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How far is the Indian nominal exchange rate from equilibrium?

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Abstract

Examining misalignments from equilibrium exchange rates for eight key emerging markets does not find evidence of systemic overvaluation. Swings associated with global events suggest changes are driven more by surges in global capital. The Indian equilibrium nominal rate depreciated since 2012 despite real appreciation but the range of 68-71 for INR/USD was close to equilibrium in 2018.

Keywords: Nominal exchange rate; Misalignments; India; Emerging market Economies

JEL Code: F31, F41

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1. Introduction

A strand of literature pointed to undervalued exchange rates in emerging market economies (EMEs), especially in China, as responsible for global current account imbalances and build-up of risks that resulted in the global financial crisis (GFC) (Blanchard and Milesi-Ferretti, 2012). But there is an alternate view that large cross border flows due to under-regulation and excessive leverage affected exchange rates (Goyal, 2009). Investments in US bonds due to dollar strength encouraged over-consumption in advanced economies (AEs) (Dooley et al 2004, Gourinchas et al 2012). Similarly, the slowdown after the crisis led to the 'currency wars' hypothesis that countries were trying to support their own exports through currency depreciation. The alternative hypothesis is that surges and sudden stops in capital flows due to global risk-on risk-off and quantitative easing (QE) affected exchange rates (Rey 2013). If the trade related mercantilist view is correct, exchange rates of key EMEs should have been under-valued both before and after the GFC. If EME exchange rates are found to be largely over-valued the alternative hypothesis of excess global leverage and liquidity would be more valid.

Distinguishing between the two hypotheses through estimating misalignment first requires a good measure of equilibrium real exchange rates (ERER). If the ERER estimation includes structural EME variables they will not distort the calculated misalignment. This paper derives misalignments for the nominal exchange rates of eight key EMEs[1] using such earlier estimates of equilibrium real exchange rates.

It also, therefore is able to contribute to a domestic debate on how far the rupee is from equilibrium values after a period of large volatility following the GFC and subsequent global events.

The remaining paper is structured as follows: Section 2 discusses estimation of the equilibrium real exchange rate while section 2 extracts the equilibrium nominal exchange rate. Section 4 interprets deviations and section 5 concludes by drawing out implications for the Indian nominal exchange rate.

2. Estimating the equilibrium real exchange rate

To derive the equilibrium nominal exchange rate, it is first necessary to know the ERER. This is what affects fundamentals such as trade decisions, although financial returns to holding currency asset depend on changes in nominal exchange rates.

The problem is there are many ways of estimating ERER. Purchasing Power Parity (PPP) based on the value that would remove trade arbitrage opportunities, offers an objective theory to determine the real exchange rate. But all kinds of transaction costs and aggregation issues prevent perfect

[1] Huidrom et al (2017) analyzes seven of these EMEs and finds they have considerable influence on emerging and frontier markets.

trade arbitrage from occurring[2]. These problems are more acute when EMEs are involved. Our objective is to estimate the equilibrium value of the nominal exchange rate (NER) for EMEs, in particular for India, and to obtain deviations from this in the context of trade competition during the post GFC slowdown as well as capital flow surges.

Banerjee and Goyal (2019) estimate the ERER using modified OLS (FMOLS) and dynamic OLS (DOLS) with panel data[3] over 1995 to 2017[4] from eight major[5] systemically important but structurally diverse EMEs. Pooling increases the power of the econometric tests. The socio-economic-political environment differs in EMEs, which affects productivity or wage/relative-price structures. Their ERER estimate takes into account the behavioral differences between nations like size of the economy, productivity or policy stances, which are 'real' variables consistent with the structural conditions of EMEs. In order to focus on trade relations between EMEs and AEs they construct an index of real exchange rate (RER) taking into account the changing trade shares between EMEs and advanced economies[6] (AEs), for the estimation. RER is defined as the price of a basket of goods in AEs vis-a-vis the average price of a similar basket in the home EME, both expressed in domestic currency terms. Here, an increase in RER amounts to an increase in prices of AEs relative to home country or EMEs, which can also be seen as RER depreciation for the home country. Instead of the commonly used base of USD, they take a basket of AE currencies. Factors affecting trade arbitrage and relative prices of this basket are included in the estimation, such as unexplored variables like dependency ratio and fiscal procyclicality.

The weighted RER (WRER) of the ith EME w.r.t. jth AE is defined as, $RER_{it} = \sum_{j=1}^{4} Wijt \ RERijt$.

