Determinants of real exchange rate movements in 15 emerging market economies

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Paper for the 4th Workshop on New Developmentalism; Sao Paulo, July 25-26, 2019

Abstract

Previous work has established that an appreciation of the real exchange rate (REER) contributes to premature deindustrialization, less productive investment and dependence on commodity booms and busts in emerging markets economies (EME). From the previous literature, it is less clear however what the most important drivers for the cyclical REER movements in EME are. The main aim of this study is to provide empirical evidence about the determinants of the REER movements of 15 emerging markets during the last two decades, using statistical analysis and a dynamic panel fixed effects model approach. Our analysis shows that although "commodity" and "industrial" EME are heterogeneous, REER volatility tends to be higher among the former. Yet, REER volatility between emerging and advanced countries does not differ very much, apart from a few EME countries. Countries that had more stable REER trend fared better than those that had a depreciating or appreciating trend (with the notable exception of China). As theoretically expected, commodity prices are an important structural driver of REER movements in "commodity EME". Moreover, the results confirm the existence of the Harrod-Balassa-Samuelson effect, and show the importance of financial inflows. Further, exchange rate regimes and the intervention of central banks were partially successful to avoid more substantial appreciations (depreciations). Finally, we find that lower country risk and, at least in some periods, growing broad money has led to REER appreciations.

Keywords: Real Exchange Rate; Foreign Exchange Rate Policy, Commodity Prices, Capital Inflows, Global Risk

JEL codes: F6, F31, F41, O11, O57, P52

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1. Introduction

Real exchange rates are considered as indicators for the average price competitiveness of all firms of an economy. Emerging Market Economies (EME) are considered here middle-income countries which are in transition to advanced countries but still incorporate many features of developing countries. Their price- and non-price competitiveness needs to improve in order to catch-up with the lower ranks of the group of advanced countries. Hence, their real exchange seems to be important for further development. Standard development economics and standard growth theories more or less ignore the role of exchange rates for development and growth. Yet, there is widespread agreement that overvalued real exchange rates hamper growth, in many cases even persistently. "New Developmentalism" (ND) holds that overvalued exchange rates, temporarily or chronically, are a key determinant of under-development, especially for those EME which need to further industrialise or change the ongoing trend to premature deindustrialisation. A closer look shows that EME are a quite diverse group of countries and the role of real exchange rates for growth and development is not clear-cut. In this paper, we want to shed more light on these issues.

Let us first clarify the key terms, real exchange rates and emerging economies. Real exchange rates (RER) are defined as inflation-adjusted nominal exchange rates against the main trading partners (real effective exchange rates, REER). Due to data availability, mostly consumer inflation (CPI) is used for inflation-adjustment. CPI often differs from producer inflation or wholesalers' inflation, export price inflation or the GDP-deflator. CPI includes prices of imports which do not – or nor not directly – affect export prices. Hence, CPI depends, among other factors, on nominal exchange rates, which are key factors for explaining real exchange rates. Since reliable export prices or cost indicators are not available, we have to get along with CPI-adjusted real exchange rates.

Furthermore, if RER are used explain "competitiveness" of a nation, we normally take this term as the capability of a country to export not much less or better more than the country imports. The reference is then the trade balance (or the current account balance), or, alternatively, the export market share of a country in the global economy. However, the trade balance is only partially dependent on the RER; non-price factors, reflected e.g. in the income elasticity for imports of the rest of the world from the exporting country is at least equally important, also the growth differential between countries. Not always will a RER depreciation improve the trade balance. Despite of these – often overlooked – problems we believe that the well-known Marshall-Lerner conditions by and large are satisfied (see Bahmani et al., 2013) so that RER changes have a significant though limited impact on the current account and on external deficits.

Traditional exchange rate theories hold that the real equilibrium ER is determined by absolute or relative PPP, measured with prices for tradables under competitive conditions, adjusted for transaction costs. Alternatively, equilibrium nominal ER gravitate towards uncov-

ered nominal interest rate parity (UIRP), whereby idiosyncratic country risks have to be accounted for. Deviations stem mainly from expectations regarding future interest rates and country risks. All variants of these theories have been developed without special attention to developing countries or EME. There is broad consensus that these theories cannot predict future exchange rates in the short and medium term better than random walk. The PPP theory is even more questionable for developing countries for several reasons (in particular due to structural differences in consumption baskets relative to advanced countries), and UIRP as well, mainly due to time-varying country risks. The shortcomings of traditional exchange rate theories weigh even heavier when applied to EME. However, heterodox theories are grappling with sound alternatives backed by robust evidence. Our paper attempts to shed more light on these issues.

Now we turn to emerging economies. The term EME was initially invented as a group of developing countries capable to absorb commercial financial inflows from first-world financial investors. The term has never been clearly defined and is often used arbitrarily; it often includes countries like Korea, Hong Kong, Taiwan or Israel, which we consider on all counts developed. Here we adapt the term for mainly upper middle-income countries (in the World Bank classification). We gathered a sample of 15 major EME which account for 29 percent of world GDP and 84 percent of middle-income countries' GDP (in current US$ in 2016), with the exception of South Africa half-half from Asia and Latin America (all data in this section are from WDI).

In the sample, India and Indonesia are classified by the World Bank as lower middle-income countries and Chile and Argentina as high-income country though not far above the threshold of US$ 12,055 GNI per capita. India, Peru und Philippines are lower middle-income countries (below the threshold of US$ 3,895) (see graph 1). China, India and Indonesia performed with the highest GDP-growth in the period 1996-2016, Argentina, Brazil and South Africa with the lowest growth (around 2.5 percent p.a.). These data illustrate the heterogeneity of this country grouping.

Graph 1: GNI per capita (current US$, 2016) and GDP per capita growth (1996-2016)
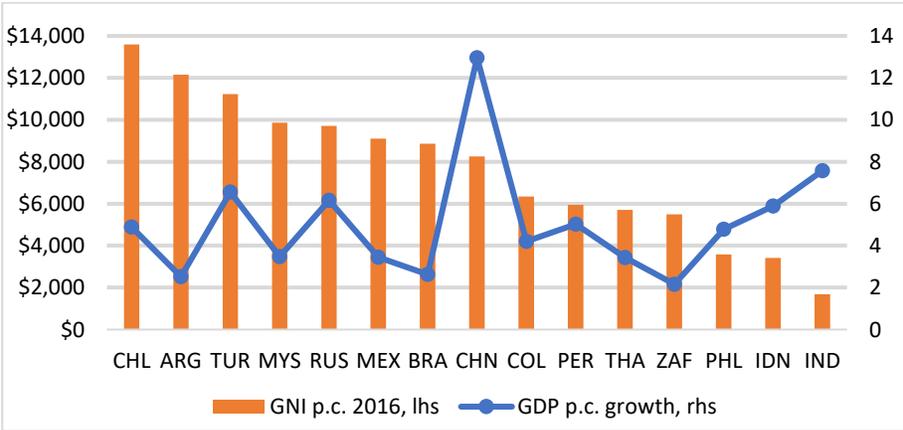
Source: WDI (2019)

Graph 2: GDP as percentage of total GDP of the 15 EME (current US$, 2016)

ARG	BRA
CHL	CHN
IND	IDN
MYS	MEX
PER	PHL
RUS	ZAF
THA	TUR
COL	
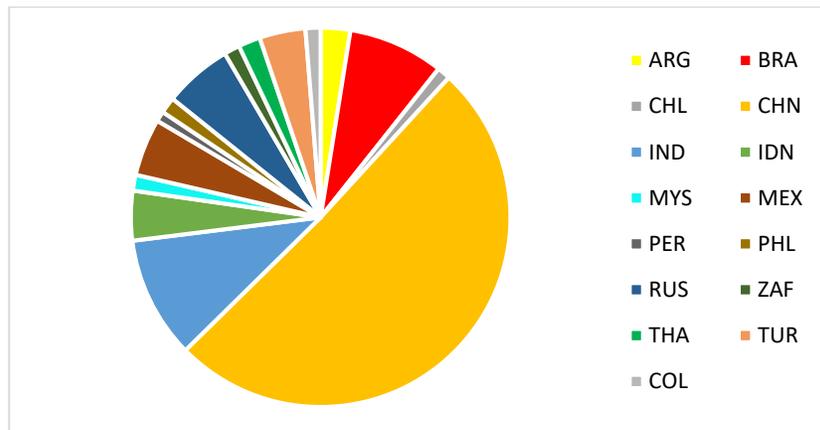
Source: WDI (2019)

The remainder of this paper tries to unravel the main determinants of recent exchange rate changes in the fifteen EME of our sample. To achieve this aim, we use first descriptive statistical analysis and then dynamic panel fixed effects regression. This contribution is important insofar because existing research has left many questions open regarding EME. These questions comprise mainly the following issues:

- Are the REER over the long haul of two decades by and large stable, with ups and downs, or is there in some countries a clear upward or downward trend?

- In what way does the REER of "industrial EME" differ from that of "commodity EME"? Are the REER of "industrial EME" more stable?

- Are the REER of advanced countries more stable those of EME? Does the REER of the group of "commodity EME" co-move with the REER of the three main advanced commodity producers, namely Australia, New Zealand and Norway?

- In currencies with strong overvaluation episodes, do capital inflows matter? What is the role of carry trade?

- Are there peculiar boom periods with high capital inflows and sudden stop episodes with capital flight?

