0	-1846.2	-2078.0	-2662.4	-1774.2	-2429.1	-2660.2	-3394.6	-3661.9	-7297.7	-7920.0
CBT_1	0.00494 ***	0.00951 ***	0.01004 ***	0.00245	0.00800 ***	0.00363 ***	0.00640 ***	0.00339 **	0.00404 ***	0.00429 **	0.00426 ***		
CBT_2	0.00259 ***	0.00291 **	0.00324 ***	0.00124	0.00079	0.00203 **	0.00258 ***	0.00273 ***	0.00248 ***	0.00254 **	0.00205		
CBT_3	0.00713 ***	0.00782 ***	0.00778 ***	0.00534 ***	0.00486 **	0.00541 ***	0.00518 ***	0.00577 ***	0.00500 ***	0.00591 ***	0.00585 ***		
CBT_4	0.00230 **	0.00287 **	0.00309 **	0.00126	0.00013	0.00156 *	0.00189 *	0.00099	0.00185 **	0.00174	0.00138		
CBT_5	0.00593 ***	0.00598 ***	0.00636 ***	0.00489 **	0.00491 **	0.00306 *	0.00237	0.00470 ***	0.00385 **	0.00490 **	0.00135		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 6: Determinats SD REER - Developing Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	-0.00042	-0.00034	-0.00021	-0.00110 **	-0.00091	-0.00074	-0.00111	-0.00009	-0.00044	-0.00068	-0.00129 *		
CBI	-0.00778	0.00554	0.00297	-0.00525	0.00691	-0.00968	0.01398	0.00723	-0.01174				
SD Inflation (yearly)	0.00296 ***	0.00111 ***	0.00137 ***	0.00150 ***	0.00110 ***	0.00119 ***	0.00164 ***	0.00120 **	0.00120 ***	0.00113 ***		0.00058 ***	
SD M2 Growth (monthly)		0.00206 ***											
SD M2 Growth (yearly)			0.00016		0.00012								
SD GDP Growth (yearly)				-0.00007									
GDP per Capita					0.00001 *								
GDP Growth					-0.00058 ***	-0.00027							
Inflation					0.00007	-0.00019 **	-0.00028 **	0.00014	-0.00018 **				
Trade Openness					0.00008								
Peg										-0.00975	-0.02551 ***	-0.02998 ***	-0.03867 ***
Crawling Peg										-0.01621 **	-0.03025 ***	-0.03654 ***	-0.04394 ***
Crawling Band										-0.01065	-0.02308 ***	-0.03239 ***	-0.03931 ***
Free Floating										-0.01337	-0.02383 **	-0.03007 ***	-0.03519 ***
Absolute Exchange Rate Growth						0.00035 ***	0.00034 ***	0.00035 ***	0.00036 ***				
Real Interest Rate						-0.00039 ***	-0.00046 ***	-0.00012	-0.00036 ***				
Capital Flow Restrictions							0.01580						
Credit Market Regulations								-0.00112					
Banking Crisis									0.00356				
Explicit Inflation Targeting												-0.00760 *	-0.00805 *
Constant	0.01732 *	0.01056	0.01572	0.02169 ***	0.00275	0.02749 ***	0.01007	0.02079 **	0.02508 ***	0.03303 ***	0.05115 ***	0.05287 ***	0.06121 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No
N	381	246	238	138	228	332	185	238	332	504	560	547	608
Countries	42	33	33	20	31	38	21	33	38	56	61	56	61
F	101.4	33.7	26.6	7.9	15.8	90.4	63.6	5.3	90.0	5.0	7.0	13.6	17.9
Adj. R^2	0.406	0.287	0.229	0.058	0.281	0.640	0.694	-0.007	0.639	-0.066	-0.057	0.036	0.039
R^2	0.509	0.311	0.303	0.149	0.072	0.651	0.669	0.191	0.653	0.085	0.077	0.144	0.149
AIC	-2135.8	-1624.8	-1552.9	-933.8	-1491.9	-1989.6	-1043.6	-1607.3	-1988.6	-2579.7	-2866.0	-2729.6	-3044.1
BIC	-2120.0	-1607.2	-1535.5	-919.2	-1461.1	-1959.2	-1017.8	-1579.6	-1958.2	-2550.1	-2840.0	-2699.5	-3017.6
CBT_1	0.00272	0.00313	0.00470	0.00255	0.00853 **	0.00216	-0.00249	0.01054 *	0.00173				
CBT_2	-0.00240	-0.00157	-0.00245	-0.00283	-0.00287	-0.00213	-0.00281	0.00038	-0.00036				
CBT_3	-0.00122	-0.00114	-0.00167	-0.00129	-0.00118	-0.00069	-0.00160	-0.00024	-0.00016				
CBT_4	-0.00178	-0.00185	-0.00133	-0.00386 *	-0.00337	-0.00204 *	-0.00337 *	-0.00092	-0.00119				
CBT_5	-0.00126	-0.00124	-0.00098	-0.00357 *	-0.00142	-0.00111	-0.00344 *	0.00015	0.00082				

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the REER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

6.3 Bilateral Exchange Rates

After analysing exchange rate indices (NEER and REER), we now turn to bilateral exchange rates. Given that all exchange rates are expressed in terms of local currency vis-à-vis the US Dollar, we only include explanatory variables for the country from the respective local currency. Thus, everything is expressed in relative terms.

6.3.1 Monthly Data

When estimating ERV based on monthly bilateral exchange rate data, we use two different measures: the SD of yearly[39] and monthly growth rates of the exchange rate in a given year.

We will start with the results for fluctuations of annual growth rates (see Table 7)[40]. In contrast to the case of NEER (see 6.1) and REER (see 6.2), there is a composite effect of transparency on ERV. As it turns out CBT significantly increases ERV in all but two estimations. The only two cases in which we do not find a significant effect of ERV in the composite sample is when we only include dummies for the different exchange rate categories and the SD of inflation (columns *fe10* and *fe11* in Table 26). However, in all other estimations in which we check for macroeconomic causes of exchange rate fluctuations and the exchange rate system, central bank transparency significantly increases exchange rate fluctuations. The estimations also confirm the results regarding the control variables, namely that inflation and its SD increase ERV while GDP growth is related to lower variability of the exchange rate. When replicating the same regressions for the sub-samples of developing countries and developed countries[41], the results basically confirm the results of sections 6.1 and 6.2: CBT increases ERV in developed countries while it tends to have a decreasing – albeit not significant – effect in developing countries. Furthermore, we see once more that among the five dimensions of CBT political transparency (CBT_1) is the most important one.

Next we analyse the SD of monthly growth rates of the bilateral exchange rates. The main results are presented in Table 8. The robustness checks are available in Table 27 in the Appendix. Again we find that in all but two estimations, transparency leads to higher exchange rate fluctuations. The exceptions are the same as in the previous case (see columns *fe10* and *fe11* in Table 8): only if we just include dummies for the different exchange rate systems and the SD of inflation as control variables does CBT not have an effect in the composite sample. When just looking at developing countries[42], transparency is of no relevance in terms of exchange rate variability. On the other hand, we find a significant increasing effect on ERV in all estimations in the sub-sample of developed countries. Thus, the results confirm the main finding from the previous subsections: CBT increases ERV in developed countries but is rather unimportant in developing countries. With respect to the subindices of CBT, we find that both political transparency (CBT_1) and procedural transparency (CBT_3) are of increased importance among the five dimensions. The coefficients of these two variables are significantly positive in most estimations. We also estimate the impact of EIT. In none of the estimations is EIT of any importance (*fe12* and *fe13* in Table 7 and *fe12* and *fe13* in Table 8). This confirms the previous findings that it is not just EIT but the amount of CBT that affects ERV.

[39] To be precise: this is computed as the growth rate of the exchange rate in a particular month with respect to the value of the exchange rate in the same month of the previous year.

[40] The robustness checks including further control variables are presented in Table 26 in the Appendix

[41] These estimations are not shown in the paper but are available upon request.

[42] For the sake of brevity, the results for the subsamples of developing and developed countries are not shown in this paper.

Table 7: Determinats SD ER Growth (Yearly) - All Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	0.627 ***	0.717 **	0.556 **	0.906 ***	0.732 ***	0.797 **	0.534 ***	0.520 **	0.496 ***	0.322	-0.022		
CBI	9.556 *	9.853 *			8.216	9.436	9.756 ***	9.000 ***					
SD Inflation (yearly)	3.333 ***	3.275 ***	3.047 ***	2.996 ***	2.884 ***	2.829 ***	2.568 ***	2.464 ***	1.758 ***	1.593 ***		0.993 ***	
SD M2 Growth (monthly)					0.813 ***	0.760 ***							
SD GDP Growth (yearly)							0.372 **	0.047					
SD M2 Growth (yearly)									0.177 ***				
Peg									-9.064 ***	-5.817 **	-28.710 ***	-103.958 ***	-25.558 ***
Crawling Peg									-9.900 ***	-8.731 ***	-29.062 ***	-83.027 ***	-27.248 ***
Crawling Band									-4.894 **	-4.644 *	-24.441 ***	-78.254 ***	-22.037 ***
Free Floating									-2.621	-3.691	-22.514 ***	-56.480	-18.165 ***
Explicit Inflation Targeting												11.705	-0.297
Constant	-7.580 ***	-5.605 **	-2.204 *	-2.240	-8.735 ***	-8.018 **	-6.810 ***	-3.379 *	7.212 ***	8.222 ***	33.172 ***	91.617 ***	31.278 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No
N	756	756	1048	1048	558	558	392	392	703	936	1084	3918	5,241
Countries	68	68	92	92	55	55	35	35	77	91	101	154	173
F	580.2	121.1	593.2	87.1	235.9	63.4	116.1	41.4	77.1	42.2	11.6	2349.0	126.3
Adj. R^2	0.689	0.697	0.511	0.516	0.614	0.629	0.522	0.610	0.394	0.144	0.074	0.781	0.080
R^2	0.695	0.704	0.551	0.561	0.598	0.614	0.426	0.528	0.427	0.227	0.178	0.776	0.160
AIC	5167.2	5158.4	7533.4	7533.7	3809.0	3797.2	2271.9	2202.1	4140.5	6359.6	7807.4	54638.9	44678.0
BIC	5185.8	5232.4	7548.3	7608.0	3830.6	3870.7	2291.7	2269.6	4176.9	6393.5	7837.3	54682.8	44717.3
CBT_1	1.193 *	1.447 **	1.120 **	1.478 ***	1.985 **	2.341 ***	1.632 **	1.469 *	2.610 ***	1.139 **	-1.081		
CBT_2	0.921 *	0.607	1.137 **	1.420 **	1.680 **	1.211	0.846	0.156	1.351 **	0.765	-0.246		
CBT_3	1.308 *	0.967	0.688	0.512	2.040 **	1.256	2.126 ***	1.557 **	1.067	0.519	-1.306		
CBT_4	0.603	0.301	0.409	0.489	1.303 **	0.894	1.389 **	1.313 *	1.065 **	0.473	0.233		
CBT_5	1.010 *	0.748	0.851	0.901	1.147	0.673	0.499	-0.261	0.616	0.603	-2.076 ***		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the yearly growth rate of the bilateral exchange rate. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 8: Determinats SD ER Growth (Monthly) - All Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	0.231 **	0.372 **	0.119	0.336 **	0.335 ***	0.170 **	0.195 ***	0.015	0.186 ***	0.090	0.076		
CBI	0.954	1.775			-0.163	0.359	1.602	1.411 *					
SD Inflation (monthly)	1.116 ***	0.990 ***	1.088 ***	0.896 ***	0.573 ***	0.508 ***	0.908 ***	0.502 ***	0.468 ***	0.457 *		2.027 ***	
SD M2 Growth (yearly)					0.153 ***	0.119 ***							
SD M2 Growth (monthly)									0.144 ***				
SD GDP Growth (monthly)							0.054	0.070 **					
Peg									-4.143 ***	-2.761 *	-3.413 ***	-16.354 ***	-9.916 ***
Crawling Peg									-4.099 ***	-3.759 ***	-3.768 ***	-12.064 ***	-10.091 ***
Crawling Band									-3.471 ***	-2.207 *	-2.184 ***	-10.232 ***	-7.341 ***
Free Floating									-3.885 ***	-2.850	-2.509 **	-7.171	-6.512 **
Explicit Inflation Targeting												1.979	0.534
Constant	-0.015	1.677	0.999	2.222 ***	0.012	0.341	-0.622	0.309	4.493 ***	4.597 ***	4.984 ***	13.309 ***	11.476 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No
N	751	751	1042	1042	555	555	401	401	706	927	1066	3870	4954
Countries	68	68	93	93	55	55	36	36	76	90	101	153	173
F	11.7	5.3	12.7	4.2	20.5	12.9	11.5	14.3	13.6	3.1	7.4	20.7	8.4
Adj. R^2	-0.049	-0.002	-0.071	-0.047	0.042	0.198	0.017	0.308	0.019	-0.090	-0.068	-0.009	-0.028
R^2	0.042	0.077	0.020	0.049	0.113	0.186	0.070	0.135	0.212	0.040	0.067	0.033	0.008
AIC	4015.6	3992.4	5960.7	5948.1	2075.6	1987.0	1317.4	1186.9	2618.6	5293.9	5224.9	40581.4	44784.5
BIC	4034.1	4066.3	5975.5	6022.3	2097.2	2060.4	1337.4	1254.8	2655.1	5327.7	5254.7	40625.2	44823.6
CBT_1	0.337	0.761	-0.070	0.356	0.725 ***	0.704 ***	0.516 **	0.310	0.115	0.024	0.022		
CBT_2	0.414	0.740	0.312	0.772 **	0.696 ***	0.418 **	0.347 **	-0.086	0.527 ***	0.174	0.079		
CBT_3	0.606	0.717	0.072	0.194	1.022 ***	0.658 ***	0.712 ***	0.374 *	0.209	-0.011	-0.079		
CBT_4	0.270	0.528	0.172	0.545 *	0.323 *	0.025	0.189	-0.102	0.330 **	0.261	0.205		
CBT_5	-0.196	-0.020	-0.110	0.182	0.323	0.061	0.134	-0.252	0.345 *	-0.125	-0.214		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the bilateral exchange rate. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Overall, it is much more difficult to explain variations of exchange rate changes measured by monthly growth rates. This is apparent from the R^2 of the respective estimations in Table 8. In most cases, the R^2 has a value of 0.15 or below which shows that the explanatory power of the models is low. When using annual growth rates (see Table 7, the explanatory power is much higher with values of the R^2 of 0.5 or above in most estimations.