Where $RERijt$ is the bilateral RER of i^{th} EME with each of the AEs where j = USA, UK, Japan, Australia. The weights are the trade shares of the jth AE in the total trade of the ith EME.

$RER_{ij} = S_{ij} (P_j / P_i)$ where S_{ij} is the cross nominal exchange rate in terms of i^{th} EME currency per unit of j^{th} AE currency calculated as $S_{i, USA} / S_{j, USA,.}$ $P_{j,}$ the price level of the j^{th} AE, is taken as its WPI with base 2010=100, P_i is the price level of the i^{th} country (home) using WPI, base 2010=100. The usage of price indices with base 2010 necessitates indexing of the nominal exchange rates to base 2010=100.

w_{ijt} is the share of j^{th} AE in total trade of the i^{th} EME defined as below:

w_{ijt} = Total trade (exports + imports) of i^{th} economy with j^{th} AE in t^{th} year/ Total trade of i^{th} economy with the world in t^{th} year.

Among all the explanatory variables, the two with the largest coefficients are the relative difference in gross weighted labour productivity between EMEs and weighted AEs, and the difference between indices of weighted financial development. Both the coefficients are same in both the FMOLS and DOLS estimations. The value of the first coefficient is negative 0.56. It gives the elasticity of RER with

[2] Purchasing Power Parity based nominal exchange rates cannot be taken as equilibrium if persistent frictions and structural features keep the equilibrium away from PPP values.
[3] Sourced from the World Bank, IMF, and United Nations Comtrade databases.
[4] In the DOLS estimation, incorporation of lags uses up two data points leading to the sample of 1997-2017.
[5] They are Brazil and Mexico (from Latin America), China, Indonesia, Thailand (East Asia), India (South Asia), Russia and Turkey (Eastern Europe).
[6] The weighted real exchange rate (WRER) of each EME is a weighted average of the bilateral RERs with respect to the four major AEs e.g. United States of America, United Kingdom, Japan and Australia.

respect to an increase in productivity differential. It implies RER appreciates by around half of the percentage increase in productivity of EMEs over AEs. In an EME, real wages and the price level are lower compared to AEs so the purchasing power parity exchange rate exceeds unity. With development productivity rises relatively more in traded goods thereby increasing wages and non-traded goods prices leading to real appreciation. This is the Balassa-Samuelson (BS) effect. The negative coefficient of productivity difference supports this effect at a high level of significance.

The coefficient in the differential in financial development is positive. It indicates improvement in domestic financial infrastructure and credit growth as well as removal of infrastructural bottlenecks. Hence, RER depreciates, that is, domestic EME goods become cheaper. A rise in the relative supply of EME products, or fall in costs, lowers the relative value of EME goods. The impact of this variable is significant and as high as the BS effect, only less by 4 basis points.

Thus, as development takes place, there are factors that tend to appreciate equilibrium real rates, but also those that tend to depreciate it.

3. Extracting the equilibrium nominal exchange rate

The estimated equilibrium RER can be used to calculate a rough measure of the average EME nominal exchange rate index against a basket of the four AEs for each year.

RER $_{it}$ can be written as $\sum_{j=1}^{4} Wijt(Sijt\frac{Pj}{Pi}) = \sum_{j=1}^{4} Sijt\ (Wijt\frac{Pj}{Pi})$ ---------- (A)

WRER has two components in it, one is the nominal exchange rate $Sijt$ in terms of domestic currency per unit of foreign currency, and two is the relative price ratio between foreign and home price indices $\frac{Pj}{Pi}$ multiplied by the weights $Wijt$. The presence of price indices necessitates indexing of $Sijt$ to base year 2010. The weights can be taken as exogenously determined in the short run. If prices are inflexible in the short-run, it can be assumed that relative price ratios are annually determined by the short run levels of output in the AEs and EMEs. Under these assumptions, we can estimate the equilibrium nominal exchange rate in the EMEs in each year.

Let us assume that for the i^{th} EME and t^{th} year, S_{Eit} is an average over the four nominal exchange rates vis-à-vis the AEs of USA, UK, Japan and Australia defined in terms of i^{th} EME currency per unit of j^{th} AE currency.