- What are the main features of countries with a bad rating and above average rating?

- What is the role of exchange rate regimes, capital controls, and FX-interventions?

- What role plays monetary expansion in advanced countries, and global risk perception changes?

The key working hypotheses are as follows.

1) The sample of EME is quite heterogeneous. Volatility of REER is not completely different from advanced countries, but in some EME significantly higher.

2) For the REER of "commodity EME", the cycle of commodity prices plays a significant role, with a hierarchy of impact commensurate with differential price volatility of fossil energy, mineral commodities and agricultural prices; whereas for the REER of "industrial EME" commodity prices are not decisive.

3) Gross capital in- and outflows impact REER in all countries to different degrees, especially carry trade and market pressure originating in the financial centres of core countries.

4) Regulatory differences among EME can explain parts of differing REER performance.

5) Financial crises, i.e. loss of financial stability, in Mexico, Asia, Russia, Brazil and Turkey are connected to strong appreciation and depreciation surges, while the global financial crisis had pervasive consequences for all EME.

6) A specific set of characteristics predicates vulnerability to poor rating by agencies, conversely for above average ranking. Time-varying country risks are key to explain REER movements.

This paper is structured as follows. In the next chapter (2), we summarise briefly the main tenets of "New Developmentalism" regarding exchange rates issues. In Chapter 3, we present an overview on the literature regarding exchange rates in EME. Chapter 4 illustrate key data regarding the 15 EME, using descriptive statistical analysis. Chapter 5 presents the methodology used to test econometrically the main determinants of the REER in the EME of our sample, and then analyses the results from the dynamic panel fixed effects regression. Chapter 6 concludes.

2. "New developmentalism" and real exchange rates

New Developmentalism (ND) stands in contrast to the original pioneers of Development Economics and to the Latin American *dependençia* theories despite much overlapping. It focuses on the following propositions, summarised by Bresser Pereira (2019). The basic idea is, in our understanding, to merge development economics with important parts of post Keynesian macroeconomics. The focus is on middle-income countries, and thereby emphasises the role of exchange rates and the external equilibrium. We summarise the main ideas, as far as related to exchange rates, in our own terminology, as follows:

- Economic growth with foreign saving –aka with chronic current account deficits – is rejected as it is considered to involve overvalued real exchange rates, among other reasons.

- A balanced or surplus current account should be achieved, thus learning from the majority of East Asian catching-up countries. Hence, import substitution should be replaced by export promotion. Trade protection is not on the agenda of ND, protection or support via exchange rates is a cornerstone of ND.

- Dutch disease is seen as a "disease" with broader prevalence than in the original model, which addressed mainly countries with fossil fuels and minerals, hence with non-reproducible resources. The extension intends to address also agricultural commodities and hence commodity prices in general. In an even broader understanding soaring capital inflows are included as part of Dutch disease.

- Dutch disease is understood either as leading to temporary or chronic overvaluation of currencies which is assumed to hamper investment, industrialisation, technical progress and growth.

- Dutch disease of all kinds generates cyclicality of real exchange rates and amplifies exchange rate volatility. The commodity price cycle is connected to financial crises, mainly balance of payment and subsequent financial crises, which trigger deep depreciation, recovery and again overvaluation.

- Exchange rate changes contribute to profit rate changes, uncertainty and lower overall investment dynamics.

- For promoting further industrialisation (or reverting premature deindustrialisation) "industrial" real exchange rates are required, hence a stable reduced value of the currency compared to the commodity currency value. Some authors coin the target exchange rate "stable and competitive real effective exchange rate" (SCREER) which can potentially make more manufactures competitive, assisted by industrial policy.

- Nominal anchor currency pegs are rejected, as they induce over-valuation, also high interest rates as a means to defend over-valued exchange rates and for mitigating inflation (strong exchange rates as "exchange rate populism"). Inflation targeting as the predominant monetary policy strategy is seen critically.

Regarding macroeconomics, Bresser Pereira (2019, 208f.) stresses five pivotal issues: the balancing of "macroeconomic prices" (i.e. exchange rates, interest rates, wages, profits, inflation); current account balance and exchange rates; a new theory of exchange rates; cyclical and chronic overvaluation and growth without foreign debt. Due to space considerations, we cannot discuss these propositions in this paper. Yet, our analysis and empirical data supports many but not all features highlighted by ND.

3. The state of exchange rate theory on EME currencies

Contemporary exchange rate theories as presented in modern advanced textbooks that incorporate recent research pay hardly any special attention to developing or emerging market economies. The traditional approaches to exchange rate determination are based on the monetary approach, the purchasing power parity (PPP) approach and the interest rate parity approach (IRP) and elaborate on several variants in each category (Sarno & Taylor, 2003; MacDonald, 2007; Isard, 2008; Pilbeam, 2013). None of the approaches has so far delivered robust empirical results that allow exchange rate forecasts (for currencies under floating regimes) that are better than random walk.

Keynesian approaches emphasize the role of expectations, uncertainty and speculation. Behavioural approaches, similar to Keynesian, focus often on microeconomic behaviour and practices of forex traders, often in the form of information seeking activities that feeds into the formation of expectations or backward-looking expectation in face of uncertainty for the future combined with herding behaviour. An important offspring of interest rate parity theories is the *portfolio balance approach*, which assumes that financial assets differ among countries, so that the same assets are imperfect substitutes due to different currency; this approach includes time-varying risk perception similar to Keynes's animal spirits including changing liquidity preference. Some strands in this area analyse country-specific risks, which lead to higher risk premia and the existence of a currency hierarchy in the global economy. Besides depreciation risks, elements of country-specific risks relevant for EME (and developing countries in general) are: balance of payments deficits, currency mismatches due to "original sin", fiscal policy risks regarding public debt in foreign currency, underdeveloped bond markets, fragility of the financial sector and its prudential supervision, inflation risks, and distributional conflicts in face of economic inequality.

Regarding currencies of advanced countries, the search for equilibrium exchange rates has been – de facto – assigned to the forex markets with fully floating exchange rates. The so-called PPP-puzzle and the forward-premium puzzle have not been solved, i.e. strong and long deviation of exchange rates from PPP (with long reversion time) and deviation from covered as well as uncovered IRP. Theory has failed to explain the puzzles, accepting that market rates deviate strongly from any kind of stable equilibrium for long spells.

Regarding currencies of developing and emerging market currencies, there has been substantial empirical research that has shed light on many aspects. The main peculiarity of developing countries' currencies is seen in their status as "commodity currency" since most developing countries, including many emerging economies, are predominantly commodity producers. The terms-of-trade fluctuation and related Dutch disease are the key issues in this part of the literature. Another more recent thematic area focuses on financial flows related to portfolio-balance models and changing risk perception of financial investors in the centres of the world economy. A third research area, mainly rooted in economics of finance, analyses country risk premia and, in a more theoretical approach, the global currency hierarchy. A

fourth important theme is research on over- and undervaluation and misalignment of exchange rates. The first and second themes shall be reviewed briefly in the next section using a sample of the literature, which might represent many similar analyses of other authors.

3.1 Commodity prices and exchange rates

The vast literature on Dutch disease has identified a clear causal link between natural resource prices and real change rates. Commodities are here confined to sub-soil fossil resources, traditionally oil, gas and coal, but also metal commodities. Based on two IMF-defined criteria –above 20 percent natural resource exports to total exports and more than 20 percent fiscal revenue from natural resources – 51 almost exclusively low- and lower middle-income countries are commodity dependent (from our sample only Indonesia is included in this). With regard to upper middle-income countries, 14 are classified as natural resource-rich but not all of them suffice both criteria mentioned (from our sample Chile, Ecuador, Mexico, Peru and Russia are included in this list, besides countries like Iran, Algeria or Libya) (IMF 2012, 49).[1] These countries are not representative for the entire middle-income countries and only partially for EME.

Venables (2016) gives a recent summary of this literature, with the key insight that Dutch disease countries are conspicuously different from agricultural commodities. He summarises that almost all resource-rich countries with non-renewable sub-soil commodities have suffered low growth in the long-run, besides high-growth episodes in commodity booms. Dutch disease based on persistently overvalued real exchange rates is a pervasive feature of all these countries with the exception of Botswana, Chile and to some extent Venezuela. The blessing of rich and scarce natural resources is mixed since prices are volatile, crowding-out of non-resource tradeable production - mainly manufacturing - is prevailing, and prudent governance of resource rents is difficult and demanding with regard to institutional capacities.

While Venables does not elaborate on the main differences between sub-soil mineral and renewable agricultural resources, these are clear-cut: the former are much scarcer and allow reaping very high rents, they are often state-owned, global competition is mostly oligopolistic (hence countries are not necessarily price takers), their comparative advantage relative to manufacturing is extreme (making it difficult and extremely ambitious to produce non-resource tradable exports profitably), their price hikes are a multiple of agriculture-based price surges and, in contrast to agricultural commodities, their prices did not have a declining trend during the last five decades. Therefore, the term Dutch disease has to be used carefully. While early debates on Dutch disease focused explicitly or implicitly only on fossil energy, mineral resources seem more similar to energy than to agricultural commodities.

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[1] Eight high-income resource-rich countries are listed (Bahrain, Brunei, Trinidad and Tobago, Saudi-Arabia, Qatar, United Arab Emirates, Oman and Norway).