6.3.2 Daily Data

Lastly, we analyse the effect of central bank opaqueness on ERV based on daily data. Table 9 shows the results of the estimations where the dependent variable is the SD of the continuously compounded exchange rate changes.[43] As in section 6.3.1, we find a significant composite effect of CBT in almost all estimations. Higher central bank opaqueness seems to be related to fewer fluctuations in exchange rates. The exception are the cases in which we include exchange rate system dummies and the SD of inflation and money growth but no other control variables. For developing countries, we again find a tendency towards a decreasing effect of CBT on ERV. However, this effect is not statistically significant. In developed countries, there is unanimous evidence that CBT increases the variability of daily growth rates in bilateral exchange rates.[44]

Finally, we analyse whether the main findings are still apparent when we use a conditional volatility (CV) measure (the average of the estimated conditional standard deviations of daily exchange rate growth). Table 10 presents the results for the respective estimations, robustness checks are shown in the Appendix in tables 29 and 30. In the composite sample, CBT raises ERV in most estimations. Here we use a CV measure for inflation as an alternative to the SD of inflation. However, $CVInflation$ does not work much better than the SD of inflation. In accordance with the previous findings, the sub-samples reveal that developed countries with higher CBT tend to have currencies that fluctuate less while CBT, in the case of developing countries, is irrelevant in terms of exchange rate fluctuations. It is noteworthy that in the case of developing countries, we find a significant negative effect of CBT on ERV if we only include dummies for the exchange rate system and CBT as explanatory variables. In the other cases, we do not find any effect of EIT when using ERV measures based on daily data.

Concerning the dimensions of CBT, policy transparency (CBT_5) is the most relevant sub-index for the SD of daily growth rates. On the other hand, procedural transparency (CBT_3) matters most when we use the GARCH type measure of ERV.

In general, the explanatory power of the models explaining daily ERV is very low. This should not be surprising as most of the explanatory variables are only measured at a monthly or annual basis.

7 Central Bank Transparency under Uncertainty

The final step is to assess the hypothesis of Dominguez and Panthaki (2006) and Fratzscher (2008a) that news and central bank communication have a stronger impact during times of high uncertainty. We explained the empirical approach in section 5.2 in detail. The main idea is to test whether there is an interaction effect between CBT and some measure of uncertainty (in this case volatility of inflation and the exchange rate). We start by looking at the results for the interaction effect between CBT and the SD of inflation. The results of the estimations for the

[43] Robustness checks are available in Table 28.
[44] These estimations are not shown in the paper but are available upon request.

Table 9: Determinats SD ER Growth (Daily) - All Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10
CBT	0.00049 *	0.00049 ***	0.00051 ***	0.00020	0.00009	-0.00041			0.00039 **	0.00042 ***
CBI	0.00223	0.00236	0.00143						0.00191	0.00198
SD Inflation (yearly)	0.00102 ***	0.00051 ***	0.00056 ***						-0.00002	0.00028
SD Inflation (monthly)				0.00129 ***	0.00126 ***		0.00109 ***			
SD M2 Growth (yearly)			0.00022 ***						0.00012 **	0.00011 **
SD M2 Growth (monthly)		0.00015		0.00036 ***						
Absolute Exchange Rate Growth			0.00011 ***						0.00015 ***	0.00018 ***
Inflation			-0.00013 ***						0.00003	0.00013 **
GDP Growth									-0.00013 ***	-0.00007
Broad Money Growth									-0.00003 *	-0.00001
Real Interest Rate									-0.00001	0.00000
Peg				-0.00551 ***	-0.00637 **	-0.01573 ***	-0.01072 ***	-0.02144 ***	0.00749 ***	0.00377
Crawling Peg				-0.00650 ***	-0.00936 ***	-0.01683 ***	-0.01164 ***	-0.02416 ***	0.00748 ***	0.00360 *
Crawling Band				-0.00419 **	-0.00644 **	-0.00963 **	-0.00941 ***	-0.02053 ***	0.00857 ***	0.00531 ***
Free Floating				-0.00659 ***	-0.00738 *	0.03445 ***	-0.00612	-0.00315		
Capital Controls										0.00030 **
Explicit Inflation Targeting							-0.00071	0.00004		
Constant	0.00097	0.00145	0.00120	0.00876 ***	0.01240 ***	0.02057 ***	0.01645 ***	0.02864 ***	-0.00475 *	-0.00470 *
N	697	486	475	667	916	1080	1374	1630	416	371
Countries	66	50	50	70	88	97	114	129	47	45
F	43.5	31.4	33.3	9.0	4.5	13.5	9.5	6.7	10.8	9.7
Adj. R^2	0.082	0.130	0.234	-0.020	-0.078	-0.032	-0.047	-0.065	0.147	0.157
R^2	0.171	0.210	0.296	0.168	0.045	0.028	0.056	0.034	0.106	0.201
AIC	-4744.8	-4085.4	-4043.9	-5475.3	-6232.6	-5711.1	-8041.6	-7521.1	-3616.0	-3303.3
BIC	-4726.6	-4064.5	-4014.7	-5439.3	-6198.8	-5681.2	-8005.0	-7488.7	-3563.6	-3248.5
CBT_1	0.00068	0.00096	0.00183 ***	0.00007	-0.00016	-0.00387 *			0.00108 *	0.00177 **
CBT_2	0.00152 *	0.00134 ***	0.00124 ***	0.00107 **	0.00111	-0.00062			0.00055	0.00064
CBT_3	0.00091	0.00144 ***	0.00164 ***	0.00073	-0.00009	-0.00214			0.00080	0.00138 **
CBT_4	0.00150 **	0.00080 **	0.00108 ***	0.00054	0.00082	0.00058			0.00106 ***	0.00095 ***
CBT_5	0.00084	0.00043	0.00088 *	-0.00033	0.00009	-0.00253			0.00068	0.00021

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the daily growth rate of the bilateral exchange rate. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 10: Determinats CV (GARCH) ER Growth - All Countries

Variable	fe1	fe2	fe3	fe4	fe5	fe6	fe7	fe8	fe9	fe10	fe11	fe12	fe13
CBT	0.000008 **	0.000004 *	0.000012 ***	0.000008 **	0.000008 ***	0.000007 *	0.000010 ***	0.000008 *	0.000004 *	0.000002	-0.000002		
CBI	-0.000012	-0.000025	0.000016	0.000011	0.000034	0.000040	0.000018	0.000024					
CV (Inflation)	0.000000	0.000001 ***	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000					
(t-1)		0.000000											
SD Inflation (monthly)									0.000023 ***	0.000023		0.000029	
SD M2 Growth (monthly)	0.000000	0.000000	0.000000	-0.000001	0.000000	-0.000001	0.000000	-0.000001	0.000003				
GDP per Capita	0.000000	0.000000											
GDP Growth	-0.000003 ***	-0.000004 ***											
Inflation	0.000003 ***	0.000004 ***	0.000002 **	0.000000	0.000003 ***	0.000002 *							
(t-1)		-0.000002 ***											
Trade Openness	0.000001 **	0.000000											
Absolute ER Growth			0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***					
Broad Money Growth			0.000000	0.000000	0.000000	0.000000							
Real Interest Rate					-0.000001	0.000000							
Peg					0.000027	0.000021			-0.000081 **	-0.000116	-0.000299 *	-0.000179	-0.000408
Crawling Peg					0.000080 **	0.000079 **			-0.000100 ***	-0.000139	-0.000314 **	-0.000163	-0.000374
Crawling Band					0.000072 **	0.000070 **			-0.000091 ***	-0.000110	-0.000277 *	-0.000132	-0.000329
Free Floating									-0.000140 ***	-0.000138	-0.000277	-0.000094	-0.000276
Capital Flow Restrictions							-0.000063 *	-0.000048					
Explicit Inflation Targeting												0.000009	0.000018
Constant	0.000044	0.000065 **	0.000054 *	0.000076 **	0.000010	0.000030	-0.000012	-0.000022	0.000384 ***	0.000383 **	0.000632 ***	0.000432	0.000698 ***
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	Yes	No	Yes	No	Yes	No	No	No	No	No
N	414	408	414	414	375	375	272	272	594	802	1171	1171	1392
Countries	44	43	45	45	43	43	29	29	63	78	98	98	110
F	9.3	14.8	19.7	10.4	9.1	5.8	14.4	7.7	7.0	0.2	0.4	0.4	0.4
Adj. R^2	0.053	0.191	0.173	0.232	0.112	0.147	0.162	0.239	-0.035	-0.114	-0.094	-0.094	-0.087
R^2	0.002	0.004	0.002	0.000	0.000	0.001	0.105	0.169	0.003	0.003	0.000	0.000	0.001
AIC	-6830.6	-6922.6	-6889.3	-6910.6	-6271.7	-6277.9	-4519.2	-4536.5	-9665.6	-9882.1	-12313.3	-12313.3	-14862.7
BIC	-6798.4	-6882.5	-6857.1	-6834.1	-6224.6	-6187.5	-4494.0	-4471.6	-9630.5	-9849.2	-12277.8	-12277.8	-14831.3
CBT_1	0.000019 *	0.000011	0.000038 ***	0.000021 **	0.000019 **	0.000013	0.000035 ***	0.000025 **	0.000002	-0.000001	-0.000019		
CBT_2	0.000011	0.000008	0.000021 ***	0.000005	0.000012 **	0.000001	0.000018 ***	0.000003	0.000017 **	0.000053	0.000024		
CBT_3	0.000026 ***	0.000027 ***	0.000037 ***	0.000026 ***	0.000018 **	0.000009	0.000039 ***	0.000029 ***	0.000022 **	0.000019	-0.000024		
CBT_4	0.000004	0.000002	0.000019 ***	0.000007	0.000016 ***	0.000010 **	0.000017 **	0.000005	0.000009	0.000052	0.000050		
CBT_5	0.000005	0.000000	0.000018 **	0.000000	0.000011 *	0.000003	0.000013	-0.000003	-0.000002	0.000029	-0.000025		

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the annual average of the conditional standard deviation of daily exchange rate growth. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

composite sample are presented in Table 11. Tables 12 and 13 present the same estimations for developed and developing countries, respectively.

The findings are in line with the main ones in the previous sections. For the composite sample, there is neither a significant effect of CBT nor the interaction term. There is only an exception in the case of the SD of annual exchange rate growth rates. Thus, we split the sample again. For the case of developing countries (see Table 13), we come up with the exact same result that CBT is of no relevance. In only one case (*IE18* in Table 13) is the interaction term significantly different from zero. However, a completely different picture emerges when we only look at developed countries (see Table 12). In all cases we find CBT to be positively correlated with ERV. Perhaps even more interesting is the result that the interaction effect $(\varphi_{i,t-1} - \overline{\varphi_i}) \left(CBT_{i,t-1} - \overline{CBT_i}\right)$ is significantly different from zero in all but one case (*IE9* in Table 12). This means that CBT has an even stronger increasing effect on ERV if the fluctuations in the inflation rate (i.e. inflation uncertainty) were relatively high in the previous year.