Taking out the value of S_{Ei} in (A), we can re-write the expected value of WRER $_{it}$ as E(WRER $_{it}$) = S_{Eit} $\sum_{j=1}^{4} Wijt(\frac{Pj}{Pi})$ ---------- (B)

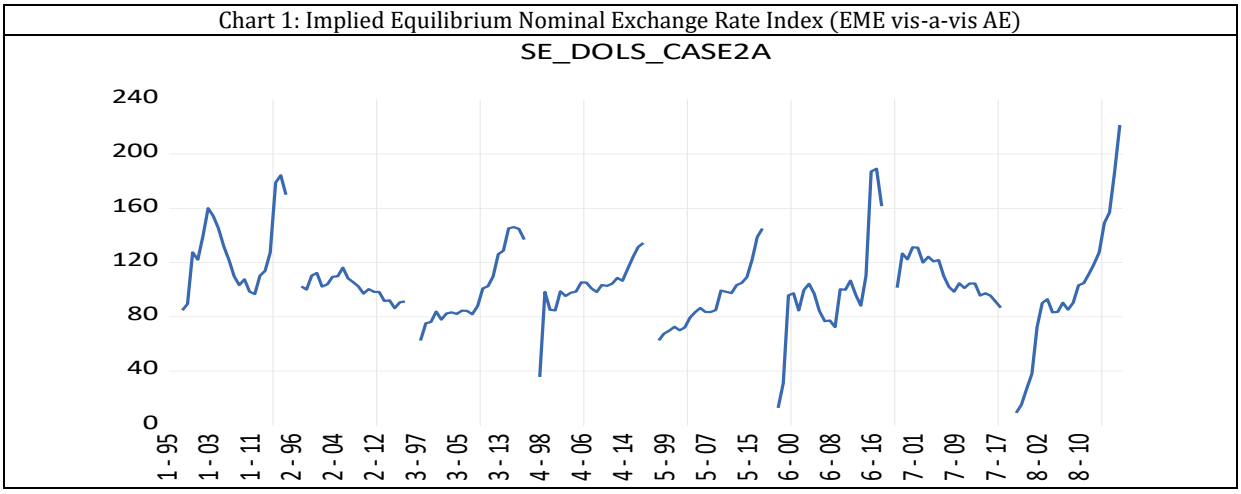
E($WRER_{it}$), in essence, is the short-run version of the ERER already estimated by FMOLS and DOLS. Each year, when prices and trade weights can be taken as exogenously fixed, the nominal exchange rate would adjust. For ease of calculation, we take the average nominal exchange rate, rather than bilateral rates. The estimated ERER is the expected value of WRER for the set of EMEs that is determined as an outcome of several stochastic variables. In the short run, when weights and relative prices are fixed, the ERER can be seen as driven by the average nominal exchange rate S_{Eit}. However, over the long run both nominal exchange rate as well as prices should adjust to yield the ERER.

So, from the estimated ERER we can find out the value of the average equilibrium nominal exchange rate of EME vis-à-vis AEs (we call it S_E) and from (B), it can be calculated as ERER / $\sum_{j=1}^{4} Wijt(\frac{Pj}{Pi})$. We use the ERER estimates from the DOLS equation in Banerjee and Goyal (2019), since the literature suggests that although the coefficients of both have the same limiting distributions, DOLS and its t-statistic have the least bias amongst OLS, FMOLS and DOLS estimators. The coefficients obtained are consistent in sign across the estimations.

Chart 1 gives a clear comparative picture of the trends in the calculated average nominal exchange rate (S_E) of EMEs vis-a-vis chosen AEs. Since the values are indexed to 2010 prices, S_E is used to understand the direction of movement in the exchange rates of the EMEs rather than the actual value. The average currency value for China and Thailand has moved downwards, or shown appreciation since 2005. As is to be expected currencies have on average depreciated in the post 2005 years in high inflation countries such as India, Indonesia, Mexico, Russia and Turkey. Russia and Turkey show the most divergent exchange rate behavior, while China shows considerable stability compared to the other economies. The Brazilian real follows an unusual path of strong cyclicality and might be expected to appreciate over the next few years if the downturn continues in the S_E. Indonesia shows trend depreciation post 2013 after a period of stability in the 2000s. India is showing some correction in 2016-17 after steady depreciation in the post GFC years. Brazil and Russia also show some appreciation in the post 2016 period.

Chart 2 plots the S_E index along with the actual cross country exchange rate indices for each EME against the four AEs. Here, we can see the misalignments in the actual nominal exchange rate from the implied equilibrium nominal rate S_E. For most of this time period (1997-2017), the S_E was above the actual nominal rates vis-à-vis Japan and Australia. EMEs were therefore over-valued with respect to Japan and Australia. But S_E was below the actual nominal exchange rate index of each EME with USA, and in some cases with respect to UK, especially before the GFC. The undervaluation with respect to USA may have been due to dollar strength from large pre-crisis cross border and subsequent safe haven inflows into the USA, since the actual RER was over-valued with respect to the estimated ERER throughout the period, especially in China, India and Indonesia (Chart 3)[7].