Similarly, *Bleaney* (1996) finds a correlation of Australia's real exchange rate response to the long trend of declining commodity prices over 92 years; and many other authors, especially from Latin America, address the relationship of commodity price related terms of trade with exchange rates (see e.g. various publications from Diaz-Alejandro; Edwards, 1985). However, Australia's REER, for example, has not followed a secular trend of decline. There are obviously also other determinants at work.

Chen and Rogoff (2002) analyse three commodity-producing advanced countries (Australia, Canada and New Zealand) over the period 1984-2001 after these countries had turned to floating exchange rates. They find that the REER of these countries moved differently than those of other developed countries, which in the case of Australia and New Zealand is mainly explained by the robust influence of commodity prices and terms of trade (with a commodity price elasticity of exchange rates of 0.5 to 1.0). The currencies of these countries are thus coined "commodity currencies", and the authors conjecture that their finding also can be relevant for commodity producing developing countries that are small open economies and predominantly price takers.

Cashin et al. (2004) test the relationship of real commodity prices with REER for 58 commodity-producing countries for the period 1980-2002. Real commodity prices are nominal commodity prices relative to world market prices for manufacture exports, which can be seen as a special measure of terms of trade. The authors use 44 different commodity prices, adjusted to each country's exports weights. For one-third of the commodity producing countries analysed, they find a robust relationship between real commodity prices and REER, with causality from the former to the latter. Hence, following a remark from Keynes, Cashin et al. conclude that terms of trade are one of the main explanators why exchange rates deviate from PPP.

According to their results, the reversion time of exchange rates to PPP of "commodity currencies" is only 10 months, which is considerably shorter than the 3 to 5 years that other studies find (e.g. Meese and Rogoff, 1983). This implies, however, that these currencies are more volatile. According to this analysis, the long-run equilibrium exchange rate is not constant, as in PPP, but moves alongside real commodity prices. This seems logically inconsistent if commodity prices explain both deviations from equilibrium and the equilibrium itself. Moreover, it remains unclear what explains the difference between "commodity currencies" and the currencies of the majority of two-third of commodity producing countries.

De Gregorio and Labbé (2011) illustrate Chile's copper dependence since 1999 when Chile turned to full floating and inflation targeting. Their resumé is that despite volatile copper prices Chile managed to keep the long-run real exchange rate stable but allowed short-term fluctuations serving as shock absorber. Short-term exchange rate fluctuations were mitigated by interventions on the forward market and with derivatives. The recession-free GDP growth was moderately high, and output fluctuations were fairly de-linked from copper price fluctuations (copper prices fell from the late 1980s until 2002, surged threefold until 2007,

and dropped again in 2008). This was achieved with macroeconomic policies, namely counter-cyclical fiscal policy and the turn to inflation targeting. The fiscal revenue from copper feed into sovereign wealth funds, which amount almost to 20 percent of GDP. This made Chile a net international creditor economy. In sum, the example of Chile shows that in principle a small country can live with heavy commodity price fluctuations; however, Chile made no progress in industrialisation.

Finally, some recent research argues that the REER may not only be affected by the traditional "spending" and "relocation" effects but also by massive inflows of external capital that are used to finance the exploitation of raw materials. More specifically, Bresser Pereira (2009) argues that commodity boom related financial inflows can generate an overvaluation of the exchange rate that causes a decline in the industrial sector. This argument is corroborated by studies like Ibarra (2011), Naceur et al. (2012), Goda Torres García and Botta (2017), which show that commodity boom related FDI and FPI inflows have led to an appreciation and higher volatility of the REER, which in turn has had negative effects on the manufacturing sector in "commodity EME".

3.2 Financial flows and exchange rates

It is well known that the term EME originated in the notion of emerging financial markets in middle-income countries, thus making them attractive for financial investors from core currency countries. The fact that in most EME "original sin" is prevalent, i.e. the necessity to issue securities in hard currencies (mainly USD) increases the appeal to first-world financial investors – although increasingly financial assets are also denominated in EM-currency with high yield. Financial globalisation with relatively open financial accounts and low transaction costs for capital mobility contribute to increasing cross-border capital flows. These complex financial interlinkages between currencies of different quality certainly affect exchange rates. At first sight, these linkages of global finance and EM-exchange-rates are unrelated to commodity prices; however, interactions of commodity boom-bust-cycles and global financial flows exist but are difficult to discern. The impact of global finance is often underestimated when the focus is traditionally confined to the real economy, including commodity markets.

FX transactions in EM-currencies are small and shallow compared to those where advanced countries' currencies are traded (mainly the USD, EUR and Yen): EM-currencies account for 10.5% of global transactions, whereas the USD alone has a share of 43.8% (BIS, 2016). Moreover, the daily turnover on all FX markets (excluding derivatives) is in the largest EM-FX-market, the one with Renminbi, only 1.8% of China's GDP; similarly, the market with Mexican peso is 8.8% of Mexico's GDP while for the US it is 23.7%. The comparatively shallow EM-FX-markets imply that portfolio shifts in global stocks of financial assets can cause heavy exchange rate changes with severe repercussions on all EM financial markets.

Many EME run persistently current account deficits. At first glance, one might conjecture this as such already explains overvaluation of an EM currency as net capital inflows are needed to finance deficits. But, this is a misunderstanding. Think of financing with foreign currency loans or equity inflows sufficient to cover the deficit. FX-markets are not involved in such transactions since hard currency flows in and flows out again as imports are typically denominated in foreign currency (mainly USD). However, in case of foreign currency loans, income for debt service is normally earned mainly in local currency and involves FX-markets but stretched over the period to maturity. Seen from another angle, currency overvaluation is indeed involved if a devaluation were capable to balance trade. This view implies that the current account balance is simply a function of the real exchange rate, excluding all other determinants that relate to the quantity of exports and imports rather than on prices.

Concentrating on *net* capital in- or outflows obfuscates that exchange rates can be influenced heavily by *gross* capital flows even when net flows remain unchanged. The vast majority of capital flows are gross flows that do not touch the current account since double-entry booking occurs within the financial account. An example could be carry trade, i.e. hard currency inflows that are exchanged into local currency; the latter is kept on deposits or used to purchase other financial assets in local currency. The EME increases its liabilities to non-residents but earns foreign currency. The current account is only affected indirectly if the capital flows affect the REER or aggregate income and through these channels items are booked in the current account, such as for instance imports.

Hence, *Forbes and Warnock* (2012) call for looking at *gross* capital in- and outflows, not only those caused by non-residents but also outflows of finance owned by residents or "retrenchment" of foreign funds owned by residents, apart from foreign exchange reserves of the central bank. They highlight inflow surges, sudden inflow stops, capital flight and capital retrenchment. Often, these offset each other, but they can nevertheless impinge on the exchange rate. Unfortunately, data on foreign currency denominated gross flows are not readily available.

A part of capital inflow surges is related to boom phases of EME, for instance phases with commodity booms in case of "commodity EME" or industrial booms for "industrial EME". Such upswings normally trigger asset price hikes on local security markets (as well as real estate markets) that attract foreign investors. These traditional avenues affect REER as long as inflation differentials and nominal exchange rate changes diverge. Appreciation pressure in principle can be mitigated by FX-interventions (sterilised or non-sterilised purchase of foreign currency). In contrast to core countries, many EME practice these interventions to smooth short-run exchange rate fluctuations with the aim to stabilise also long-run trends. Even central banks committed to full floating regime intervene on FX-markets, more to avoid unwanted appreciations (and subsequent steep depreciations) than stopping ongoing depreciation or sudden stops problems.

Most interventions are considered successful; otherwise, managed floating would probably not be conducted (see e.g., Blanchard et al., 2015; Menkhoff & Stöhr, 2017). A side effect is an increase of foreign reserves which is however costly if interest rates on hard currency safe assets are low. Central banks refraining from interventions in upswing phases might indulge in "exchange rate populism" (Bresser Pereira), believing in "strong currency" and in mitigating inflation pressure with unfettered appreciations.

EME have experienced an enormous wave of inflows of gross foreign finance in the early 2000s. Asian EME absorbed half of these inflows, while the other half was almost completely flowing to Eastern Europe and Latin America (in similar proportions) – leaving very little for Africa and the Middle East. In 2008, a sudden stop occurred when investors pulled out their finance, which led to massive currency depreciation in EME. In 2010 financial investors returned to EME, after most core economies had recovered somewhat and Quantitative Easing in many OECD countries had provided ample liquidity. In 2013, "tapering talk" emerged which induced expectations of rising interest rates and less liquidity provision in core countries, which led again to a retreat from EME. According to Deutsche Bundesbank (2017), the change in inflows has caused (massive) *Exchange Market Pressure* (EMP)[2] that lead to (strong) appreciations or depreciations.

Hence, many researchers affirm that a great part of global capital flows is determined by monetary policy in core countries (mainly the US) and by behavioural changes of financial investors that is influenced by changing perception of risks and changes in risk-taking attitudes. Moreover, increasing foreign currency reserves faces limitations for EME since they are costly and give little additional value beyond a certain threshold; and macroprudential policies (coined "capital flow management" by the IMF) are difficult to apply and often not sufficient to fend-off excessive in- or outflows.

Three (interlinked) channels of transmission of impulses from global liquidity to EMP are discussed in the literature: carry trade, risk taking and funding liquidity. Carry trade is funding financial investments in low-interest-rate countries and short-term investment in economies with higher interest rates. Liquidity risks related to funding, mostly with high leverage, and exchange rate risks regarding the funding and the target currency have to be gauged with interest rate differentials. Carry trade contradicts uncovered interest rate parity theory, but seems to involve remarkable profits.