Eventually, we focus on the role of time-persistence of ERV and the interaction effect between CBT and previous exchange rate fluctuations. This calls for a dynamic panel data model. As explained in section 5.2, we apply system GMM. Table 14 shows the results of the GMM estimations for the various ERV measures. Additional estimations for developed and developing countries are shown in Table 15 and 16.

As previously done with the other estimations, we compute the composite effect and the effect for the two sub-groups. For the composed data set, we find a significant increasing effect of CBT on ERV in three out of six cases (*ab3*, *ab4*, and *ab5* in Table 14). Next we look at the sub-groups. In the case of developing countries, we find a significant effect of CBT in one case (*ab15* in Table 16) while CBT has no impact in the other cases. On the other hand, CBT is related to higher ERV in all estimations when it comes to developed countries (see Table 15). This confirms the main findings of the article. The estimations also show that there is persistence in ERV. In most cases the coefficient of the lagged dependent variable is significantly positive. With respect to interaction effect, there is no evidence whatsoever that the effect of CBT is contingent upon the level of previous exchange rate fluctuations. In none of the estimations (composite or sub-samples) is the coefficient of the interaction term significantly different from zero.

Finally, we check the properties of the system GMM models. The two criteria are autocorrelation of the error terms and exogeneity of the instruments. The Arellano-Bond test examines autocorrelation of the differenced residuals. The results of this test are presented at the bottom of the table. They show that the null hypothesis of no AR(2) in differenced residuals cannot be rejected. In one case (*ab9* in Table 15), the null hypothesis of no AR(2) in differenced residuals is rejected. Thus, we used the third lag instead of the second lag of the dependent variable as an instrument. Then we check for an AR(3) process in differenced residuals but do not find evidence against the null hypothesis of no third order autocorrelation. This is an important result as higher order autocorrelation would harm the moment conditions of system GMM. The other requirement is exogeneity of the employed instruments. Here we employ the Hansen J statistic that tests the overidentification restrictions. The null hypothesis of this test is that the instruments are exogenous. The null hypothesis is not rejected in any case. Thus, even this condition is met and we can trust the results.

8 Conclusions

The idea of this study was to analyse the effect of central bank transparency on exchange rate volatility. We started with an overview of theoretical models analysing the effect of news on

Table 11: Interaction Effects - All Countries

Variable	**IE1**	**IE2**	**IE3**	**IE4**	**IE5**	**IE6**
Dep. Var.	**SD NEER (Bruegel)**	**SD REER (Bruegel)**	**SD ER Growth (yearly)**	**SD ER Growth (monthly)**	**SD ER Growth (daily)**	**CV (GARCH)**
CBT	0.00019	0.00009	0.58433 **	0.12267	0.00017	0.00001
$\left(\varphi^{y}_{i,t-1} - \overline{\varphi^{y}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$	0.00000	0.00000	0.00123		0.00000	
$\left(\varphi^{m}_{i,t-1} - \overline{\varphi^{m}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$				-0.00596		0.00001
SD Inflation (yearly)	0.00330 ***	0.00322 ***	3.09757 ***		0.00112 ***	
(t-1)	-0.00055 ***	-0.00043 ***	-0.06082		-0.00015 *	
SD Inflation (monthly)				1.65274 ***		0.00006
(t-1)				0.28182		0.00003
Constant	0.01043 ***	0.01196 ***	-2.32410 *	0.29260	0.00373 ***	0.00022 **
N	1131	1131	1041	1034	942	833
Countries	96	96	92	92	88	79
	All	All	All	All	All	All
F	80.709	86.284	296.038	10.992	34.287	1.146
Adj. R^2	0.165	0.179	0.512	-0.052	0.047	-0.103
R^2 (overall)	0.265	0.285	0.554	0.021	0.150	0.026
R^2	0.238	0.251	0.556	0.045	0.139	0.006
AIC	-6092.8	-6186.4	7488.4	5906.5	-6335.6	-10296.1
BIC	-6067.6	-6161.2	7513.1	5931.2	-6311.4	-10272.5

Notes: The table shows the results of fixed effects estimations with robust standard errors. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 12: Interaction Effects - Developed Countries

Variable	**IE7**	**IE8**	**IE9**	**IE10**	**IE11**	**IE12**
Dep. Var.	**SD NEER (Bruegel)**	**SD REER (Bruegel)**	**SD ER Growth (yearly)**	**SD ER Growth (monthly)**	**SD ER Growth (daily)**	**CV (GARCH)**
CBT	0.00148 ***	0.00138 ***	0.84465 ***	0.36706 ***	0.00080 ***	0.00001 ***
$\left(\varphi^{y}_{i,t-1} - \overline{\varphi^{y}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$	0.00006 ***	0.00006 ***	0.00667		0.00001 **	0.00000 ***
$\left(\varphi^{m}_{i,t-1} - \overline{\varphi^{m}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$				0.28571 ***		
SD Inflation (yearly)	0.00357 ***	0.00294 ***	2.10865 ***		0.00083 ***	0.00002 ***
(t-1)	-0.00068	-0.00054	0.55765 ***		0.00000	0.00000
SD Inflation (monthly)				2.72261 ***		
(t-1)				0.33776		
Constant	0.00151	0.00316	-2.59084 **	-1.32777 ***	-0.00017	-0.00003 **
N	594	594	514	510	390	364
Countries	95	95	89	89	48	42
	developed	developed	developed	developed	developed	developed
F	25.977	23.711	61.405	46.398	25.123	19.755
Adj. R^2	0.010	-0.005	0.230	0.155	0.113	0.086
R^2 (overall)	0.125	0.104	0.283	0.141	0.181	0.112
R^2	0.173	0.161	0.368	0.308	0.229	0.199
AIC	-3898.5	-4018.5	2795.8	1785.9	-3528.7	-6226.6
BIC	-3876.6	-3996.5	2817.0	1807.1	-3508.9	-6207.1

Notes: The table shows the results of fixed effects estimations with robust standard errors. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 13: Interaction Effects - Developing Countries

Variable	**IE13**	**IE14**	**IE15**	**IE16**	**IE17**	**IE18**
Dep. Var.	**SD NEER (Bruegel)**	**SD REER (Bruegel)**	**SD ER Growth (yearly)**	**SD ER Growth (monthly)**	**SD ER Growth (daily)**	**CV (GARCH)**
CBT	-0.00075	-0.00087	0.07886	-0.15379	-0.00057	0.00000
$\left(\varphi^{y}_{i,t-1} - \overline{\varphi^{y}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$	-0.00002	-0.00002	-0.00306		0.00000	
$\left(\varphi^{m}_{i,t-1} - \overline{\varphi^{m}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$				-0.08010		0.00000 *
SD Inflation (yearly)	0.00330 ***	0.00326 ***	3.20922 ***		0.00114 ***	
(t-1)	-0.00058 ***	-0.00048 **	-0.10262		-0.00017 **	
SD Inflation (monthly)				1.33010 ***		0.00004 ***
(t-1)				0.30427		0.00001 *
Constant	0.01485 ***	0.01684 ***	-1.57475	1.10270	0.00635 ***	0.00059 ***
N	537	537	527	524	458	379
Countries	55	55	56	56	50	43
	developing	developing	developing	developing	developing	developing
F	41.779	45.219	159.194	3.698	34.540	10.057
Adj. R^2	0.169	0.186	0.523	-0.092	0.157	-0.016
R^2 (overall)	0.281	0.301	0.586	0.015	0.253	0.148
R^2	0.259	0.275	0.577	0.031	0.255	0.108
AIC	-2606.7	-2642.5	4076.5	3309.2	-3098.2	-5967.9
BIC	-2585.3	-2621.1	4097.8	3330.5	-3077.6	-5948.2

Notes: The table shows the results of fixed effects estimations with robust standard errors. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 14: Dynamic Panel Data Models

Variable	ab1	ab2	ab3	ab4	ab5	ab6
Dep. Var.	**SD REER (Bruegel)**	**SD NEER (Bruegel)**	**SD ER Growth (yearly)**	**SD ER Growth (monthly)**	**SD ER Growth (daily)**	**CV (GARCH)**
SD REER (Bruegel) (t-1)	0.28215974 ***					
SD NEER (Bruegel) (t-1)		0.29269788 ***				
SD ER Growth (yearly) (t-1)			0.18229939 *			
SD ER Growth (monthly) (t-1)				0.07545301		
SD ER Growth (daily) (t-1)					0.03624856	
CV (GARCH)						1.0011021 ***
CBT	-0.0000615	-0.00017934	0.39132935 ***	0.15859078 ***	0.00019692	4.72E-06 **
CBI	-0.00200595	-0.00041608	0.06686282	0.02162087	-0.00021094	-0.00003497
$\left(ERV^{y}_{i,t-1} - \overline{ERV^{y}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$	-3.19E-06	0.00003856	0.02017724			
$\left(ERV^{m}_{i,t-1} - \overline{ERV^{m}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$				-0.00519673	2.77E-06	-2.19E-07
SD Inflation (yearly)	0.00033935	-0.00020814	1.496148 **	0.08536906	0.00035925 **	
SD Inflation (monthly)						0.00001866
peg	-0.00304505 **	-0.00347049 **	0.07352237	0.40804186	0.00093817	0.00001264
Constant	0.01142471 ***	0.01269537 ***	-0.57652836	1.0875113 **	0.00430033 ***	-0.00005422
N	640	641	661	653	592	559
Groups	63	63	65	64	60	55
Hansen statistics	23.413909	23.221666	47.470385 *	26.096385	25.645025	19.373419
p-value	0.32231281	0.33227443	0.03845646	0.20279769	0.17785821	0.49768597
AR(1)	-3.9638357 ***	-3.2207667 ***	-3.4608862 ***	-2.8798851 ***	-2.7828893 ***	-2.158411 **
AR(2)	0.36275519	0.25189792	-2.9879332 ***	0.6567121	0.47323996	1.8694068 *
AR(3)			0.97145925			

The table shows the results of system GMM estimations with robust standard errors where the dependent variable is the respective ERV measure. The respective lagged ERV measure is treated as endogenous variable. The instruments being used are the lagged endogenous variables. The asterisks indicate whether a coefficient is significantly different from zero at the 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 15: Dynamic Panel Data Models – Developed Countries

Variable	ab7	ab8	ab9	ab10	ab11	ab12
Dep. Var.	**SD REER (Bruegel)**	**SD NEER (Bruegel)**	**SD ER Growth (yearly)**	**SD ER Growth (monthly)**	**SD ER Growth (daily)**	**CV (GARCH)**
SD REER (Bruegel) (t-1)	0.31774919 ***					
SD NEER (Bruegel) (t-1)		0.32653681 ***				
SD ER Growth (yearly) (t-1)			0.25455679 ***			
SD ER Growth (monthly) (t-1)				0.08813413		
SD ER Growth (daily) (t-1)					0.05131373	
CV (GARCH)						0.09333919 **
CBT	0.00034772 *	0.00039696 *	0.26180685 ***	0.10736382 **	0.00026242 **	2.90E-06 **
CBI	-0.00388408	-0.00368987	1.8997282	0.89098803	0.00211351	3.66E-06
$\left(ERV^{y}_{i,t-1} - \overline{ERV^{y}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$	-4.54E-06	0.00004997	-0.01945061			
$\left(ERV^{m}_{i,t-1} - \overline{ERV^{m}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$				0.00541474	0.00018349	-1.79E-06
SD Inflation (yearly)	0.00065611 *	0.00041026	1.3670284 ***	0.22382691 ***	0.00032517 *	
SD Inflation (monthly)						0.00009839 ***
peg	-0.0029292 **	-0.00278923 *	-0.56406969	0.30472537	-0.000049	-5.35E-06
Constant	0.00884778 ***	0.00843306 ***	-1.2913046	0.40156073	0.00239446 **	-0.00003295
N	315	315	312	306	297	282
Groups	40	40	40	38	39	35
Hansen statistics	25.854533	22.297781	24.635157	23.576691	20.109777	18.33789
p-value	0.2120501	0.3825276	0.8205306	0.31401754	0.45108173	0.56516042
AR(1)	-3.1502218 ***	-2.2546414 **	-3.0860565 ***	-1.4368201	-1.6962365 *	-3.2568284 ***
AR(2)	1.0031736	1.4362698	-2.2399969 **	1.2766087	-0.06227516	-1.2091578
AR(3)			0.14989107			

The table shows the results of system GMM estimations with robust standard errors where the dependent variable is the respective ERV measure. The respective lagged ERV measure is treated as endogenous variable. The instruments being used are the lagged endogenous variables. The asterisks indicate whether a coefficient is significantly different from zero at the 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 16: Dynamic Panel Data Models – Developing Countries