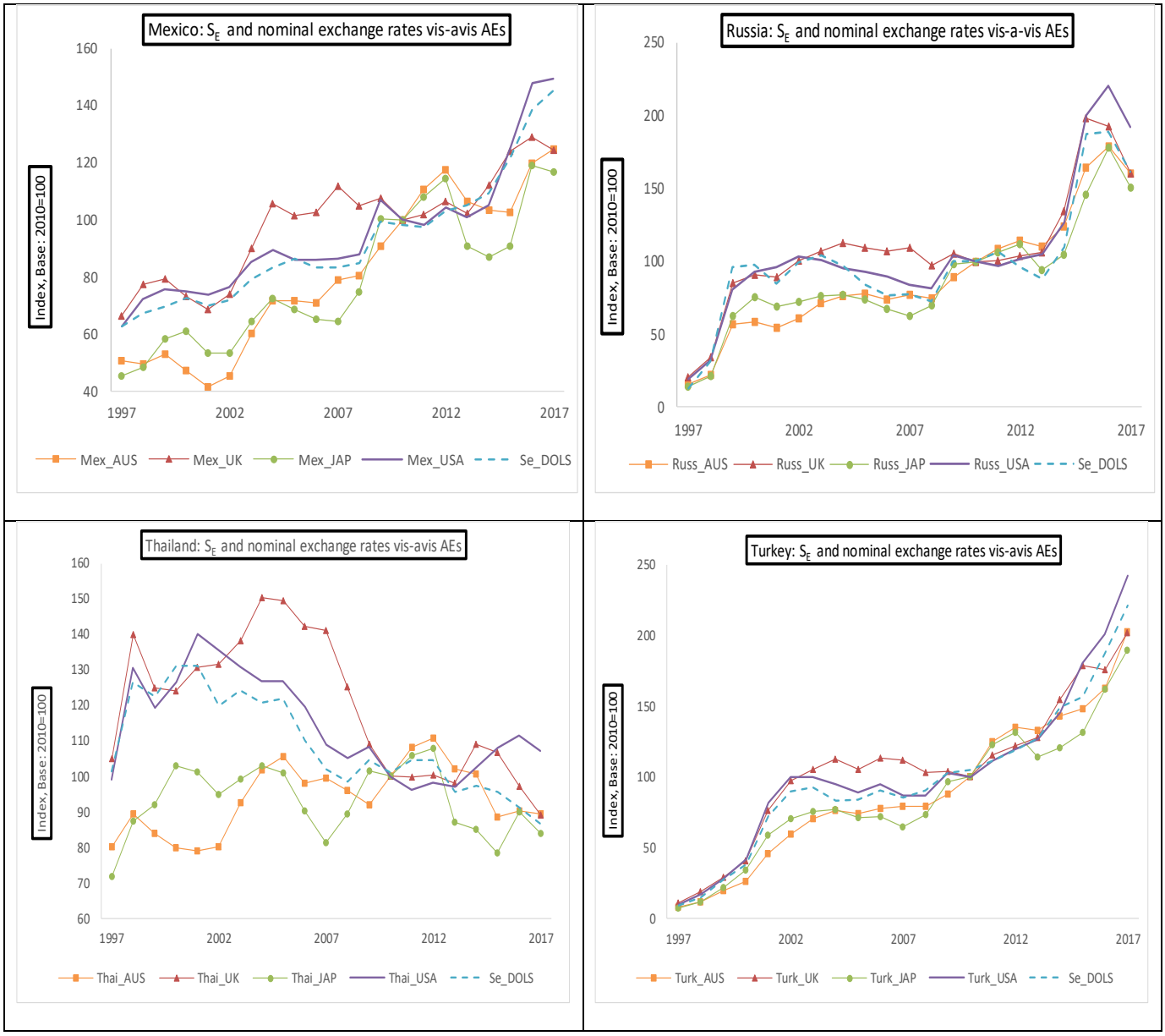
Chart 1: Implied Equilibrium Nominal Exchange Rate Index (EME vis-a-vis AE)



[7] In the definition of RER used in Banerjee and Goyal (2019), a lower value means appreciation. If the actual RER is below the ERER then it is over-valued w.r.t. the ERER.