Unfortunately, data about the size and impact of carry trade are scarce. A rough comparison of nominal short-term interest rates in our sample countries over the period 1996-2016 shows that the average nominal short-term interest rate of 8.6% exceeded the average nominal depreciation against the USD of -4.5%.[3] This illustrates the potential for carry trade, and explains why there is consensus that carry trade contributes to exchange rate volatility in

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[2] EMP is measured by the change rate of nominal EM-exchange-rates (foreign currency per local currency unit) and by the change of central bank's currency reserves.

[3] Observers agree that risks are too high in times of crisis and currency turmoil so that carry trade dries out.

EME (La Marca 2007, Brunnermeier et al. 2008, Deutsche Bundesbank 2014), especially in case of unwinding open positions. Sometimes winding-up and unwinding is compared with walking up the stairway and going down by elevator.

The risk-taking channel refers to changes in attitudes towards taking risk, be it risk-aversion in critical times or risk-taking (more "risk-appetite") in tranquil periods. This observation refers implicitly to Hyman Minsky's theory of financial cycles (Minsky, 1986). The degree of risk-taking is often proxied by the VIX, which measures the volatility of the S&P 500. High volatility is considered low risk-taking behaviour. Low-risk taking would be similar to preference for highly liquid assets in core countries. Changing financial risk disposition changes the risk perception of EM financial assets and EM-currencies.

Independently from interest rate differentials that are important for carry trade, risk attitudes determine the composition of financial wealth portfolios. Low or high funding liquidity influences the scale of investing abroad, for instance under zero lower bound interest rate policy or under a regime of Quantitative Easing. As unintended side effects, waves of financial investment in EM-currencies can emerge, stop suddenly or turn direction. If EM-currencies under open financial account regimes are highly exposed to such short-term on-off external finance, they suffer from exchange rate volatility irrespective of country-specific characteristics. At least for the period since the outbreak of the global financial crisis evidence for such waves exist (see e.g., Adrian et al., 2015, Chen et al. 2015, Aizenman et al., 2015), but whether these financial investments flow to all EME or are selective is still open to empirical research.

Hélène Rey (2015; 2018) interprets the new global finance situation much more rigorous than others. She argues for the existence of a global financial cycle that is driven by the core countries of the world economy (mainly the US). The VIX as an indicator for risk aversion is the pacemaker of cross-border capital flows, with excessive liquidity and credit growth, high leverage and excessive inflows to EME –independent from their macroeconomic situation and the specific exchange rate regime. Such excessive financial flows are good predictors of subsequent financial crises. Due to this process, EM central banks lose the traditional option to conduct sovereign monetary policy if they allow for fully floating exchange rates. Thus, the traditional macroeconomic trilemma of combining only two out of the three free targets, namely capital mobility, sovereign monetary policy and exchange rate stability, shrinks to a dilemma: "… independent monetary policies are possible if and only if the capital account is managed." (2018: 1).

She concludes that four policy options remain: a) targeted capital controls, b) changes of monetary policies of the leading central banks, c) national macroprudential policies in EME, d) imposing limits on leverage for financial intermediaries. By contrast, many EM central banks and bank regulators use (with more or less success) different monetary policies, exchange rate regimes (mostly intermediate ones), and experiment with different regulatory measures to contain excessive inflows. In this way, they tinker within the confines of the

trilemma and choose a position somewhere in the centre of the triangle. In our EME sample, at least three have so far found a *modus operandi* that has enabled them to limit exchange rate volatility and maintain some degree of monetary sovereignty (i.e. China, Chile and India). Yet, even in these countries the situation is fragile and in transition to unknown territory.

4. Descriptive overview about recent exchange rate trends in 15 EME

In this chapter, we illustrate key data regarding exchange rates for our sample of 15 EME. Furthermore, we show the main macroeconomic structural features for these countries for the period 1996-2016, considering annual data. The period chosen should be as long as possible but was constrained by data availability. The period includes a number of severe shocks: the Asian crisis 1997, Russia's balance-of-payments-crisis 1998, Brazil's and Colombia´s financial crisis 1999, Argentina-crisis 2001, Turkey's crisis 2001, the global financial crisis of 2007-9, sharp changes in monetary policy in the US in 2013-14 ("tapering" of Quantitative Easing), and the end of the global commodity boom in 2012. We kept the sample of countries small in order to be able to trace the exchange rate performance with in-depth knowledge about the institutional setting and the structural particularities in the country. Besides the BRICS group we included larger economies in Asia and Latin America and a few distinct commodity producers like Chile and Peru.

First, it is important to mention some country specific structural features of our sample countries, which are summarized in Table 1. Brazil, Colombia, Peru, Turkey and South Africa have sizable negative current account balances. The only countries that have positive NIIP are China, Argentina, Malaysia and Russia (due to their long-lasting current account surpluses). On the contrary, Turkey, Indonesia, Mexico and Brazil have highly negative positions. The sample is quite heterogenous with respect to the nominal short-term interest rate differentials with the USA. The interest rate differentials are very high in Turkey, Russia, Argentina, Brazil, Indonesia and Colombia, and low in Thailand, Chile, Peru and China.

During the period, most countries have had an average rating by Standard & Poor that is below investment grade or slightly above a BBB rating. Those that have an investment grade, have a narrow distance to the loss of it, with the notable exception of China, Chile, Thailand and Malaysia. Most exchange rate arrangement are floating (and even fully floating in Chile, Mexico and Russia), whereas China and Malaysia report special targets. The countries with a (fully) floating regime report inflation targeting as monetary policy regime. All countries but Argentina have increased their currency reserves considerably, especially China, Malaysia, Russia, Peru and Indonesia. This indicates that they intervene frequently in FX-markets, and that appreciations (depreciations) would have been more pronounced without the interventions.

Finally, an important distinction between the countries is their GDP share of manufacturing value added, which ranges from 12.7% (Brazil) to 31% (China). Next to China, Thailand,

Indonesia, Malaysia, Philippines have a relatively high share, whereas, together with Brazil, Chile, Russia and Colombia have a very low share for middle-income countries. Most commodity countries in our sample even increased their concentration on commodities over time. Hence, it makes sense to distinguish between commodity producers and those with relatively low commodity orientation.

**Table 1: Selected structural indicators (mean values, 1996-2016)**

	Current account balance (% of GDP)	S&P rating[a]	NIIP[b] (% of GDP)	Short-term interest rate differential with USA (in pp)	Change in reserves (% p.a.)	Exchange rate arrangement[c]	Manufacturing value added (% of GDP)
ARG	-0.2	17.7	11.3	12.3	-0.6	IT. F	16.9
BRA	-2.0	11.5	-31.0	13.8	0.7	IT. F	12.7
CHL	-0.8	5.7	-14.0	2.1	0.6	IT. FF	13.8
CHN	4.6	5.3	23.5	3.8	4.5	stabil., target M	31.3
COL	-2.7	10.8	-26.7	8.1	0.7	IT. F	14.1
IDN	0.7	14.3	-39.0	9.5	0.8	IT. F	25.2
IND	-1.3	10.8	-11.9	5.2	1.8	IT. F	16.1
MEX	-1.6	9.7	-37.6	6.8	1.0	IT. FF	17.1
MYS	10.1	7.4	1.3	1.8	3.0	other. F	26.5
PER	-2.5	10.8	-28.9	2.4	2.0	IT. F	15.3
PHL	1.1	11.5	-20.2	6.2	1.7	IT. F	22.5
RUS	6.1	11.1	6.1	20.3	2.5	IT. FF	13.5
THA	3.4	8.7	-16.0	0.5	2.1	IT. F	28.7
TUR	-3.4	13.0	-41.1	28.7	0.5	IT. F	17.6
ZAF	-2.7	9.4	-13.7	7.3	0.7	IT. F	15.1

Note: [a] scale 1-25. Investment grade <11; [b] Net international investment position; [c] IT inflation targeting; FF full floating, F floating; China: stabilisation, targeting monetary aggregate. Data sources: IMF 2018; IMF; WDI.

For this distinction we use two criteria: primary exports as a share of merchandise exports (the threshold is 46%, which represents the mean across the countries during 1996-2016), and the median growth of the commodity terms of trade during the boom period 2002-2012 (27%). According to these criteria, six of our countries are "commodity EME" (see Introduction). For simplicity reasons we name the other countries "industrial EME", although not all of them have a strong industrial sector but rather a large service sector (please note that Indonesia and South Africa are close to the threshold and thus can be seen as hybrids).

Graph 3 shows the REER performance of "industrial EME". We index the base year of the data on 1996 as 100, just before the Asian crisis. This implies that the recovery of the Mexican peso from the peso crisis in December 1994 appears as a great appreciation. Two strongly appreciating countries stand out: Turkey and China. Turkey followed a growth-boom based on current account deficits and building up trade and financial ties with the European Union. China started with pegging its currency to the US$ until 2005, with conspicuous undervaluation of the RMB against the dollar and even more against the Euro (which was overvalued against the dollar until 2008). In face of excessive current account surplus, in 2005 the Chinse authorities embarked on a regime change toward managed appreciation against the dollar and Euro. Mexico is the only country of this group that followed a depreciation trend after 2002, whereas the other countries hovered around a more or less horizontal trend.