Variable	ab13	ab14	ab15	ab16	ab17	ab18	ab19
Dep. Var.	**SD REER (Bruegel)**	**SD NEER (Bruegel)**	**SD ER Growth (yearly)**	**SD ER Growth (yearly)**	**SD ER Growth (monthly)**	**SD ER Growth (daily)**	**CV (GARCH)**
SD REER (Bruegel) (t-1)	0.27765244 ***						
SD NEER (Bruegel) (t-1)		0.33661585 ***					
SD ER Growth (yearly) (t-1)			0.18256881	0.19454078			
SD ER Growth (monthly) (t-1)					0.02781043		
SD ER Growth (daily) (t-1)						0.08156398	
CV (GARCH)							0.99866628 ***
CBT	0.00005462	-0.00013063	0.34127699 *	0.34680046 *	0.1164594	0.00014945	1.65E-07
CBI	-0.00081532	0.00173877	-3.0424015	-3.1047607	-0.42846382	-0.00492513 *	-0.00001688
$\left(ERV^{y}_{i,t-1} - \overline{ERV^{y}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$	-0.00001509	0.00001212	0.00065487	-0.00171319			
$\left(ERV^{m}_{i,t-1} - \overline{ERV^{m}_{i}}\right)\left(CBT_{i,t-1} - \overline{CBT_{i}}\right)$					-0.00215969	-6.79E-06	7.09E-08
SD Inflation (yearly)	0.00019914	-0.00060297	1.5642256 **	1.5456172 **	0.08882217	0.00032345 *	
SD Inflation (monthly)							2.09E-06
peg	-0.00191272	-0.0021807	0.24737457	0.38074055	0.35373128	0.00206704	3.25E-06
Constant	0.01343796 ***	0.01030602 **	0.28541618	0.13057936	1.7828606 **	0.00581041 ***	-0.00003777
N	325	326	349	349	347	295	277
Groups	40	40	42	42	42	38	35
Hansen statistics	21.531111	18.619036	25.947714	30.171652	27.565003	21.461847	19.392412
p-value	0.42694691	0.60956396	0.20844974	0.55929862	0.1529249	0.37041093	0.49646604
AR(1)	-3.1922785 ***	-2.7385778 ***	-3.0166734 ***	-3.0433709 ***	-2.1854944 **	-2.4246962 **	-1.6903359 *
AR(2)	-0.94349673	-0.8754083	-1.6391372	-1.6420836	-0.08483041	0.47408399	1.4686442
AR(3)				0.59674213			

The table shows the results of system GMM estimations with robust standard errors where the dependent variable is the respective ERV measure. The respective lagged ERV measure is treated as endogenous variable. The instruments being used are the lagged endogenous variables. The asterisks indicate whether a coefficient is significantly different from zero at the 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

exchange rates. Then we discussed the role of information provision by central banks. There are several ways in which central bank transparency can help to improve forecasts. This includes the publishing of economic models and data, clear explanations of monetary policy, or forward guidance. It is also helpful to know what strategy the central bank conducts and what the main targets of the central bank are. On the other hand, there is a plethora of studies analysing the effect of central bank speak that finds that information provision including interviews, speeches, or announcements shakes financial markets. In such a way central bank transparency could contribute to higher volatility on financial markets. Thus, it is necessary to analyse the relation between CBT and ERV empirically.

The empirical results show that there is hardly any composite effect of CBT in the case of NEER and REER. On the other hand, there is a significant positive effect of CBT on ERV in the case of developed countries while CBT has a tendency to diminish exchange rate fluctuations in developing countries. The result remains stable under a multitude of robustness checks. When using bilateral exchange rate measures the result is, on the whole, very similar. Transparency raises the variability of exchange rates in developed countries and is of low importance in developing countries. On the other hand, we also find a composite effect for the case of bilateral exchange rates.

Thus, this study contributes to the existing literature examining the effect of CBT on macroeconomic variables like inflation, unemployment or output volatility. The results are meaningful as many central banks have increased their transparency in the last two decades and there is still a debate as to whether this is a good development from an economic point of view (leaving aside the democratic perspective). The results reveal that higher information provision of central banks is not beneficial in terms of lower fluctuations of exchange rates. Quite the opposite: higher transparency leads to higher ERV in developing countries. Thus, the concern that higher information provision by the central bank creates confusion among investors and traders thereby increasing the fluctuations of exchange rates is partly confirmed. On the other hand, this might just be the price for central banks willing to be less opaque. As CBT has some positive effects in other fields, it might still be desirable from an economic point of view.

9 Appendix

Table 17: Descriptive Statistics - All Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
CBT	1,506	4.702523	3.047872	0	14.5
CBT_1	1,188	1.992003	0.7748544	0	3
CBT_2	1,188	0.7424242	0.8415704	0	3
CBT_3	1,188	0.8059764	0.7371634	0	3
CBT_4	1,188	0.6334175	0.8184392	0	3
CBT_5	1,188	0.7213805	0.7021911	0	3
CBI	1,075	0.4497516	0.20851	0.09	0.893
SD ER Growth (monthly)	2,118	370.7511	12689.12	0	533830.6
SD ER Growth (yearly)	2,144	3498224	1.62E+08	0	7.50E+09
SD ER Growth (daily)	1,698	0.0082205	0.0263518	0	0.5289371
CV (GARCH)	1,533	0.000443	0.002183	0.000000	0.0457018
SD NEER (BIS)	898	0.0139057	0.0165651	0.0010027	0.2247778
SD REER (BIS)	896	0.0147952	0.0150866	0.0021735	0.2171331
SD NEER (Bruegel)	2,469	0.0161456	0.0284363	0.001404	0.9327294
SD REER (Bruegel)	2,407	0.0175275	0.0285077	0.0023938	0.9803284
SD GDP Growth (monthly)	902	7.588107	6.597027	0	49.68646
SD GDP Growth (yearly)	880	1.767801	1.514382	0	14.40844
SD Inflation (monthly)	2,407	0.8711312	1.146481	0	26.49042
SD Inflation (yearly)	2,386	2.164038	5.805427	0	163.2342
SD M1 Growth (monthly)	1,573	4.394269	8.585416	0	323.6889
SD M1 Growth (yearly)	1,573	4.394269	8.585416	0	323.6889
SD M2 Growth (monthly)	1,605	2.678885	3.372747	0	98.34609
SD M2 Growth (yearly)	1,597	4.750561	6.076951	0	93.29546
SD M3 Growth (monthly)	915	1.998885	1.656621	0	16.39529
SD M3 Growth (yearly)	866	4.06244	5.41364	0	79.99198
Absolute Exchange Rate Growth	2,671	272.3543	13281.59	0	686316.9
Peg	2,335	0.4475375	0.4973466	0	1
Crawling Peg	2,335	0.2792291	0.4487164	0	1
Crawling Band	2,335	0.1862955	0.3894283	0	1
Free Floating	2,335	0.0423983	0.2015392	0	1
Free Falling	2,335	0.0214133	0.1447886	0	1
Dual Market	2,335	0.0231263	0.1503369	0	1
Capital Flow Restrictions	1,500	0.3609933	0.3355636	0	1
SD Inflation (last 5 years)	1,790	8.192156	1.995626	0	9.95
Capital Controls	1,163	4.566569	3.255032	0	10
Credit Market Regulations	1,797	8.24788	1.485554	0	10

Table 18: Descriptive Statistics - Developed Countries

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
CBT	739	5.915426	3.365689	0	14.5
CBT_1	626	2.165335	0.7575094	0.5	3
CBT_2	626	1.029553	0.9149455	0	3
CBT_3	626	0.9784345	0.8103914	0	3
CBT_4	626	0.8857827	0.9104579	0	3
CBT_5	626	0.8921725	0.7858464	0	3
CBI	512	0.4408594	0.2229969	0.11	0.83
SD ER Growth (monthly)	1,435	380.891	14092.62	0	533830.6
SD ER Growth (yearly)	1,455	5154634	1.97E+08	0	7.50E+09
SD ER Growth (daily)	1,062	0.0080832	0.0268556	0	0.4916377
CV (GARCH)	985	0.000243	0.001723	0.000000	0.045702
SD NEER (BIS)	776	0.0125665	0.012921	0.0010027	0.2040507
SD REER (BIS)	774	0.0135458	0.0123971	0.0021735	0.1968082
SD NEER (Bruegel)	1,793	0.0143045	0.0274169	0.001404	0.9327294
SD REER (Bruegel)	1,754	0.0159183	0.0287525	0.0023938	0.9803284
SD GDP Growth (monthly)	660	6.113573	3.885953	0	32.55002
SD GDP Growth (yearly)	653	1.665606	1.316248	0	8.775117
SD Inflation (monthly)	1,781	0.771099	1.143753	0.0134183	26.49042
SD Inflation (yearly)	1,761	1.858334	5.568486	0	163.2342
SD M1 Growth (monthly)	1,131	4.138956	3.151815	0	51.25056
SD M1 Growth (yearly)	1,131	4.138956	3.151815	0	51.25056
SD M2 Growth (monthly)	1,138	2.58989	3.768454	0	98.34609
SD M2 Growth (yearly)	1,139	4.511534	6.204287	0	93.29546
SD M3 Growth (monthly)	679	1.808892	1.487544	0	12.77101
SD M3 Growth (yearly)	660	3.691892	4.303698	0	32.82684
Absolute Exchange Rate Growth	1,926	16.35646	283.975	0	11667.83
Peg	1,647	0.5300546	0.4992475	0	1
Crawling Peg	1,647	0.1936855	0.3953053	0	1
Crawling Band	1,647	0.1851852	0.3885657	0	1
Free Floating	1,647	0.0497875	0.2175717	0	1
Free Falling	1,647	0.0115361	0.1068175	0	1
Dual Market	1,647	0.0297511	0.1699514	0	1
Capital Flow Restrictions	1,107	0.3030352	0.3091399	0	1
SD Inflation (last 5 years)	1,354	8.262489	1.957475	0	9.95
Capital Controls	922	4.925206	3.201284	0	10
Credit Market Regulations	1,357	8.368814	1.497363	0	10

Table 19: Descriptive Statistics - Developing Countries

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
CBT	767	3.533898	2.133323	0	10
CBT_1	562	1.798932	0.7484736	0	3
CBT_2	562	0.4225979	0.6094663	0	3
CBT_3	562	0.613879	0.5898907	0	2.5
CBT_4	562	0.3523132	0.5861473	0	1.5
CBT_5	562	0.5311388	0.5352213	0	2
CBI	563	0.4578384	0.1942481	0.09	0.893
SD ER Growth (monthly)	683	349.4469	9067.255	0.000081	236968.5
SD ER Growth (yearly)	689	291.1364	7429.296	0	195017.5
SD ER Growth (daily)	636	0.0084497	0.0255075	0	0.5289371
CV (GARCH)	548	0.000802	0.002794	0.000000	0.014561
SD NEER (BIS)	122	0.0224241	0.0296686	0.0042182	0.2247778
SD REER (BIS)	122	0.0227212	0.0250672	0.0066836	0.2171331
SD NEER (Bruegel)	676	0.0210287	0.0304647	0.0022903	0.3991066
SD REER (Bruegel)	653	0.02185	0.0273968	0.0033274	0.3906313
SD GDP Growth (monthly)	242	11.60957	9.960968	0	49.68646
SD GDP Growth (yearly)	227	2.061779	1.950521	0	14.40844
SD Inflation (monthly)	626	1.155727	1.106652	0	13.84131
SD Inflation (yearly)	625	3.025388	6.352266	0	92.28553
SD M1 Growth (monthly)	442	5.047569	15.38496	0.6871157	323.6889
SD M1 Growth (yearly)	442	5.047569	15.38496	0.6871157	323.6889
SD M2 Growth (monthly)	467	2.89575	2.1068	0.270353	21.97081
SD M2 Growth (yearly)	458	5.344998	5.711337	0	49.02897
SD M3 Growth (monthly)	236	2.54552	1.971151	0	16.39529
SD M3 Growth (yearly)	206	5.24963	7.890762	0	79.99198
Absolute Exchange Rate Growth	745	934.169	25144.26	0	686316.9
Peg	688	0.25	0.4333277	0	1
Crawling Peg	688	0.4840116	0.5001079	0	1
Crawling Band	688	0.1889535	0.3917565	0	1
Free Floating	688	0.0247093	0.1553507	0	1
Free Falling	688	0.0450581	0.2075826	0	1
Dual Market	688	0.0072674	0.0850008	0	1
Capital Flow Restrictions	393	0.5242494	0.3531968	0	1
SD Inflation (last 5 years)	436	7.973739	2.097035	0	9.83
Capital Controls	241	3.194523	3.09622	0	10
Credit Market Regulations	440	7.874909	1.385085	3.33	10

Table 20: Determinats SD NEER - All Countries (Robustness Checks)