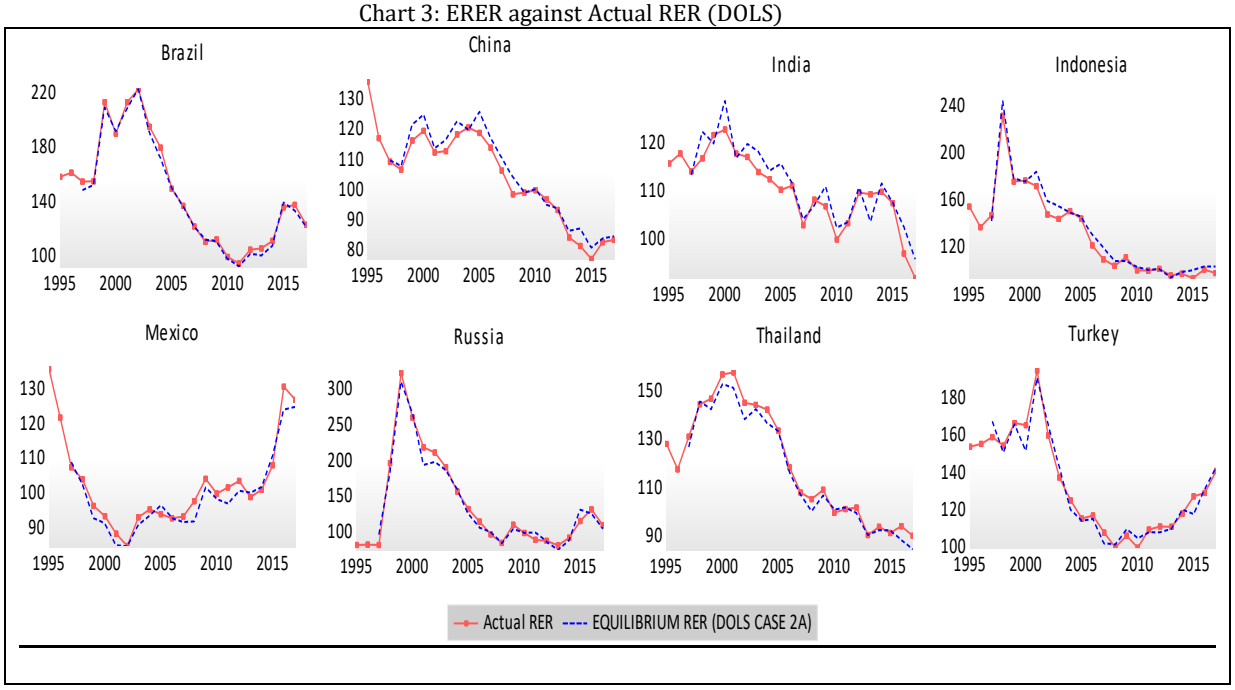
1:Brazil, 2:China, 3:India, 4:Indonesia, 5:Mexico, 6:Russia, 7:Thailand , 8:Turkey

Chart 2: Misalignments in actual nominal exchange rate index from Se, implied equilibrium exchange rate (DOLS)



AUS: Australia, UK: United Kingdom, JAP: Japan, USA: United States of America

Chart 3: ERER against Actual RER (DOLS)



4. Interpreting deviations

The information contained in Chart 2 helps us to divide the entire period into two distinct phases according to the behavior of the EME currencies against the AE currencies. The period between the Asian Financial Crisis till the beginning of the GFC was the first phase when all the EME currencies were, in general, undervalued against US Dollar and British Pound and at the same time, overvalued against Japanese Yen and Australian Dollar (AUSD). The second phase starts after the GFC and distinctly from 2010 when the trend interchanged between the two groups of AEs, e.g. overvaluation against Dollar and Pound and undervaluation against Yen and AUSD. This was a period of correction for all the EMEs against the Dollar. Post 2015, EME currencies were seen to be re-orienting towards undervaluation against the Dollar while other AE currencies remain overvalued against EME currencies. Table 1 below summarizes the observed trends. Dollar and Pound move more closely, while Yen and AUSD can be grouped together in terms of movements against EMEs. The period between 2010 and 2015 shows correction against Dollar for all EME currencies, probably driven by surges of capital flows due to Quantitative Easing (QE) and global risk-on and off.