Graph 3: REER index of "industrial EME" (1996=100)
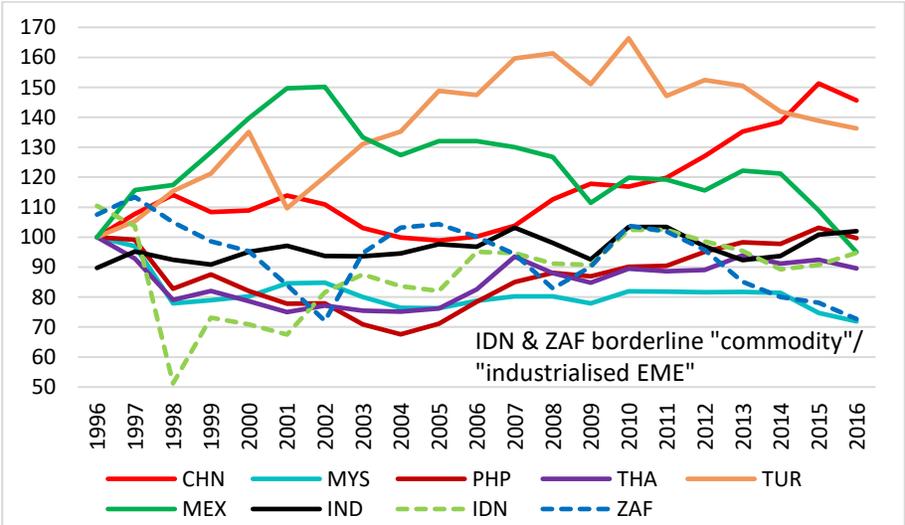

Source: BIS (2019)

In contrast, the REER of "commodity EME" tends to be more volatile. Argentina follows a straight downward trend after the 2001-crisis; Brazil and Colombia tend to co-move and depreciated heavily until 2003 and are then captured by the commodity boom until 2011 and 2012, respectively. Similarly, Russia's REER performs in line with the oil price boom until 2013 (as one would predict from Dutch disease theory), whereas Peru and Chile enjoy amazingly stable real exchange rates that are similar to the two "industrial EME" India and Indonesia. The benchmark group of commodity-heavy advanced countries, Australia, New Zealand and Norway, shows a co-movement with the pattern of the 6 EME (especially with Russia and Colombia), though with a smaller amplitude. The seminal commodity boom is illustrated in Graph 5 with strong differentials between the mining and energy sector and food prices (e.g., the meat price index differs not much from normal inflation).

Graph 4: REER index of "commodity EME" (1996=100)
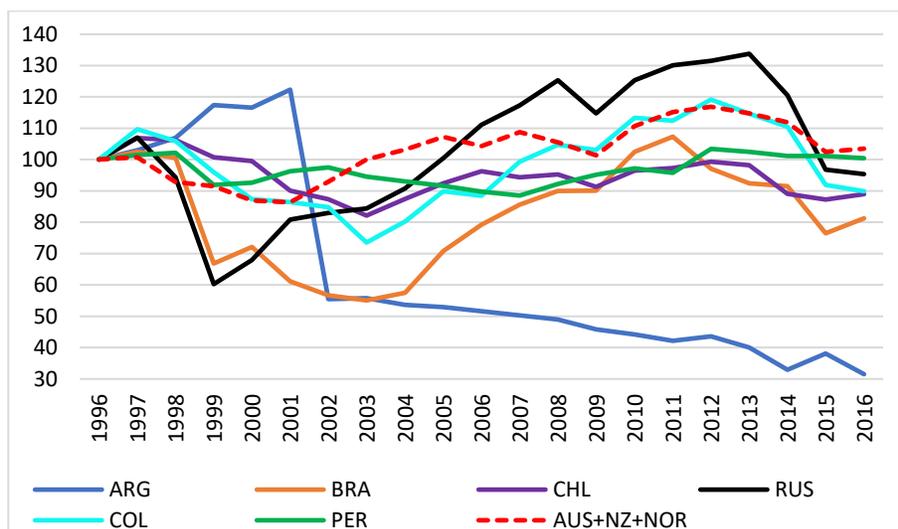
Source: BIS (2019)

Graph 5: World Commodity Prices 1996-2016, index 1996=100
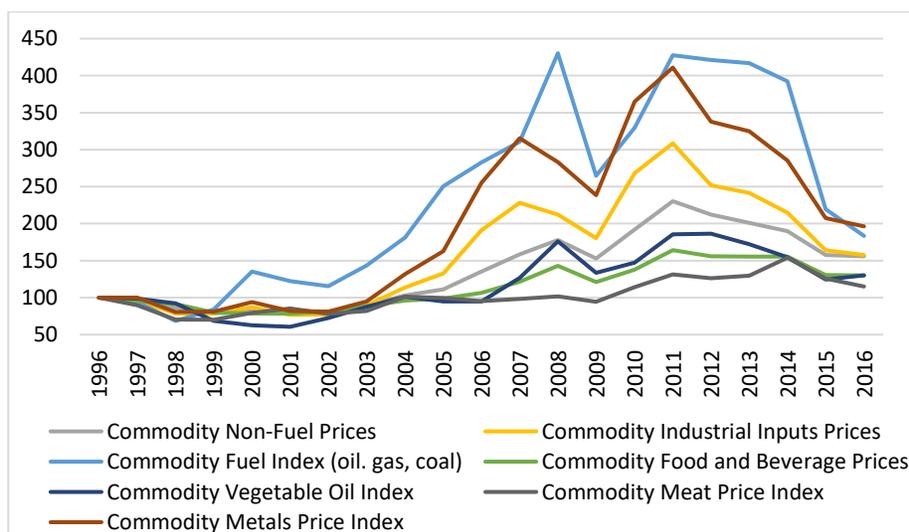

Source: IMF (2019)

Most country's value their currency against the USD, the prime currency on the globe, so to speak the standard of value of a currency. In Graph 6 we see the nexus between the nominal dollar-rate of an EM-currency in the aggregated "commodity EME" group, the RER to the USD, the nominal effective exchange rate (NEER) and the REER. The commodity-currencies, grouped together, devalued strongly against the dollar until the early 2000s; but their inflation adjusted RER against the USA devalued much less. The NEER against the main trade partners performs like the nominal dollar exchange rate, illustrating that the main trade partners co-move strongly against the USD. The bulk of the trade partners is represented by three blocs: the USA, European Union and China (the rest are mainly regional neighbours).

The RER against the USD and the REER co-move, but the REER is flatter because different movements within the bloc are neutralised. While the REER is relevant for the price competitiveness of companies, the nominal exchange rate against the USD is important for financial flows, since most financial assets are denominated in this currency. Since nowadays finance tends to have more influence on exchange rates than trade, the nominal exchange rate to the USD can be considered the main driver for the REER. Interestingly, the aggregated group performance for the nine "industrial EME" shows a very similar performance (Graph 7). The main difference is that the REER is slightly more stable. Again, the grouping hides and neutralises differences within the group (that are visible in the Graphs 3-4).

Graph 6: REER, NEER, US$/LCU and RER/US$ of "commodity EME" (Index, 1996=100)
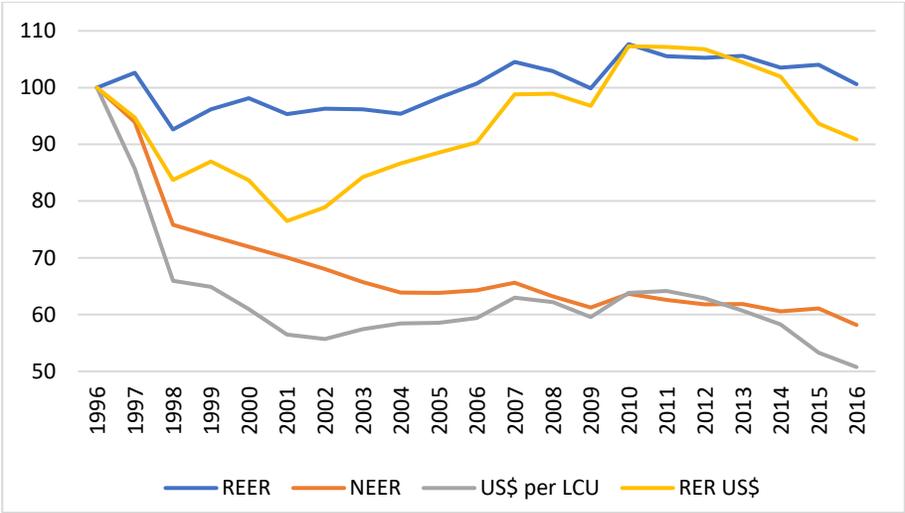
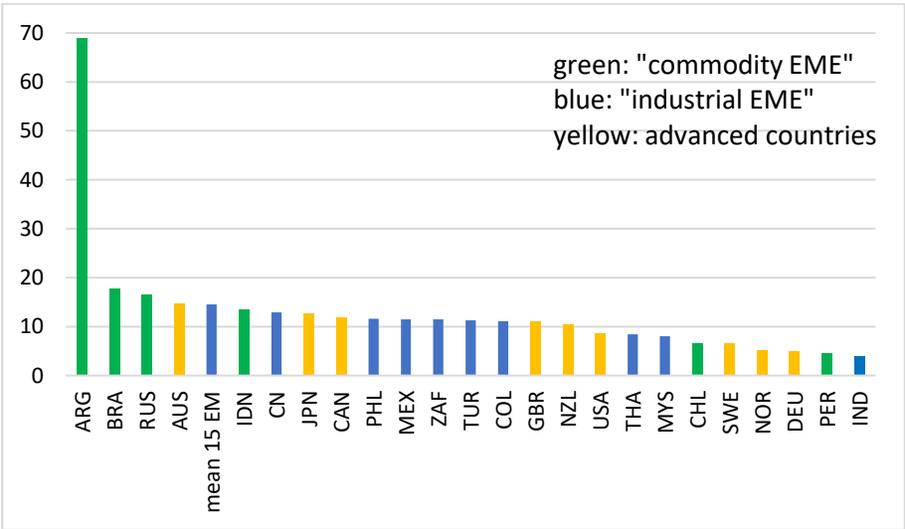