Variable	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26	fe27	fe28
CBT	0.00027	0.00047	0.00049	0.00108 **	0.00088 *	0.00057 *	0.00032	0.00049	0.00062	0.00047	0.00104 **	0.00051	0.00070 *	0.00062 *
CBI	0.00523	0.00418	0.00336	0.00085	0.00589	0.01713 ***	0.00219	0.00285	0.00076	0.00297	0.01044	0.00324	0.01143	0.01186
SD Inflation (yearly)	0.00088 ***	0.00120 ***	0.00109 ***	0.00108 ***	0.00011	0.00006	0.00147 ***	0.00104 ***	0.00101 ***	0.00102 ***	0.00011	0.00103 ***	0.00117 **	0.00122 ***
(t-1)	-0.00018 *													
SD M2 Growth (yearly)	0.00029 **	0.00043 ***	0.00046 ***		0.00060 ***									
GDP per Capita	0.00000	0.00000	0.00000											
GDP Growth	-0.00060 ***	-0.00056 ***	-0.00054 ***											
Inflation	0.00012 *	0.00000	-0.00007	-0.00012	0.00001	0.00033 **	-0.00021 ***	-0.00014 **	-0.00014 **	-0.00014 **	0.00063 ***	-0.00014 **	0.00018	0.00022 *
Trade Openness	0.00011 ***	0.00014 ***	0.00015 ***											
Peg		0.00022			0.02343 ***									
Crawling Peg					0.02190 ***									
Crawling Band					0.02329 ***									
Free Floating			-0.00460											
Free Falling			0.00903											
Absolute ER Growth				0.00032 ***	0.00041 ***	0.00051 ***	0.00039 ***	0.00039 ***	0.00039 ***	0.00039 ***	0.00058 ***	0.00039 ***	0.00038 ***	0.00039 ***
SD M1 Growth (yearly)				0.00051 ***										
Broad Money Growth				-0.00006	-0.00004									
Real Interest Rate					-0.00016 **	-0.00009	-0.00026 ***	-0.00024 ***	-0.00024 ***	-0.00023 ***	-0.00008	-0.00023 ***	-0.00006	-0.00005
Government Debt						0.00009 ***								
Manufacturing Value Added							-0.00021							
Oil Rents (% of GDP)								-0.00030						
Net Foreign Assets									0.00000 *					
Urban Population (% of total)										0.00003				
Central Government Debt											0.00011 ***			
Agricultural Land												0.00014		
SD Inflation (last 5 years)													-0.00034	
Capital Controls														0.00021
Constant	-0.00189	-0.00645	-0.00621	0.00636	-0.01624 **	-0.00170	0.01413 **	0.01084 ***	0.01024 **	0.00793	-0.00908 **	0.00405	0.00413	0.00035
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	550	494	494	530	450	285	655	732	722	732	314	732	601	601
Countries	54	54	54	54	52	43	62	66	66	66	44	66	60	60
F	17.1	10.2	9.6	19.8	8.8	29.0	117.6	117.5	116.4	116.9	29.9	117.0	10.9	10.8
Adj. R^2	0.143	0.057	0.063	0.130	0.073	0.352	0.536	0.506	0.507	0.505	0.338	0.505	0.017	0.015
R^2	0.014	0.000	0.001	0.212	0.030	0.261	0.562	0.491	0.516	0.525	0.351	0.528	0.112	0.106
AIC	-3483.6	-3110.7	-3113.0	-3325.9	-2860.3	-2169.7	-4000.0	-4490.5	-4424.0	-4488.6	-2224.9	-4489.0	-4018.3	-4017.4
BIC	-3440.5	-3068.7	-3066.8	-3291.8	-2811.0	-2140.5	-3964.1	-4453.8	-4392.0	-4451.8	-2195.0	-4452.2	-3983.1	-3982.2
CBT_1	0.00685 ***	0.00691 ***	0.00732 ***	0.00738 ***	0.00486 **	0.00116	0.00162	0.00225 **	0.00222 **	0.00215 *	0.00334	0.00223 **	0.00494 ***	0.00469 ***
CBT_2	0.00004	-0.00002	-0.00016	0.00223 *	0.00131	0.00100	0.00047	0.00073	0.00093	0.00061	0.00159	0.00080	0.00198 **	0.00208 **
CBT_3	0.00379 **	0.00377 **	0.00378 **	0.00551 ***	0.00236	0.00159	0.00176	0.00188	0.00187	0.00177	0.00183	0.00188	0.00259 **	0.00259 **
CBT_4	-0.00043	-0.00043	-0.00027	0.00295 ***	0.00126	0.00065	0.00064	0.00074	0.00093	0.00065	0.00163	0.00078	0.00140 *	0.00135 *
CBT_5	0.00045	0.00051	0.00063	0.00233 *	0.00091	0.00366 **	0.00059	0.00102	0.00167	0.00085	0.00403 ***	0.00103	0.00163	0.00128

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 21: Determinats SD NEER - Developed Countries (Robustness Checks)

Variable	fe6	fe7	fe8	fe9	fe10	fe13	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21
CBT	0.00153 **	0.00172 **	0.00166 **	0.00230 ***	0.00171 **	0.00092 **	0.00129 **	0.00144 ***	0.00112 **	0.00113 **	0.00111 **	0.00113 **	0.00099 *	0.00091
CBI	0.01113	0.01343	0.01341	0.00365	0.01736	0.01472 **	0.01023	0.00797	0.00898	0.00949	0.01128	0.00941	0.00740	0.00765
SD Inflation (yearly)	0.00113	0.00099	0.00096	0.00109	-0.00059	-0.00018	0.00124 *	0.00088	0.00112	0.00117 *	-0.00114	0.00118 *	0.00221 **	0.00236 **
(t-1)	-0.00068													
SD M2 Growth (yearly)	0.00039 *	0.00048 *	0.00038		0.00000									
GDP per Capita	0.00000	0.00000	0.00000											
GDP Growth	-0.00052 ***	-0.00039 **	-0.00041 **											
Inflation	0.00064 **	0.00059 **	0.00066 **	0.00058 **	0.00101 ***	0.00048 **	0.00093 ***	0.00089 ***	0.00093 ***	0.00091 ***	0.00135 ***	0.00090 ***	0.00040 *	0.00039 *
Trade Openness	0.00011 *	0.00015 **	0.00015 **											
Peg		0.00131			0.00578									
Crawling Peg					0.00425									
Free Floating			0.01066											
Absolute ER Growth				0.00022 *	0.00096 ***	0.00056 ***	0.00037 ***	0.00045 ***	0.00038 ***	0.00038 ***	0.00068 ***	0.00038 ***	0.00030 ***	0.00031 ***
SD M1 Growth (yearly)				0.00043 **										
Broad Money Growth				0.00001	0.00001									
Real Interest Rate					-0.00020 *	-0.00011	-0.00014	-0.00033 ***	-0.00012	-0.00013	0.00005	-0.00013	-0.00016 *	-0.00014
Government Debt						0.00012 ***								
Manufacturing Value Added							0.00026							
Oil Rents (% of GDP)								-0.00227 ***						
Net Foreign Assets									0.00000					
Urban Population (% of total)										-0.00009				
Central Government Debt											0.00016 ***			
Agricultural Land												0.00007		
SD Inflation (last 5 years)													-0.00098	
Capital Controls														-0.00001
Constant	-0.00923	-0.01493 *	-0.01584 *	-0.00832	-0.01636 **	-0.00535 *	-0.01033	0.00204	-0.00442	0.00111	-0.01626 ***	-0.00712	0.00680	-0.00140
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	325	272	272	305	239	192	361	400	390	400	210	400	363	363
Countries	53	35	35	53	34	36	55	62	62	62	37	62	58	58
F	8.0	7.1	7.3	8.8	14.9	21.3	15.8	22.9	16.7	17.2	26.5	17.2	5.8	5.6
Adj. R^2	0.033	0.071	0.076	0.007	0.307	0.359	0.121	0.187	0.111	0.116	0.406	0.116	-0.068	-0.073
R^2	0.024	0.008	0.020	0.170	0.250	0.268	0.244	0.044	0.249	0.224	0.432	0.239	0.161	0.160
AIC	-2048.0	-1677.0	-1678.6	-1896.1	-1529.5	-1495.9	-2330.7	-2650.4	-2544.3	-2616.9	-1498.4	-2616.9	-2442.9	-2441.2
BIC	-2010.1	-1640.9	-1642.5	-1866.3	-1491.3	-1469.9	-2299.5	-2618.5	-2516.5	-2584.9	-1471.6	-2584.9	-2411.8	-2410.0
CBT_1	0.00773 ***	0.00772 ***	0.00789 ***	0.00689 ***	0.00724 ***	0.00236	0.00386 **	0.00370 **	0.00377 **	0.00359 **	0.00373	0.00350 **	0.00338 **	0.00342 **
CBT_2	0.00082	0.00078	0.00074	0.00290 **	0.00210	0.00203 *	0.00245 **	0.00233 **	0.00236 **	0.00217 **	0.00210 *	0.00210 **	0.00267 ***	0.00248 **
CBT_3	0.00473 **	0.00478 **	0.00474 **	0.00740 ***	0.00519 **	0.00311 *	0.00525 ***	0.00516 ***	0.00520 ***	0.00507 ***	0.00290 *	0.00498 ***	0.00544 ***	0.00515 ***
CBT_4	-0.00009	-0.00010	-0.00005	0.00361 **	0.00181	0.00127	0.00190 *	0.00187 **	0.00179 *	0.00167 *	0.00117	0.00157	0.00106	0.00100
CBT_5	0.00493 **	0.00490 **	0.00489 **	0.00578 **	0.00279	0.00388 *	0.00319 *	0.00327 *	0.00315 *	0.00295 *	0.00532 **	0.00289 *	0.00508 ***	0.00503 ***

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 22: Determinats SD NEER - Developing Countries (Robustness Checks)

Variable	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26	fe27
CBT	-0.00046	-0.00032	-0.00003	0.00034	-0.00062	0.00021	-0.00050	-0.00034	-0.00018	-0.00047	0.00054	-0.00037	0.00021	0.00008
CBI	0.00243	-0.00469	-0.00285	0.01841	-0.00361	0.00886	-0.01320	-0.01137	-0.01236	-0.01070	0.01225	-0.01152	0.00661	0.00811
SD Inflation (yearly)	0.00088 ***	0.00118 ***	0.00080 **	0.00089 ***	0.00002	-0.00038	0.00139 ***	0.00091 ***	0.00092 ***	0.00092 ***	0.00037	0.00093 ***	0.00050	0.00053
(t-1)	-0.00010													
SD M2 Growth (yearly)	0.00011	0.00049 **	0.00045 **		0.00071 ***									
GDP per Capita	0.00001	0.00000	0.00000											
GDP Growth	-0.00066 ***	-0.00062 ***	-0.00061 ***											
Inflation	0.00008	-0.00017 *	-0.00025 **	-0.00016 *	-0.00012	0.00031	-0.00026 ***	-0.00018 **	-0.00018 **	-0.00017 **	0.00010	-0.00018 **	0.00017	0.00021
Trade Openness	0.00009	0.00010	0.00011											
Peg		-0.00541			0.00106									
Crawling Peg					-0.00100									
Crawling Band					0.00719									
Free Floating			-0.00818											
Free Falling			0.01554 ***											
Absolute ER Growth				0.00039 ***	0.00018 **	0.00047 ***	0.00039 ***	0.00040 ***	0.00040 ***	0.00040 ***	0.00058 ***	0.00040 ***	0.00040 ***	0.00042 ***
SD M1 Growth (yearly)				0.00007										
Broad Money Growth				-0.00009 *	-0.00009 **									
Real Interest Rate					-0.00009	-0.00008	-0.00035 ***	-0.00032 ***	-0.00032 ***	-0.00031 ***	-0.00004	-0.00032 ***	-0.00003	-0.00002
Government Debt						0.00005								
Manufacturing Value Added							-0.00061							
Oil Rents (% of GDP)								0.00011						
Net Foreign Assets									0.00000					
Urban Population (% of total)										0.00020				
Central Government Debt											-0.00002			
Agricultural Land												0.00026		
SD Inflation (last 5 years)													-0.00041	
Capital Controls														0.00063
Constant	0.00300	0.01043	0.00705	0.00667	0.01928	0.00703	0.03338 ***	0.02218 **	0.02287 **	0.01450	0.00441	0.01169	0.01228	0.00624
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	225	222	222	225	211	93	294	332	332	332	104	332	238	238
Countries	30	31	31	31	30	16	35	38	38	38	17	38	33	33
F	11.3	4.9	5.7	14.6	3.6	8.1	86.2	82.8	83.2	82.8	9.3	83.0	4.2	4.2
Adj. R^2	0.221	0.021	0.073	0.226	-0.003	0.273	0.657	0.618	0.619	0.618	0.289	0.619	-0.041	-0.043
R^2	0.052	0.004	0.001	0.265	0.114	0.397	0.659	0.638	0.623	0.615	0.395	0.624	0.144	0.151
AIC	-1477.1	-1465.8	-1477.1	-1476.4	-1425.8	-679.7	-1733.7	-1955.7	-1958.7	-1955.7	-757.1	-1956.2	-1597.2	-1596.7
BIC	-1443.0	-1431.7	-1439.7	-1449.1	-1385.6	-659.5	-1704.2	-1925.3	-1932.0	-1925.3	-735.9	-1925.7	-1569.4	-1568.9
CBT_1	0.00839 *	0.00846 *	0.00850 **	0.00385	-0.00022	-0.00381	-0.00027	0.00089	0.00101	0.00107	0.00309	0.00107	0.01076 *	0.00858
CBT_2	-0.00451	-0.00474	-0.00490	-0.00043	-0.00237	-0.00195	-0.00220	-0.00241	-0.00211	-0.00234	-0.00058	-0.00225	0.00046	0.00012
CBT_3	0.00092	0.00062	0.00034	0.00151	-0.00131	-0.00029	-0.00011	0.00006	0.00010	0.00023	0.00052	0.00007	0.00027	0.00018
CBT_4	-0.00364	-0.00399	-0.00351	-0.00030	-0.00187	0.00025	-0.00094	-0.00150	-0.00115	-0.00139	0.00030	-0.00154	-0.00035	-0.00046
CBT_5	-0.00243	-0.00253	-0.00217	-0.00001	-0.00149	0.00276	-0.00115	-0.00095	-0.00012	-0.00086	0.00337	-0.00104	0.00042	-0.00033