Chart 4.a. below shows the Asian EMEs of China, India, Indonesia and Thailand have experienced steadily rising productivity levels in the post 2000 period[8], although these countries still remain below the AE level of productivity. For the rest, productivity seems to have leveled off in recent years. In the case of Brazil, Mexico, Russia and Turkey, productivity has fallen post 2014 or during

[8] There is other evidence of relatively higher EME productivity growth, since this slowed more in AEs after the GFC. IMF (2017, Chapter 2) finds productivity growth slowed in Asia also after the GFC, but continued in India, perhaps since aging is not a problem here. Indian levels of about 45 are still far from the US technology frontier at 100, but the catch-up is proceeding, even in the unorganized sector. CSO (2017) shows unorganized sector compound annual productivity growth (7.2 per cent) over 2011-2016 much exceeded that in the organized sector (3.2 per cent).

the Euro debt crisis. The AE productivity levels stayed stable. The productivity differential in the Asian economies like China, India, Indonesia and Thailand is slowly moving from the negative range to zero. This lends support to the growth convergence thesis. For Mexico, however, the productivity differential is diverging away towards negative figures since 2014.

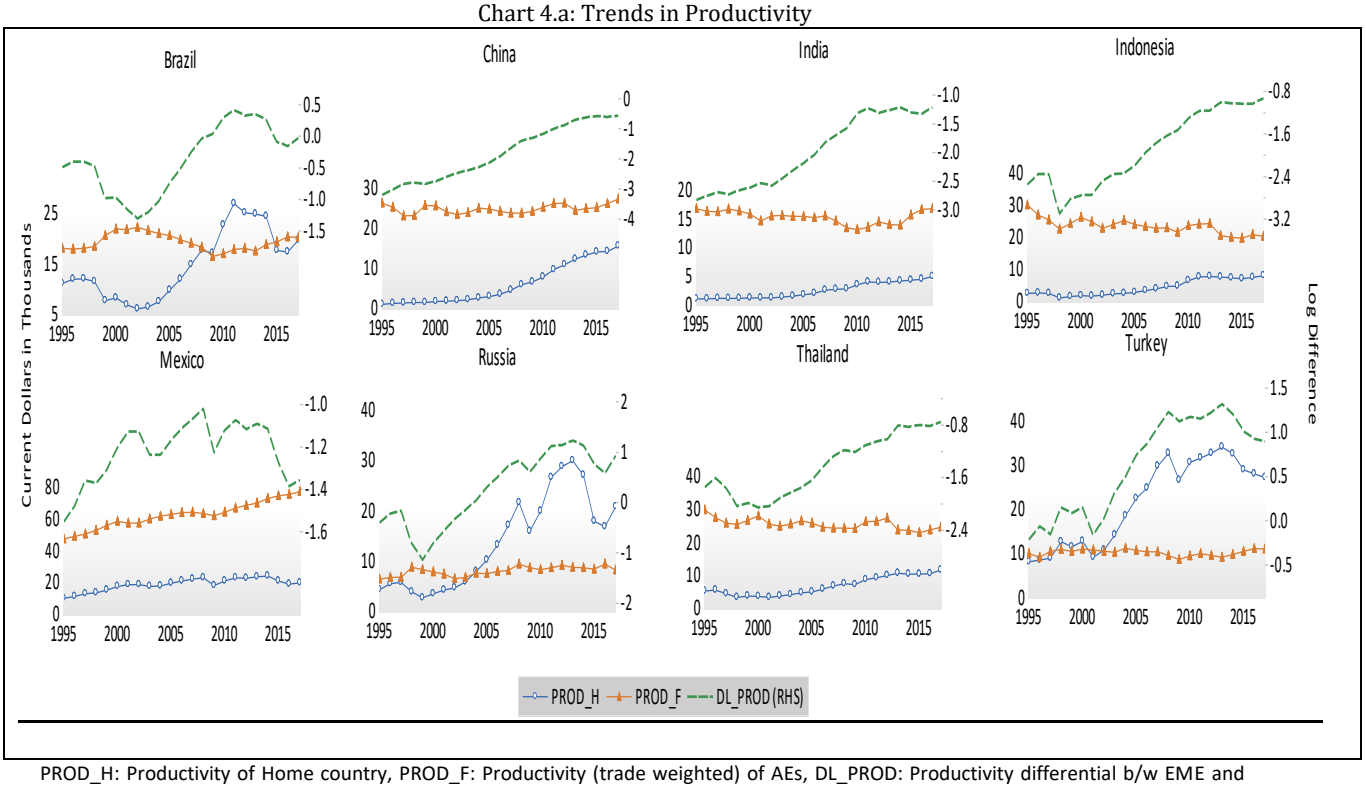
Table 1: Trends in the equilibrium average nominal rate against the individual cross-currency rates