Source: BIS (2019)

Graph 7: REER, NEER, US$/LCU, RER US$ of 9 "industrial EME", index 1996=100
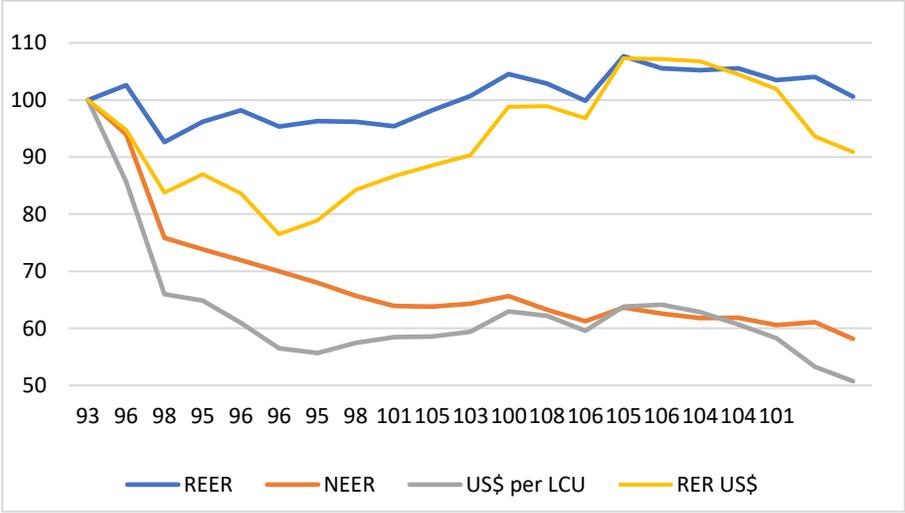
Source: BIS (2019)

Looking at the volatility of the REER of the EME (measured by the standard deviation), compared to selected advanced countries, including commodity-prone exporters, we observe a higher volatility for the "commodity EME" with the notable exceptions Chile and Peru (whereas Argentina is an extreme outlier with very high volatility). For the "industrial EME" it is notable that India, Thailand and Malaysia enjoy less volatility than some advanced countries (Graph 8). Using quarterly data, volatility is higher across all countries, but short-term volatility might be less problematic than longer swings. For the EME-15, the mean REER wing-spread (maximum-minimum, as percent of the mean) is 52 percent, over all years and all countries. Without Argentina, it would still be 45 percent. The spread ranges from only 12 percent in India to 62 percent in Brazil, excluding Argentina (142 percent) and Russia (80 percent) as the outliers.

Graph 8: Volatility (SD) of annual REER in EME and selected advanced countries (1996-2016)

Source: BIS (2019), own calculations

With regard to country groups, the descending order of volatility of annual REER is "commodity EME", "industrial EME", advanced commodity producing countries, and G7 countries –the latter comprises three Euro area countries, which reduces the volatility (Graph 9).

Graph 10 shows that the volatility of the nominal exchange rate to the USD is on average higher (with the most notable exception of Argentina), and that the ranking amongst countries differs somewhat.

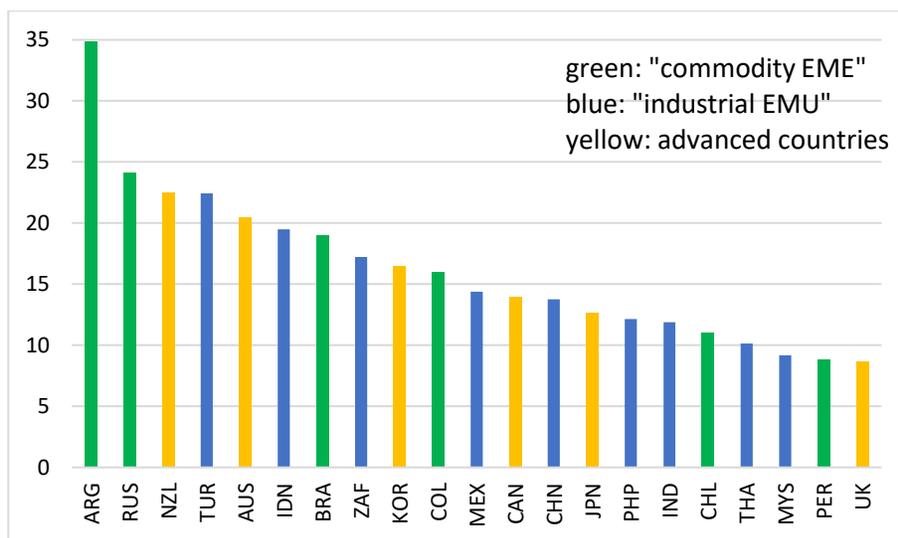**Graph 9: Country group volatility (SD) of annual REER (1996-2016)**
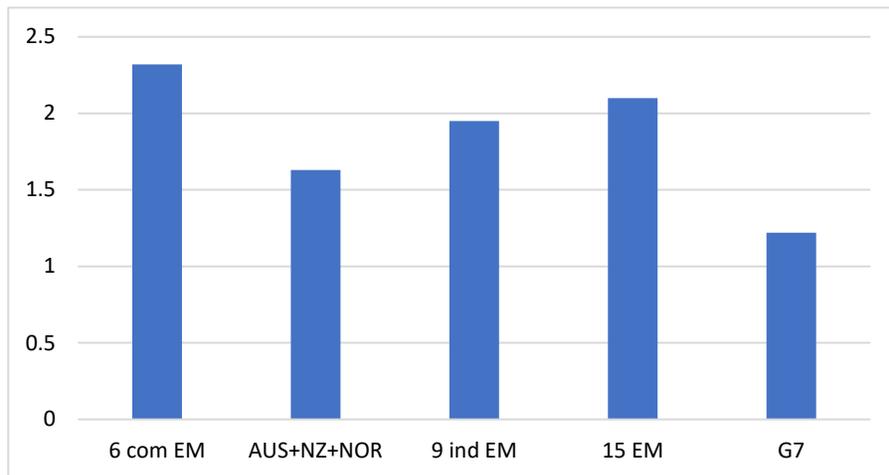
Source: BIS (2019), own calculations

Graph 10: Volatility (SD) of annual NER vis à vis USD (1996-2016)

green: "commodity EME"
blue: "industrial EMU"
yellow: advanced countries

Source: BIS, own calculations

Regarding financial inflows, we use data about annual flows of financial liabilities. We are not sure whether all financial flows can be captured correctly with this indicator. Yet, financial inflows average at 3.4% of GDP, with highest values in Chile and lowest in Indoesia and Thailand (Table 2). The volatility differs across the countries, with a relatively low average of 3.4, compared to an average REER volatility of 14.5. This looks like relatively stable capital inflows, but may not capture all the "hot money" flows like those from carry trade.

Table 2: Gross financial inflows between 1996-2016 (% of GDP)

	Mean	SD
ARG	3.4%	3.3
BRA	4.4%	2.2
CHL	8.1%	3.1
CHN	4.2%	2.5
COL	5.8%	2.7
IDN	1.6%	3.3
IND	4.5%	1.9
MEX	4.3%	1.8
MYS	4.5%	6.0
PER	5.7%	3.0
PHL	3.2%	3.8
RUS	3.6%	4.9
THA	1.6%	5.2
TUR	5.1%	2.8
ZAF	4.1%	4.6
EME-15	4.3%	3.4

Source: IMF (2019); own calculations

Finally, it is important to note that the growth performance of our sample countries differs strongly. Graph 11 illustrates the superior performance of most Asian countries, with the exception of Peru and Chile that are in the middle of the ranking. That is to say, "industrial EM" perform significantly better in this respect (except South Africa, Mexico and Thailand). Without the commodity boom, the diverging growth trends would be even bigger.