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the NEER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 23: Determinats SD REER - All Countries (Robustness Checks)

Variable	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26	fe27	fe28
CBT	0.00009	0.00026	0.00028	0.00078 *	0.00058	0.00046	0.00009	0.00024	0.00037	0.00028	0.00084 **	0.00027	0.00053	0.00048
CBI	0.00641	0.00600	0.00475	0.00484	0.00742	0.01635 ***	0.00380	0.00521	0.00347	0.00512	0.01312 **	0.00558	0.01143	0.01197
SD Inflation (yearly)	0.00103 ***	0.00129 ***	0.00117 ***	0.00133 ***	0.00028	0.00038	0.00171 ***	0.00125 ***	0.00122 ***	0.00123 ***	0.00056	0.00125 ***	0.00179 ***	0.00183 ***
(t-1)	-0.00004													
SD M2 Growth (yearly)	0.00025 **	0.00043 ***	0.00046 ***		0.00062 ***									
GDP per Capita	0.00000	0.00000	0.00000											
GDP Growth	-0.00056 ***	-0.00051 ***	-0.00049 ***											
Inflation	0.00009	-0.00003	-0.00015	-0.00011	-0.00007	0.00022	-0.00021 ***	-0.00014 **	-0.00014 **	-0.00014 **	0.00035 **	-0.00014 **	0.00014	0.00018
Trade Openness	0.00008 **	0.00012 **	0.00013 ***											
Peg		0.00152			0.01913 ***									
Crawling Peg					0.01562 **									
Crawling Band					0.01743 ***									
Free Floating			-0.00564											
Free Falling			0.01218 **											
Absolute ER Growth				0.00026 ***	0.00036 ***	0.00045 ***	0.00035 ***	0.00035 ***	0.00036 ***	0.00036 ***	0.00052 ***	0.00036 ***	0.00034 ***	0.00035 ***
SD M1 Growth (yearly)				0.00027										
Broad Money Growth				-0.00003	-0.00004									
Real Interest Rate					-0.00018 ***	-0.00009	-0.00026 ***	-0.00025 ***	-0.00025 ***	-0.00024 ***	-0.00004	-0.00024 ***	-0.00011 *	-0.00010
Government Debt						0.00008 ***								
Manufacturing Value Added							-0.00023							
Oil Rents (% of GDP)								-0.00019						
Net Foreign Assets									0.00000 **					
Urban Population (% of total)										-0.00005				
Central Government Debt											0.00005 *			
Agricultural Land												0.00014		
SD Inflation (last 5 years)													-0.00025	
Capital Controls														0.00035
Banking Crisis														
Explicit Inflation Targeting														
Constant	0.00091	-0.00339	-0.00286	0.00763 *	-0.00814	0.00049	0.01591 **	0.01172 ***	0.01146 ***	0.01371	-0.00441	0.00533	0.00525	0.00144
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	550	494	494	530	450	285	655	732	722	732	314	732	601	601
Countries	54	54	54	54	52	43	62	66	66	66	44	66	60	60
F	21.4	10.6	10.4	23.4	8.8	23.2	132.5	130.0	129.5	129.7	27.3	129.9	12.0	12.0
Adj. R^2	0.192	0.063	0.078	0.164	0.071	0.286	0.568	0.534	0.536	0.534	0.310	0.534	0.029	0.030
R^2	0.020	0.002	0.005	0.228	0.026	0.227	0.587	0.533	0.536	0.558	0.311	0.553	0.122	0.107
AIC	-3569.9	-3191.2	-3197.9	-3398.8	-2932.9	-2169.1	-4103.2	-4593.6	-4527.9	-4592.8	-2324.9	-4593.2	-4039.3	-4039.8
BIC	-3526.8	-3149.2	-3151.7	-3364.6	-2883.6	-2139.9	-4067.4	-4556.9	-4495.8	-4556.0	-2294.9	-4556.4	-4004.1	-4004.6
CBT_1	0.00696 ***	0.00693 ***	0.00738 ***	0.00744 ***	0.00459 **	0.00020	0.00161	0.00229 **	0.00223 **	0.00226 **	0.00203	0.00225 **	0.00511 ***	0.00473 ***
CBT_2	0.00035	0.00025	0.00009	0.00239 **	0.00151	0.00106	0.00054	0.00081	0.00100	0.00091	0.00159	0.00090	0.00198 **	0.00214 **
CBT_3	0.00304 *	0.00310 *	0.00312 *	0.00506 ***	0.00183	0.00156	0.00119	0.00133	0.00130	0.00133	0.00165	0.00133	0.00239 **	0.00243 **
CBT_4	-0.00020	-0.00027	-0.00009	0.00305 ***	0.00133	0.00022	0.00034	0.00045	0.00067	0.00051	0.00120	0.00051	0.00114	0.00112
CBT_5	0.00105	0.00087	0.00102	0.00256 **	0.00123	0.00364 **	0.00069	0.00109	0.00181 *	0.00127	0.00405 ***	0.00111	0.00157	0.00124

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the REER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 24: Determinats SD REER - Developed Countries (Robustness Checks)

Variable	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26	fe27
CBT	0.00110 *	0.00123 *	0.00121 *	0.00192 ***	0.00148 **	0.00089 **	0.00117 **	0.00132 ***	0.00104 **	0.00107 **	0.00107 **	0.00109 **	0.00102 *	0.00093 *
CBI	0.00737	0.00984	0.00983	0.00539	0.01321	0.01334 **	0.00960	0.00777	0.00924	0.00913	0.01270 **	0.00898	0.00537	0.00561
SD Inflation (yearly)	0.00108	0.00098	0.00096	0.00088	-0.00045	-0.00009	0.00130 *	0.00096	0.00112 *	0.00121 **	-0.00046	0.00122 **	0.00291 ***	0.00305 ***
(t-1)	-0.00055													
SD M2 Growth (yearly)	0.00037 *	0.00049 **	0.00044 *		0.00016									
GDP per Capita	0.00000	0.00000	0.00000											
GDP Growth	-0.00051 ***	-0.00039 **	-0.00040 **											
Inflation	0.00035	0.00028	0.00032	0.00040 *	0.00054 *	0.00039 *	0.00056 **	0.00055 ***	0.00059 ***	0.00056 ***	0.00082 ***	0.00056 ***	0.00039 *	0.00039 *
Trade Openness	0.00009 *	0.00015 **	0.00015 **											
Peg		0.00069			0.00452									
Crawling Peg					0.00147									
Free Floating			0.00536											
Absolute Exchange Rate Growth				0.00018 *	0.00085 ***	0.00055 ***	0.00030 ***	0.00037 ***	0.00031 ***	0.00031 ***	0.00066 ***	0.00031 ***	0.00026 ***	0.00027 ***
SD M1 Growth (yearly)				0.00021										
Broad Money Growth				0.00001	0.00001									
Real Interest Rate					-0.00019 *	-0.00013	-0.00011	-0.00028 ***	-0.00010	-0.00010	0.00006	-0.00010	-0.00018 *	-0.00016 *
Government Debt						0.00013 ***								
Manufacturing Value Added							0.00020							
Oil Rents (% of GDP)								-0.00200 ***						
Net Foreign Assets									0.00000					
Urban Population (% of total)										-0.00013				
Central Government Debt											0.00007 **			
Agricultural Land												0.00015		
SD Inflation (last 5 years)													-0.00094	
Capital Controls														-0.00003
Banking Crisis														
Explicit Inflation Targeting														
Constant	-0.00634	-0.01262 *	-0.01307 *	-0.00425	-0.00909	-0.00372	-0.00571	0.00427	-0.00167	0.00669	-0.01044 ***	-0.00671	0.00743	-0.00039
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	325	272	272	305	239	192	361	400	390	400	210	400	363	363
Countries	53	35	35	53	34	36	55	62	62	62	37	62	58	58
F	6.8	6.3	6.3	6.1	12.1	21.0	11.2	17.2	12.1	12.5	24.7	12.5	6.6	6.4
Adj. R^2	0.001	0.047	0.049	-0.057	0.247	0.354	0.047	0.117	0.041	0.046	0.383	0.046	-0.051	-0.056
R^2	0.018	0.001	0.005	0.126	0.217	0.267	0.189	0.024	0.198	0.157	0.400	0.163	0.165	0.164
AIC	-2125.0	-1747.2	-1747.7	-1955.7	-1579.6	-1503.0	-2390.4	-2715.3	-2610.5	-2684.5	-1585.5	-2684.6	-2457.6	-2455.9
BIC	-2087.1	-1711.1	-1711.6	-1925.9	-1541.3	-1477.0	-2359.3	-2683.4	-2582.7	-2652.6	-1558.8	-2652.7	-2426.4	-2424.8
CBT_1	0.00801 ***	0.00801 ***	0.00820 ***	0.00686 ***	0.00752 ***	0.00204	0.00393 ***	0.00379 ***	0.00390 ***	0.00367 **	0.00359	0.00359 **	0.00349 **	0.00355 **
CBT_2	0.00083	0.00079	0.00074	0.00290 **	0.00218 *	0.00225 **	0.00251 **	0.00240 ***	0.00237 **	0.00227 **	0.00226 **	0.00220 **	0.00267 ***	0.00245 **
CBT_3	0.00489 **	0.00492 **	0.00490 **	0.00749 ***	0.00561 ***	0.00343 **	0.00560 ***	0.00553 ***	0.00553 ***	0.00544 ***	0.00321 *	0.00536 ***	0.00580 ***	0.00549 ***
CBT_4	0.00013	0.00013	0.00018	0.00365 ***	0.00199 *	0.00122	0.00186 *	0.00183 **	0.00175 *	0.00165 *	0.00115	0.00155	0.00099	0.00092
CBT_5	0.00499 **	0.00496 **	0.00495 **	0.00562 **	0.00297	0.00357 *	0.00322 *	0.00330 **	0.00318 *	0.00302 *	0.00488 **	0.00296 *	0.00490 ***	0.00488 ***

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the REER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 25: Determinats SD REER - Developing Countries (Robustness Checks)