	Post Asian Financial Crisis (1997 - 2007)	Post Global Financial Crisis (2008 - 2017)
Brazil	Till 2002, Real was overvalued against the AE currencies (lying below the constructed S_E which represents what the equilibrium should be). But, in the next years running till 2007, the Real-Dollar and Real-Pound markets show undervaluation compared to our measure.	From 2010 onwards, Real rates show correction against Dollar and Pound which move close to equilibrium. But the undervaluation in the Yuan-Dollar market comes back in 2015, while for the other currencies, it continues to be overvalued.
China	The Chinese Yuan-Dollar and Yuan-Pound exchange rates show undervaluation. Over-valuation is seen w.r.t. Yen and AUSD for all years in this period.	From 2010 onwards, Yuan-Dollar as well as Yuan-Pound rates show correction. But the undervaluation in the Yuan-Dollar market comes back in 2014, while for the other currencies, it continues to be overvalued.
India	Rupee-Dollar and Rupee-Pound rates show undervaluation, while being mostly over-valued for the other two markets.	From 2010 onwards, the Rupee-Dollar and Rupee-Pound rates go below the S_E indicating correction. This continues till 2015, after that Rupee-Dollar rate again shows undervaluation.
Indonesia	Rupiah also shows same trend of undervaluation w.r.t. Dollar and Pound in this period, along with overvaluation w.r.t. Yen and AUSD.	Exactly, same trend as Brazil, China and India is observed here too with a brief span of correction in the value of Rupiah against Dollar and Pound between 2010 and 2012. However, after 2016 Rupiah-Dollar rates continue to be undervalued while the rest show over-valuation.
Mexico	Peso, similarly, remains undervalued w.r.t. Dollar and Pound in this period, while over-valued w.r.t the other two AE currencies.	The Peso-Yen and Peso-AUSD markets show overvaluation after 2010, while Peso moves near equilibrium against Dollar and Pound between 2010 and 2015. Post 2016, undervaluation continues only against the Dollar.
Russia	The Ruble moved close to equilibrium till 2003 against Dollar and Pound, after which it remained undervalued till 2007. The other two markets were over-valued compared to S_E in this period.	Between 2010 and 2012, for a short while Ruble-Dollar and Ruble-Pound rates saw correction, beyond which it still remained close to S_E. Post 2015, Ruble shows undervaluation w.r.t. Dollar only.
Thailand	A similar trend of undervaluation in the Baht-Dollar and Baht-Pound markets is observed, while the Baht stayed over-valued against the Yen and the AUSD.	Between 2010 and 2013, Baht dipped against Yen and AUSD and corrected against Dollar and Pound. Beyond 2015, the undervaluation continued against Dollar.
Turkey	Turkish Lira is an exception in that the Lira-Dollar rates remained very near equilibrium in the whole period, and only diverged towards undervaluation post 2015. Similar trend was observed for other AE markets e.g. undervaluation w.r.t. Pound and overvaluation w.r.t. Yen and AUSD.	Between 2010 and 2013, Lira dipped against Yen and AUSD and corrected against Dollar and Pound which remained very near equilibrium. Beyond 2015, the undervaluation continued against Dollar only.

Chart 4.b. shows the internal terms of trade (ITT is the relative price of tradables to non-tradables) have followed different paths in the EMEs. However, in the latest years, the ITT have reached similar level in the EMEs. Both China and India started at a high ITT of 1.2 and experienced steady reduction in the relative price of tradables during this period. This is equivalent to rising relative non-tradable prices predicted by the BS effect. Turkey also started at 1.14; however, the reduction has been largest since 2015. For Brazil, Indonesia, Russia and Thailand, ITT has risen over the years starting from below 1 indicating that prices of tradables were initially less than the prices of non-tradables in