Graph 11: Average real GDP growth (1996-2016)
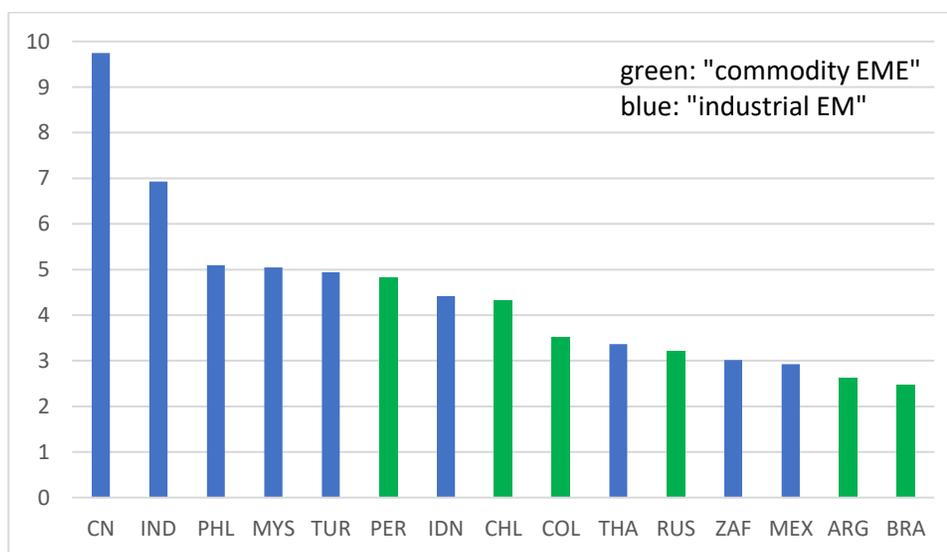
Source: WDI (2019)

We summarise tentative answers to the research questions mentioned in the introduction, as far as they can be derived from the descriptive statistical analysis, as follows:

- Typical sudden stop episodes have been present during the Russian, Brazilian and Argentinian financial crises, in Turkey and Mexico several times, probably amplified by capital flight. Less extreme drops in REER occurred in 2009 and at the beginning of the 2010s.

- "Commodity" and "industrial" EME groups are heterogeneous. Yet, on average, REER volatility is higher among commodity producers.

- Russia's REER trend changes can be considered as a prototype of classical fossil energy Dutch disease; the REER of the other "commodity EME" behave similar but less extreme (with the exception of Argentina).

- There is some co-movement of REER of the commodity EME with commodity-heavy advanced countries like Australia, New Zealand and Norway, but the amplitude of the swings is much bigger. Capital flows could be an amplifier of swings in EME.

- Mexico and Argentina seem to be the only countries following a long trend of REER depreciation, China and Turkey tend to appreciate and the REER of the rest of the countries is relatively flat (with some up- and downswings).

- Countries most critical to depreciation pressure, often connected to financial crisis risk, are – summarising negative or below average features – Argentina, Turkey, Brazil, South Africa and Indonesia, although for different reasons, reflected in poor S&P rating and in other indicators. The critical point is that expectations on financial crises can be self-fulfilling.

- Comparing the GDP growth trends with the REER trends indicates that those countries that hovered around a more or less horizontal REER trend fared much better than those that had a depreciating or appreciating trend (with the notable exception of China). This is true for both "commodity" and "industrial" EME.

5. Regression analysis

5.1 Methodology

To establish econometrically the main determinants of the above analysed REER movements in the fifteen EME, we use a dynamic panel fixed effects model approach that accounts for short-run effects (explanatory variables and the lagged dependent variable in first differences), long-run effects (lagged explanatory variables) and the speed of adjustment towards long-run equilibrium (an error correction term). We chose a dynamic model on the grounds that it is appropriate to account for the well-known fact that the present value of the REER

depends in part on their own lagged value[4]; while the incorporation of fixed-effects is important to capture potential unexplained variations at the country level. To account for potential heteroscedasticity and spatial and temporal dependence, we use Driscoll-Kraay standard errors in the regressions (see Hoechle, 2007). Finally, please note that this approach is broadly in line with studies like Ibarra (2011) and Goda and Torres García (2015), which use Autoregressive Distributed-lagged (ARDL) models to determine the REER determinants for Mexico and Colombia, respectively.

The general form of our model is the following:

$$\Delta REER_{it} = \beta_0 + \beta_1 \Delta REER_{it-1} + \beta_2 \Delta X'_{it} + \pi_1 REER_{it-1} + \pi_2 X'_{it-1} + \alpha_i + \mu_{it} \tag{1}$$

where t indicates the current period, i is country, Δ is the difference operator, $REER$ is a real effective exchange rate index, X' is a set of explanatory variables, α is an unobservable country-specific effect and μ is an error term.

Although quarterly REER data is available for the period 1996-2018, the period analysed in the regressions only spans from 2002Q1 – 2016Q4. The end of 2016 is the last observation to ensure that the sample is as balanced as possible and considering that at the time of writing the exchange rate regime variable only is available until the end of that year. Meanwhile 2002 has been chosen as starting date because the period 1996–2001 was afflicted by various strong financial crises in EME (as discussed in Chapter 4). The concentration of so many crises in a relatively short time span generates a lot of "noise" that is very difficult to control for in an accurate manner. For example, these crises not only had a direct impact on most of the sample countries (Mexico, Asia, Russia, Ecuador, Brazil, Colombia, Argentina and Turkey) but also produced spillover effects due to changes in investor sentiments.

In accordance with the theoretical and empirical observations from above, and previous studies like Cashin et al. (2004), Nassif et al. (2011) and Lartey *et al.* (2012), we consider the commodity terms of trade and real GDP growth rates of each country as potential "structural determinants" of the REER. Real growth rates are intended to proxy the existence of the Harrod-Balassa-Samuelson proposition that rapid productivity growth in the tradable sector result in a REER appreciation (Chinn, 2006)[5]. The country-specific commodity terms of trade represent a net export price index for 45 individual commodities that are weighted by the ratio of net exports to total commodity trade. Accordingly, a rise (decline) in commodity prices leads to a rise (decline) in the commodity terms of trade of commodity exporters, whereas it leads to a decline of the commodity terms of trade of commodity importers (i.e.

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[4] Some previous studies have used generalized method-of moments (GMM) estimators to study the determinants of REER. However, this approach is not viable in our case, given that the sample has a relatively large T (60 quarters) and small N (15 countries).

[5] Please note that Nassif et al. (2011) and Lartey et al. (2012) use real GDP per capita instead of real GDP. Unfortunately, real GDP per capita data is not available with quarterly frequency. Hence, we choose real GDP growth as second-best option.

the "industrial EME" of our sample). To distinguish between potential differential effects that commodity prices have on "commodity" and "industrial" EME, we also employ an interaction term that is derived by multiplying the commodity terms of trade with a dummy that has the value 1 for "commodity EME" and the value 0 for the other countries.

Next to these "structural determinants", we also consider the following variables: (i) current account balance, (ii) financial account liabilities, (iii) changes in international reserve holdings, (iv) exchange rate regime, (v) VIX, (vi) S&P country ratings, and (vii) M3 of OECD countries. In line with the discussions from above, the respective variables are supposed to proxy potential Dutch disease effects and the impact of current account deficits [(i)], the impact of financial gross inflows due to interest rate differentials, carry trade or investor sentiments [(ii)] – unfortunately we are not aware of publicly available data that allows to consider carry trade directly, nor capital "retrenchment"–, the impact of government exchange rate interventions [(iii))], global risk [(v)], country risk [(vi)], and the impact of monetary policy in core countries [vii]. To distinguish the peak of the expansionary monetary policies in OECD countries from the other years of the sample period, we create moreover an interaction term that is derived by multiplying the broad money variable with a dummy variable that has the value 1 in all quarters of the years 2008-2010. Finally, we also employ a dummy that accounts for country specific currency crises.

Table 3 summarizes the variables used and their respective data sources, while Table 4 presents the descriptive statistics of these variables. As can be seen, the sample is nearly balanced, with a maximum of 900 observation. The REER index varies between a minimum of 46 and a maximum of 179 index points. However, the variables with the highest standard deviation are the country-specific commodity terms of trade (especially in the case of "commodity EME") and the OECD broad money index, and the real GDP growth (from -16.3% to 16.2%,) the balance of payments variables and the country risk have a considerable range (some countries in some quarters have a selectively defaulted rating). That is to say, as already discussed in Chapter 4, our sample is not only quite heterogenous, although all sample countries are EME, but also important changes within countries have taken place during the period considered. Finally, it is important to mention that the highest correlation between the variables is 0.52 (see Table A1 in the Appendix), which suggest that all variables can be included simultaneously in the model without causing multicollinearity issues.