Variable	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26	fe27
CBT	-0.00105	-0.00070	-0.00045	-0.00004	-0.00116	-0.00002	-0.00083	-0.00072	-0.00056	-0.00084	0.00028	-0.00076	-0.00010	-0.00019
CBI	0.00673	0.00117	0.00252	0.01993	-0.00655	0.00823	-0.01291	-0.01052	-0.01159	-0.01004	0.00987	-0.01074	0.00517	0.00913
SD Inflation (yearly)	0.00112 ***	0.00132 ***	0.00102 ***	0.00127 ***	0.00031	0.00003	0.00170 ***	0.00117 ***	0.00119 ***	0.00120 ***	0.00086	0.00120 ***	0.00123 **	0.00121 **
(t-1)	0.00002													
SD M2 Growth (yearly)	0.00012	0.00052 **	0.00048 **		0.00074 ***									
GDP per Capita	0.00001 *	0.00000	0.00000											
GDP Growth	-0.00057 ***	-0.00055 ***	-0.00052 ***											
Inflation	0.00006	-0.00016	-0.00026 ***	-0.00015	-0.00012	0.00025	-0.00027 ***	-0.00018 **	-0.00018 **	-0.00018 **	0.00003	-0.00018 **	0.00015	0.00022
Trade Openness	0.00007	0.00009	0.00009											
Peg		-0.00157			0.00376									
Crawling Peg					-0.00143									
Crawling Band					0.00536									
Free Floating			-0.00824											
Free Falling			0.01490 ***											
Absolute Exchange Rate Growth				0.00031 ***	0.00013	0.00037 ***	0.00035 ***	0.00036 ***	0.00036 ***	0.00036 ***	0.00047 ***	0.00036 ***	0.00036 ***	0.00039 ***
SD M1 Growth (yearly)				0.00007										
Broad Money Growth				-0.00006	-0.00008 *									
Real Interest Rate					-0.00017 **	-0.00007	-0.00041 ***	-0.00037 ***	-0.00037 ***	-0.00037 ***	-0.00005	-0.00038 ***	-0.00011	-0.00009
Government Debt						0.00003								
Manufacturing Value Added							-0.00067							
Oil Rents (% of GDP)								0.00021						
Net Foreign Assets									0.00000					
Urban Population (% of total)										0.00016				
Central Government Debt											-0.00003			
Agricultural Land												0.00027		
SD Inflation (last 5 years)													-0.00030	
Capital Controls														0.00157 *
Constant	0.00276	0.01040	0.00860	0.00870	0.02521 *	0.00970	0.03746 ***	0.02496 ***	0.02623 ***	0.01925	0.00826	0.01469	0.01474	0.00494
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
N	225	222	222	225	211	93	294	332	332	332	104	332	238	238
Countries	30	31	31	31	30	16	35	38	38	38	17	38	33	33
F	14.0	4.8	5.7	17.9	3.3	5.2	95.5	89.7	90.0	89.5	6.6	89.8	5.1	5.5
Adj. R^2	0.282	0.018	0.071	0.282	-0.018	0.133	0.682	0.638	0.639	0.638	0.184	0.638	-0.015	-0.001
R^2	0.066	0.004	0.002	0.316	0.059	0.318	0.674	0.649	0.639	0.633	0.346	0.642	0.180	0.127
AIC	-1469.5	-1457.7	-1469.0	-1469.6	-1407.1	-680.3	-1768.9	-1987.9	-1990.6	-1987.5	-757.5	-1988.1	-1605.6	-1608.8
BIC	-1435.3	-1423.7	-1431.6	-1442.3	-1366.9	-660.0	-1739.4	-1957.5	-1964.0	-1957.0	-736.3	-1957.6	-1577.8	-1581.1
CBT_1	0.00830 **	0.00864 **	0.00869 **	0.00362	-0.00142	-0.00867	-0.00024	0.00109	0.00127	0.00135	-0.00152	0.00134	0.01064 *	0.00697
CBT_2	-0.00306	-0.00323	-0.00339	0.00012	-0.00260	-0.00245	-0.00209	-0.00236	-0.00199	-0.00187	-0.00121	-0.00219	0.00051	0.00013
CBT_3	-0.00129	-0.00114	-0.00144	0.00026	-0.00323	-0.00073	-0.00124	-0.00103	-0.00096	-0.00066	-0.00028	-0.00097	-0.00028	-0.00041
CBT_4	-0.00347	-0.00362	-0.00312	-0.00040	-0.00203	-0.00067	-0.00149	-0.00213 *	-0.00171	-0.00172	-0.00065	-0.00213 *	-0.00089	-0.00085
CBT_5	-0.00148	-0.00151	-0.00114	0.00027	-0.00098	0.00284	-0.00102	-0.00080	0.00020	-0.00005	0.00401 *	-0.00087	0.00050	-0.00021

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the REER. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 26: Determinats SD ER Growth (Yearly) - All Countries (Robustness Checks)

Variable	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26
CBT	0.988 ***	0.771 **	0.954 ***	0.793 **	0.721 ***	0.663 **	0.604 ***	0.477 **	0.649 ***	0.753 ***	1.243 ***	0.932 ***	0.340 **
CBI	11.417 **	14.024 **	12.180 **	14.742 ***	10.517 **	11.963 **			6.616	7.725 *	11.855 **	12.177 **	
SD Inflation (yearly)	1.177 ***	1.120 ***	1.220 ***	1.164 ***	1.692 ***	1.588 ***	1.625 ***	1.665 ***	2.099 ***	1.998 ***	0.471 ***	0.392 **	1.303 ***
(t-1)			-0.068	-0.076	0.175 ***	0.179 ***	0.154 ***	0.171 ***					
SD M1 Growth (yearly)											-0.315 *	-0.305 *	
SD M2 Growth (yearly)	-0.387 ***	-0.464 ***	-0.389 ***	-0.463 ***	-0.176 **	-0.209 ***	-0.065	-0.077	0.167 **	0.104			0.271 ***
GDP per Capita	0.000	0.000	0.000	0.000	0.000	0.000	0.000 *	0.000 *	0.000	0.000			
GDP Growth	-0.247 ***	0.006	-0.251 ***	0.001	-0.307 ***	-0.039	-0.319 ***	-0.032	-0.273 ***	-0.056			
Inflation	0.510 ***	0.525 ***	0.516 ***	0.531 ***	0.655 ***	0.691 ***	0.729 ***	0.744 ***	0.012	0.014	0.469 ***	0.501 ***	-0.021
(t-1)					-0.339 ***	-0.354 ***	-0.393 ***	-0.416 ***					
Trade Openness	0.009	0.016	0.012	0.021	0.009	0.027	-0.033	-0.017	0.047 **	0.049 **			
Capital Flow Restrictions							0.252	-1.122					
Peg									-1.311	-2.249			1.031
Crawling Peg													-0.442
Crawling Band													3.560 *
Absolute Exchange Rate Growth											0.188 ***	0.145 ***	0.249 ***
Broad Money Growth											0.009	0.024	-0.024
Real Interest Rate													-0.020
Constant	-9.894 ***	-10.426 ***	-10.065 ***	-10.856 ***	-7.496 ***	-11.421 ***	-2.678	-4.188	-8.585 ***	-9.144 ***	-11.173 ***	-10.657 ***	-1.808
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
N	532	532	527	527	526	526	531	531	474	474	507	507	610
Countries	54	54	54	54	54	54	51	51	54	54	53	53	70
F	199.6	88.9	176.2	84.1	220.2	116.2	247.9	134.1	53.9	28.9	202.5	83.4	77.0
Adj. R^2	0.743	0.762	0.743	0.763	0.803	0.825	0.820	0.845	0.472	0.516	0.729	0.750	0.531
R^2	0.694	0.704	0.697	0.700	0.760	0.744	0.709	0.761	0.313	0.235	0.672	0.695	0.567
AIC	3438.9	3407.4	3410.6	3379.3	3266.8	3213.4	3249.2	3182.5	2810.8	2778.3	3260.9	3230.4	3474.3
BIC	3477.4	3497.2	3453.3	3473.2	3313.8	3311.5	3296.3	3280.8	2852.4	2865.7	3294.7	3314.9	3522.9
CBT_1	4.303 ***	4.701 ***	4.298 ***	4.668 ***	3.289 ***	3.431 ***	2.824 ***	2.468 ***	4.280 ***	4.806 ***	2.564 ***	2.208 ***	2.382 ***
CBT_2	1.062	0.946	1.057	0.941	0.657	0.728	1.057	0.540	1.036	0.975	1.868 ***	0.982	0.855
CBT_3	2.270 **	1.850 *	2.159 **	1.734 *	1.954 **	1.609 *	2.014 **	1.231	2.263 **	1.913 **	2.234 ***	1.008	1.068 *
CBT_4	1.353 **	1.238 *	1.295 **	1.178 *	0.627	0.500	1.254 *	1.002	1.319 **	1.172 *	1.667 ***	0.659	1.097 **
CBT_5	1.383 *	1.436 *	1.341 *	1.397	0.649	0.814	0.333	-0.511	1.354 *	1.504 *	1.442 **	0.372	0.725

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the yearly growth rate of the bilateral exchange rate. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 27: Determinats SD ER Growth (Monthly) - All Countries (Robustness Checks)

Variable	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26	fe27
CBT	0.244 ***	0.099	0.237 ***	0.098	0.230 ***	0.105	0.174 **	0.069	0.269 ***	0.143 *	0.271 ***	0.114	0.378 ***	0.167 **
CBI	-0.365	0.210	-0.312	0.207	-0.218	0.265	0.612	1.652	-0.223	0.306	-0.292	0.109	0.576	0.513
SD Inflation (monthly)	1.059 ***	1.020 ***	1.055 ***	1.008 ***	1.033 ***	0.997 ***	0.153	0.280	1.100 ***	1.019 ***	1.109 ***	1.041 ***	1.063 ***	0.981 ***
(t-1)			-0.021	0.010	-0.087	-0.056								
SD M1 Growth (monthly)													0.138 ***	0.124 ***
SD M2 Growth (yearly)	0.085 *	0.073 *	0.084 *	0.068	0.087 *	0.070	0.105 *	0.084	0.087 *	0.058	0.090 *	0.059		
GDP per Capita	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
GDP Growth	-0.095 ***	-0.049 **	-0.095 ***	-0.048 **	-0.100 ***	-0.047 **	-0.100 ***	-0.028	-0.106 ***	-0.060 ***	-0.104 ***	-0.060 ***		
Inflation	-0.002	0.000	-0.001	0.001	0.012	0.009	0.018 **	0.014 *	0.015	0.011	0.005	-0.007	-0.045 ***	-0.059 ***
(t-1)					-0.013 *	-0.007	-0.009	-0.004						
Trade Openness	0.014 **	0.006	0.015 **	0.007	0.016 **	0.008	0.017 **	0.010	0.011	0.004	0.012 *	0.005		
Capital Flow Restrictions							-2.277 ***	-2.334 ***						
Peg									-0.171	-0.139				
Free Floating											-0.347	-0.078		
Free Falling											1.030	2.011 ***		
Absolute Exchange Rate Growth													0.078 ***	0.089 ***
Broad Money Growth													-0.017 ***	-0.012 ***
Constant	-1.041	-0.127	-1.083	-0.181	-0.986	-0.245	-0.104	0.528	-0.974	-0.245	-0.993	-0.057	-1.081	-0.739
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
N	535	535	531	531	528	528	335	335	475	475	475	475	502	502
Countries	54	54	53	53	53	53	33	33	53	53	53	53	53	53
F	20.6	13.2	18.2	12.5	17.0	12.0	10.6	10.4	17.6	12.2	16.1	12.2	32.2	21.9
Adj. R^2	0.163	0.264	0.163	0.263	0.170	0.265	0.160	0.343	0.171	0.267	0.173	0.278	0.249	0.408
R^2	0.065	0.141	0.062	0.138	0.067	0.143	0.023	0.101	0.108	0.187	0.105	0.191	0.230	0.336
AIC	1948.6	1890.2	1938.6	1881.0	1925.9	1872.2	1162.7	1090.0	1710.2	1661.1	1709.8	1654.4	1771.9	1663.1
BIC	1987.2	1980.1	1981.4	1975.0	1972.9	1970.4	1204.6	1177.7	1751.9	1748.5	1755.6	1746.0	1805.6	1747.5
CBT_1	1.011 ***	0.895 ***	1.042 ***	0.913 ***	1.029 ***	0.942 ***	1.077 ***	0.893 ***	1.012 ***	0.915 ***	0.932 ***	0.722 ***	1.090 ***	0.820 ***
CBT_2	0.414 **	0.265	0.412 **	0.264	0.396 *	0.272	0.174	-0.076	0.409 *	0.262	0.389 *	0.201	0.684 ***	0.236
CBT_3	0.844 ***	0.651 **	0.814 ***	0.640 **	0.758 ***	0.627 **	0.936 ***	0.812 ***	0.845 ***	0.655 **	0.764 ***	0.488 *	1.128 ***	0.673 ***
CBT_4	0.099	-0.082	0.084	-0.077	0.043	-0.088	0.036	-0.095	0.098	-0.075	0.088	-0.137	0.624 ***	0.193
CBT_5	0.372 *	0.104	0.359 *	0.106	0.283	0.093	0.054	-0.315	0.368 *	0.115	0.392 *	0.096	0.546 ***	0.061

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the monthly growth rate of the bilateral exchange rate.
The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 28: Determinats SD ER Growth (Daily) - All Countries (Robustness Checks)

Variable	fe11	fe12	fe13	fe14	fe15	fe16	fe17	fe18	fe19	fe20
CBT	0.00033 **	0.00052 ***	0.00048 ***	0.00038 **	0.00045 ***	0.00044 **	0.00038 **	0.00040 **	0.00046 ***	0.00044 ***
CBI	0.00050	0.00273	0.00095	0.00193	0.00158	0.00181	0.00141	0.00166	0.00155	0.00196
SD Inflation (yearly)		0.00083 ***	0.00053 ***	-0.00009	-0.00003	-0.00002	0.00007	0.00009	0.00025	0.00027
SD M2 Growth (monthly)	0.00041 ***									
Absolute Exchange Rate Growth		0.00017 ***	0.00011 ***	0.00016 ***	0.00015 ***	0.00015 ***	0.00013 ***	0.00013 ***	0.00017 ***	0.00018 ***
SD M1 Growth (yearly)		0.00030 ***								
SD M2 Growth (yearly)			0.00023 ***	0.00012 **	0.00012 **	0.00013 **	0.00013 **	0.00012 **	0.00012 **	0.00011 **
Inflation	0.00009 ***	-0.00020 ***	-0.00011 ***	0.00005	0.00003	0.00003	-0.00002	-0.00002	0.00011 *	0.00011 **
SD Inflation (monthly)	0.00129 **									
SD GDP Growth (monthly)	-0.00003									
GDP per Capita	0.00000 *									
GDP Growth	-0.00027 ***			-0.00014 ***	-0.00012 ***	-0.00013 ***	-0.00012 ***	-0.00012 **	-0.00007	-0.00007
Trade Openness	0.00003									
Broad Money Growth		-0.00003 **	-0.00002 *	-0.00003 **	-0.00003 *	-0.00003 *	-0.00003 *	-0.00002 *	-0.00001	-0.00001
Real Interest Rate				0.00000	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001
Peg				0.00688 ***	0.00750 ***	0.00738 ***				0.00320
Crawling Peg				0.00736 ***	0.00751 ***	0.00755 ***	0.00217	0.00253 *	0.00170	0.00367 *
Crawling Band				0.00831 ***	0.00855 ***	0.00862 ***	0.00358 ***	0.00385 ***	0.00332 **	0.00519 ***
Oil Rents (% of GDP)				0.00022 ***						
Net Foreign Assets					0.00000					
Urban Population (% of total)						-0.00007				
Agricultural Land							0.00008			
Freedom Average								0.00091 *		
SD Inflation (last 5 years)									-0.00013	
Credit Market Regulations										-0.00028
Constant	-0.00305	0.00052	0.00183	-0.00543 **	-0.00479 *	-0.00106	-0.00193	-0.00200	0.00001	-0.00094
N	250	441	469	416	416	416	416	416	371	371
Countries	28	47	50	47	47	47	47	47	45	45
F	11.6	30.2	28.6	10.7	10.2	10.0	9.6	9.8	9.9	9.4
Adj. R^2	0.216	0.264	0.236	0.162	0.151	0.145	0.121	0.127	0.146	0.151
R^2	0.076	0.292	0.307	0.027	0.114	0.120	0.227	0.090	0.250	0.227
AIC	-2253.7	-3760.3	-3991.5	-3622.4	-3619.0	-3614.3	-3603.3	-3606.1	-3299.2	-3300.5
BIC	-2218.5	-3727.6	-3958.3	-3565.9	-3566.6	-3557.9	-3550.9	-3553.7	-3248.3	-3245.7
CBT_1	0.00203 ***	0.00220 ***	0.00174 ***	0.00105 *	0.00108 *	0.00105	0.00136 *	0.00108 *	0.00202 **	0.00201 **
CBT_2	0.00026	0.00135 ***	0.00119 ***	0.00045	0.00062	0.00053	0.00057	0.00056	0.00048	0.00044
CBT_3	0.00178 **	0.00184 ***	0.00173 ***	0.00081	0.00079	0.00077	0.00087	0.00079	0.00125 **	0.00122 *
CBT_4	-0.00013	0.00146 ***	0.00109 ***	0.00098 ***	0.00116 ***	0.00109 ***	0.00111 ***	0.00109 ***	0.00098 ***	0.00097 ***
CBT_5	0.00048	0.00090 *	0.00088 *	0.00064	0.00106 **	0.00070	0.00067	0.00069	0.00041	0.00036

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the SD of the daily growth rate of the bilateral exchange rate. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 29: Determinats CV (GARCH) ER Growth - All Countries (Robustness Checks)

Variable	fe14	fe15	fe16	fe17	fe18	fe19	fe20	fe21	fe22	fe23	fe24	fe25	fe26
CBT	0.000007 **	0.000005 **	0.000007 **	0.000005 **	0.000008 **	0.000010 ***	0.000007 *	0.000010 ***	0.000008 *	0.000009 ***	0.000007 *	0.000007 *	0.000006 ***
CBI	-0.000024	-0.000001	0.000035	-0.000010	0.000028	0.000011	0.000016	0.000018	0.000024	0.000005	0.000015	0.000018	0.000007
CV (Inflation)	0.000001 ***	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000001	0.000000	0.000001	0.000000	0.000000	0.000000
(t-1)	0.000000												
SD M2 Growth (monthly)	0.000000	0.000001	0.000001	0.000002 **	0.000002 *	0.000000	-0.000001	0.000000	-0.000001	0.000000	-0.000001	-0.000001	0.000002 **
GDP per Capita	0.000000												
GDP Growth	-0.000003 ***												
Inflation	0.000003 ***	0.000001	0.000000	0.000002	0.000001								0.000002
Trade Openness	0.000000 *												
Absolute Exchange Rate Growth		0.000001 **	0.000001 *			0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***	0.000004 ***	
Broad Money Growth		0.000000	0.000000	0.000000	0.000000								0.000000
Real Interest Rate		0.000000	0.000000	0.000000	0.000000								0.000000
Peg								0.000042	0.000028	0.000036	0.000024		
Crawling Peg		-0.000021	-0.000016	-0.000024	-0.000020					-0.000019	-0.000012		
Free Floating												0.000009	
Free Falling												0.000054	
Civil Liberties		0.000000	-0.000009	0.000001	-0.000010								
Debt		0.000000 ***	0.000000 *	0.000000 ***	0.000000 **								0.000000 ***
Capital Flow Restrictions						-0.000071 *	-0.000052	-0.000063 *	-0.000048	-0.000064 *	-0.000048	-0.000046	
Banking Crisis						0.000017	0.000011						
Constant	0.000043	0.000011	0.000028	0.000013	0.000034	-0.000006	-0.000018	-0.000015	-0.000025	0.000001	-0.000014	-0.000018	-0.000008
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	No
N	408	130	130	130	130	272	272	272	272	272	272	272	130
Countries	43	22	22	22	22	29	29	29	29	29	29	29	22
F	13.9	5.8	3.8	5.5	3.7	12.6	7.3	12.4	7.2	10.9	6.8	7.0	6.6
Adj. R^2	0.154	0.195	0.243	0.156	0.219	0.164	0.238	0.160	0.237	0.159	0.234	0.241	0.156
R^2	0.003	0.359	0.317	0.309	0.302	0.097	0.165	0.115	0.179	0.123	0.186	0.187	0.403
AIC	-6905.2	-2387.4	-2389.0	-2381.9	-2385.5	-4519.0	-4535.3	-4517.7	-4534.7	-4516.7	-4533.2	-4535.4	-2383.2
BIC	-6869.1	-2353.0	-2323.1	-2350.4	-2322.4	-4490.1	-4466.8	-4488.9	-4466.2	-4484.3	-4461.1	-4463.3	-2357.4
CBT_1	0.000017	0.000000	0.000004	0.000001	0.000005	0.000034 ***	0.000023 **	0.000035 ***	0.000025 **	0.000037 ***	0.000027 ***	0.000019 *	0.000007
CBT_2	0.000011	0.000002	0.000004	0.000001	0.000003	0.000018 ***	0.000002	0.000018 ***	0.000003	0.000014 **	0.000000	0.000001	0.000010 *
CBT_3	0.000027 ***	0.000016 *	0.000024 **	0.000017 *	0.000025 **	0.000037 ***	0.000026 **	0.000039 ***	0.000030 ***	0.000035 ***	0.000028 ***	0.000026 ***	0.000024 ***
CBT_4	0.000004	0.000002	0.000006	0.000002	0.000007	0.000018 ***	0.000005	0.000017 **	0.000006	0.000016 **	0.000006	0.000004	0.000007
CBT_5	0.000004	0.000000	0.000002	0.000000	0.000002	0.000020 **	0.000001	0.000013	-0.000003	0.000012	-0.000004	-0.000003	0.000007

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the annual average of the conditional standard deviation of daily exchange rate growth. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

Table 30: Determinats CV (GARCH) ER Growth - All Countries (Robustness Checks)

Variable	fe27	fe28	fe29	fe30	fe31	fe32	fe33	fe34	fe35	fe36	fe37	fe38	fe39
CBT	0.000009 ***	0.000006 ***	0.000010 ***	0.000016 **	0.000025 ***	0.000006 ***	0.000011 ***	0.000007 ***	0.000011 ***	0.000006 ***	0.000010 ***	0.000007 ***	0.000011 ***
CBI	0.000042	0.000010	0.000022	0.000298	0.000329	0.000009	0.000021	0.000010	0.000023	-0.000007	0.000012	-0.000006	0.000011
CV (Inflation)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001
SD M2 Growth (monthly)	0.000001 *	0.000002 *	0.000001	0.000001	0.000001	0.000002 **	0.000001	0.000002 **	0.000001	0.000002 *	0.000001	0.000002 *	0.000001
GDP per Capita		0.000000	0.000000 *	0.000000	0.000000 **	0.000000	0.000000 **	0.000000	0.000000	0.000000	0.000000 *	0.000000	0.000000 *
GDP Growth		0.000000	0.000000	-0.000001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Inflation	0.000001	0.000002	0.000001	0.000002	0.000001	0.000002	0.000000	0.000002	0.000001	0.000002 *	0.000001	0.000002 *	0.000001
Broad Money Growth	0.000000 *	0.000000	0.000000 *	0.000001 **	0.000001 ***	0.000000	0.000000 **	0.000000	0.000000 *	0.000000	0.000000 *	0.000000	0.000000 *
Real Interest Rate	0.000000	0.000000	0.000000	0.000000	-0.000001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Debt	0.000000 **	0.000000 ***	0.000000 *	0.000001 **	0.000001 *	0.000000 ***	0.000000 *	0.000000 ***	0.000000 *	0.000000 ***	0.000000 *	0.000000 **	0.000000 *
Current Account Balance				0.000000	0.000000								
Manufacturing Value Added						0.000000	0.000002						
Urban Population (% of total)								-0.000003	-0.000002				
SD Inflation (last 5 years)										0.000004	0.000006		
Capital Controls												0.000001	0.000000
Constant	-0.000018	-0.000003	-0.000065 **	-0.000318	-0.000462 **	0.000000	-0.000124 **	0.000171	0.000066	-0.000042	-0.000125 **	-0.000014	-0.000076 *
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
N	130	128	128	76	76	126	126	128	128	116	116	116	116
Countries	22	21	21	19	19	20	20	21	21	20	20	20	20
F	3.9	5.1	3.8	3.6	3.4	4.6	3.6	4.7	3.6	4.4	3.4	4.3	3.3
Adj. R^2	0.211	0.143	0.231	0.125	0.218	0.142	0.238	0.140	0.225	0.140	0.220	0.131	0.202
R^2	0.372	0.445	0.044	0.141	0.074	0.435	0.030	0.234	0.177	0.460	0.055	0.441	0.055
AIC	-2385.1	-2342.7	-2350.1	-1378.0	-1385.3	-2302.8	-2311.2	-2341.7	-2348.5	-2126.9	-2132.8	-2125.8	-2130.2
BIC	-2327.8	-2314.2	-2290.2	-1352.4	-1348.0	-2271.6	-2248.8	-2310.3	-2285.7	-2096.6	-2075.0	-2095.5	-2072.4
CBT_1	0.000011	0.000009	0.000017			0.000009	0.000018	0.000004	0.000014	0.000008	0.000015	0.000011	0.000018
CBT_2	0.000013 *	0.000009	0.000015 *	-0.000023	-0.000021	0.000009	0.000018 **	0.000008	0.000015 *	0.000007	0.000011	0.000008	0.000011
CBT_3	0.000032 ***	0.000026 ***	0.000031 ***	0.000049 **	0.000059 **	0.000025 ***	0.000032 ***	0.000026 **	0.000032 ***	0.000027 ***	0.000030 ***	0.000031 ***	0.000033 ***
CBT_4	0.000011	0.000006	0.000011	-0.000003	-0.000008	0.000006	0.000011	0.000004	0.000011	0.000003	0.000008	0.000004	0.000007
CBT_5	0.000009	0.000007	0.000013	0.000033	0.000034	0.000007	0.000014	0.000004	0.000011	0.000004	0.000008	0.000005	0.000009

Notes: The table shows the results of fixed effects estimations with robust standard errors where the dependent variable is the annual average of the conditional standard deviation of daily exchange rate growth. The asterisks indicate whether a coefficient is significantly different from zero 10 % (one asterisk), 5 % (two asterisks) or 1 % (three asterisks) significance level.

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