Table 3: Definitions of variables used and their sources

Variable name	Definition	Details of calculation	Data sources
REER	Real effective exchange rate (Index, 100=2010Q1)	Averages of monthly data	BIS (2019)
Growth	Real GDP growth (in %) From quarter one year ago, based on accumulated GDP in local currency	Readily available for the ARG, CAN, USA Accumulated GDP and growth rates are calculated for other countries	IFS (2019), Fred (2019), DANE (2019)
Com	Commodity net export price index (Index, 100=2010Q1) Individual commodities weighted by ratio of net com exports to total com trade; rolling weights	Averages of monthly data	IMF (2019)
Com_EME	Com*country dummy	Created dummy where "commodity EME"=1	
CA_GDP	Current Account Balance (% of GDP)	BCA_BP6_USD/ nominal GDP in US$ Based on accumulated values; GDP in LCU converted to USD with Bloomberg NER averages	IFS (2019), Fred (2019), DANE (2019), Bloomberg (2019)
FA_GDP	Financial Account Liabilities (% of GDP)	Sum(BFDL_BP6_USD; BFPL_BP6_USD; BFOL_BP6_USD; BFFL_BP6_USD)/ nominal GDP in US$ Based on accumulated values; GDP in LCU converted to USD with Bloomberg NER averages	IFS (2019), Fred (2019), DANE (2019), Bloomberg (2019)
RA_GDP	Variation in Reserve Assets (in % of GDP)	BFRA_BP6_USD/ nominal GDP in US$ Based on accumulated values; GDP in LCU converted to USD with Bloomberg averages	IFS (2019), Fred (2019), DANE (2019), Bloomberg (2019)
Regime	Coarse Exchange Rate Arrangement (1=no legal tender / peg; 5=freely falling)	Averages of monthly data	Reinhart (2019)
VIX	VIX Index (100=2010Q1) Expected volatility calculated by using the midpoints of S&P 500 Index	Averages of trading day data	CBOE (2019)
S&P	S&P Rating foreign currency, long term (AAA=1; SD=23)	Alphabetical changed to numerical representation	S&P (2019)
M3	Broad Money (100=2010Q1)	Readily available	OECD (2019)
M3(2008-2010)	M3 * year dummy	Created dummy where 2008Q1-2010Q4=1	
Crisis	Year dummy	Created dummy where year of currency crisis=1	Reinhard (2019)

Table 4: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
REER	900	95	12.8	46	179
Growth	900	4.6	3.5	-16.3	16.2
Com	900	100	21.9	45	222
Com_EME	900	36	46.3	0	147
CA_GDP	900	0.7	4.6	-9.2	18.5
FA_GDP	900	4.5	3.8	-19.5	20.9
RA_GDP	885	1.9	3.4	-12.2	17.7
Regime	890	2.7	0.6	1	5
VIX	900	20	8.2	11	44
S&P	892	10	3.5	4	23
M3	900	99	28.1	59	154
M3(2008-2010)	900	19	38.8	0	104

5.2 Results

Table 5 shows the results of our dynamic fixed effects panel data regressions. Model (i) considers the "structural forces" of the REER, namely real GDP growth and each country's commodity terms of trade, and a currency crisis dummy. The results indicate that the cycle of commodity prices plays a significant role for the six commodity producing countries of our sample but has no significant effect on the "industrial EME". That is to say, increasing (decreasing) prices of the commodities that commodity producers export lead to an appreciation (depreciation); while increasing (decreasing) prices of the commodities that "industrial EME" import does not lead to a depreciation (appreciation). This finding is in line with the presented hypotheses and the empirical evidence of Chapter 4.

The positive and statistically significant coefficient of real GDP growth confirms the existence of the Harrod-Balassa-Samuelson effect, which is reported by various previous studies that analyze the REER determinants of EME (see e.g. Lartey, 2011; Nassif et al., 2011; Ibarra, 2011; Goda & Torres Garcia, 2015). However, the statistical significance is not very strong (10%-level). Moreover, the currency crisis dummy is also significant and has the expected negative sign (i.e. a currency crisis leads to a depreciation of EME currencies). It is important to note, that this basic model explains nearly 40% of the REER movements of our sample.

Table 5: The main determinants of changes in EME REER

	(i)		(ii)		(iii)	
$REER_{t-1}$	-0.208**	(0.080)	-0.217***	(0.078)	-0.225***	(0.076)
$Growth_{t-1}$	0.189*	(0.101)	0.199*	(0.111)	0.233*	(0.094)
Com_{t-1}	-0.021	(0.016)	-0.018	(0.016)	-0.016	(0.018)
Com_EME_{t-1}	0.104**	(0.045)	0.104**	(0.044)	0.079**	(0.038)
CA_GDP_{t-1}			0.269**	(0.114)	0.267**	(0.098)
FA_GDP_{t-1}			0.145**	(0.065)	0.098**	(0.062)
RA_GDP_{t-1}			-0.208**	(0.100)	-0.171*	(0.090)
$Regime_{t-1}$					0.678*	(0.380)
VIX_{t-1}					0.018	(0.380)
$S\&P_{t-1}$					-0.331*	(0.038)
$M3_{t-1}$					0.000	(0.005)
$M3(2008\text{-}2010)_{t-1}$					0.001*	(0.005)
$Crisis$	-3.373**	(1.280)	-3.383**	(1.271)	-3.346**	(1.300)
N	15					
T	2002Q1 - 2016Q4					
Number Obs.	900		884		874	
Within R^2	0.39		0.40		0.50	

Note: This table shows the long-run results of dynamic fixed effects panel data regressions with the REER in differences as dependent variable. All regressions include a constant and the explanatory and lagged dependent variable in first differences, which are not reported. The columns 2-4 report the coefficients and Driscoll-Kraay standard errors (in parenthesis). The statistical significance of the coefficients at the 1%, 5% and 10% level is indicated with ***, ** and *, respectively. The bottom rows indicate the number of countries (N), the sample period (T), the number of observations (Number Obs.) and the within R-squared of the different models. For a detailed variable description see Table 1.

Model (ii) considers the aforementioned "structural forces" and includes additionally balance of payment variables. The previous results stay robust when including these variables. With regard to the other variables, an improvement (deterioration) of the current account balance and financial gross inflows have an appreciating (depreciating) effect, whereas an increase (decrease) in foreign reserves has a depreciating (appreciating) effect. The finding regarding the current account is in line with the Dutch disease literature, and moreover backs the empirical evidence of Chapter 4 that substantial current account deficits lead to a weak currency in EME. The result that financial gross inflows appreciate EME currencies is in line

with our hypotheses and recent theoretical and empirical evidence (Bresser Pereira, 2009; Cardarelli et al., 2010; Ibarra, 2011; Goda & Torres Garcia, 2015; Botta, 2017). The negative sign of the foreign reserve variable suggests that the interventions of EME Central Banks to avoid more substantial appreciations (depreciations) were at least partially successful.

Finally, Model (iii) controls for the effect of financial openness, global risk, country risk and the amount of broad money that is in circulation in OECD countries. As expected, we find that an increase (decrease) in country risk leads to a depreciation (appreciation) of the REER. Moreover, during our sample period financial openness seems to have led to appreciation of EME currencies, which indicates that especially financially open economies or the process of opening have attracted capital inflows that had an appreciating effect. This result is in line with previous findings (e.g., Lartey, 2011). Interestingly, global risk and the broad money stock of OECD countries has had no statistically significant effect on EME currencies. However, during the global recession and the peak of the accommodating monetary policies in OECD countries (2008 to 2010) the increase in broad money had the expected appreciating effect.

6. Conclusions

The aim of this paper was to study the determination of REER in fifteen EME. The results of this exercise indicate that EME are heterogenous, especially "commodity" and "industrial" EME. REER volatility tends to be higher among the former. Yet, REER volatility between emerging and advanced countries does not differ much, apart from a few EME countries, Countries that had a more stable REER trend fared better than those that had a depreciating or appreciating trend (with the notable exception of China). As theoretically expected, commodity terms of trade are an important structural driver of REER movements in "commodity EME". However, the experiences of countries that are dependent on mining and energy commodities tend to be different than those from agriculture-dependent countries.

Moreover, it is crucial to consider financial inflows when studying EME REER movements. Unfortunately, it is difficult to control for important factors like carry-trade, and better data and more research on the topic is needed. The results also confirm the existence of the Harrod-Balassa-Samuelson effect, and the partial success of countries that use exchange rate regimes with interventions in the FX-market to avoid more substantial appreciations (depreciations). Furthermore, we find that lower country risk and, at least in some periods, growing broad money has led to REER appreciations.

Finally, in line with the propositions of New Developmentalism, the data suggests that EME that had a relatively stable REER and current account surpluses fared much better in terms of overall macroeconomic indicators than those EME that had an appreciating trend and current account deficits. However, the examples of China and Mexico show that for upper-middle countries the concept of competitive "industrial real exchange rates" is not as

clear cut as proposed by ND (China has a stable and strong manufacturing sector and a REER with an appreciating trend since 2005, whereas Mexico has had a depreciating trend but a declining manufacturing sector). Moreover, the problem of high interest rates in EME needs more attention. With a permanent GDP growth rate far below the interest rate, credit markets tend to be big barrier to growth, and several of the better performing EME were able to de-mobilise their monetary policy rates without endangering their currency stability (sometimes thanks to capital controls). These points should receive more attention in future research.

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Appendix

Table A1: Correlation Matrix

	REER	Growth	Growth	Com_EME	CA_GDP	FA_GDP	RA_GDP	Regime	VIX	S&P	M3	M3 (2008-10)	Crisis
REER	1												
Growth	0.11	1											
Growth	0.15	0.15	1										
Com_EME	-0.04	-0.16	-0.16	1									
CA_GDP	0.12	0.13	0.02	-0.10	1								
FA_GDP	0.14	0.35	0.05	0.14	-0.15	1							
RA_GDP	0.06	0.44	0.05	-0.07	0.39	0.47	1						
Regime	-0.17	-0.41	-0.09	0.03	-0.20	-0.12	-0.33	1					
VIX	0.00	-0.12	0.00	-0.01	0.04	-0.12	0.00	0.01	1				
S&P	-0.21	-0.16	0.01	0.14	-0.12	-0.34	-0.17	0.04	0.02	1			
M3	0.16	-0.14	0.07	0.05	-0.27	0.09	-0.26	0.09	-0.14	-0.27	1		
M3 (2008-10)	0.11	-0.12	0.02	0.03	0.07	0.00	0.06	0.00	0.52	-0.08	-0.04	1	
Crisis	-0.04	-0.10	-0.08	0.05	-0.07	0.04	-0.04	0.06	0.31	0.06	-0.14	0.27	1