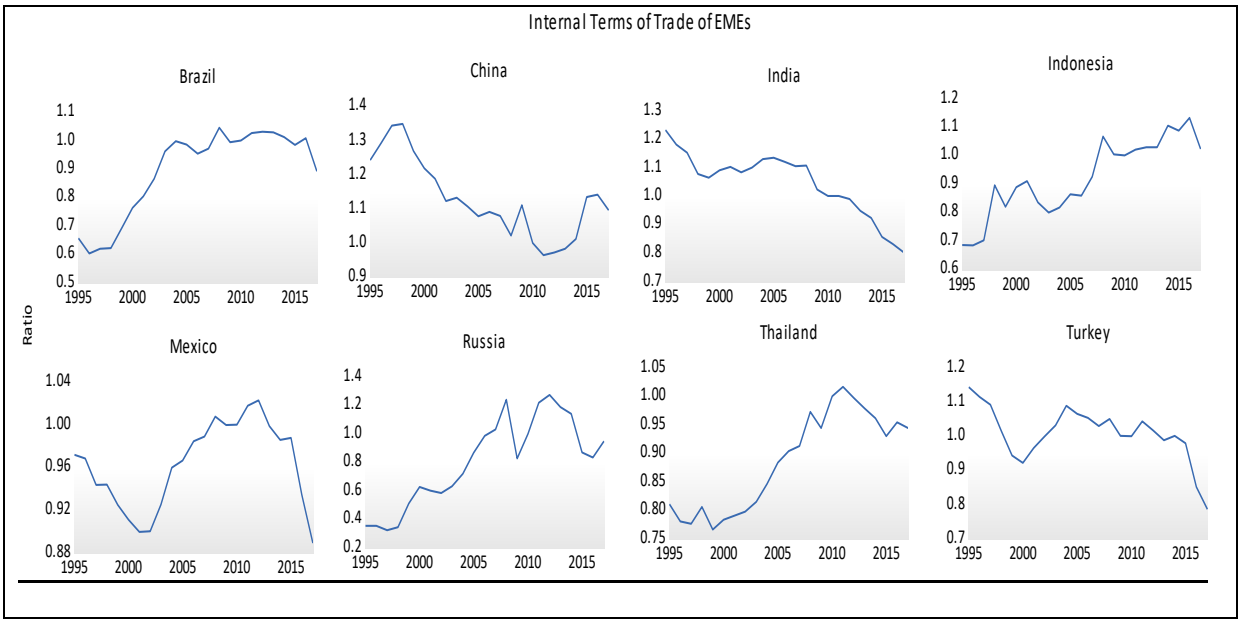
these countries. Their ITT has, however, started to decline from around 2014-15. Cross- referencing with Chart 4.a. we observe that productivity series has indeed taken a positive turn in these countries in the latest years. For Mexico, we observe no trend but a cyclical pattern in ITT. It rose in the 2000s, and is falling after 2012.

Chart 4.a: Trends in Productivity



PROD_H: Productivity of Home country, PROD_F: Productivity (trade weighted) of AEs, DL_PROD: Productivity differential b/w EME and AE.

Chart 4.b: EME Internal Terms of Trade



Since ERER is appreciating for almost all EMEs over the estimation period, it implies that factors leading to appreciation, such as the BS effect, are dominating. That productivity is rising faster in almost all EMEs also supports this. But there is no relative rise in non-traded goods prices in many EMEs. It is there in China and India but these are labour surplus countries, where labour market tightness is unlikely to drive a rise in wages. Therefore the BS effect is better interpreted as a differential growth in productivity and wages across sectors with possible skill shortages. In the standard BS effect full-employment implies that as productivity growth is faster in tradables, and wage growth is equalized across sectors, non-tradable prices rise relative to tradables.

5. Conclusion: Indian equilibrium nominal exchange rate

The equilibrium nominal rate against the four major AEs is found to be appreciating only for China and Thailand, while depreciating for the rest. But most EME equilibrium nominal rates are under-valued relative to US and UK, with wider divergences before the GFC. The RER however, is over-valued (Chart 3) so that the mercantilist trade bias and currency war argument is not supported. Short term nominal exchange rate misalignments are more likely driven by surges in capital flows, since under-valuation is largely with respect to the dollar, whose special status and strength attracts inflows. This indicates the need for further exploration into the real (trade) and nominal (banking and finance) channels of AE spillovers to EME variables.

Swings in Indian 36 country export weighted nominal and real effective exchange rates (REER) exceeded ten percent in the period after the GFC, corresponding to surges and outflows of foreign capital. After 2014, however, there was sustained real appreciation. Chart 3 shows the actual RER to have appreciated compared to ERER in this period. Even though the ERER was appreciating, the actual RER had appreciated even more as large inflows came in over 2017. The REER, for which a rise is an appreciation, rose from 105 in 2009-10 to 121 in 2017-18, when the ERER fell from 105 to 95 but the actual RER was below this. By May 2018, the REER had depreciated to 117.5, close to the equilibrium ERER, so the range of 68-71 for INR/USD was also close to equilibrium. There was some recovery in export growth.

The real exchange rate was largely kept stable at a REER value of 100 through the nineties. It was at this value even in 2004-05. Therefore it is suggested the REER is now over-valued by about 20%. But according to ERER estimation that controls for productivity differentials and other structural changes, the new equilibrium is around 115 as argued also in Goyal (2018).

Our estimated S_E index depreciated from 100 in 2010 to 140 and then appreciated. The bilateral INR/USD, depreciated from 45.6 to 64.5 over the same period. The 42% depreciation almost equivalent to that in the S_E suggests our estimation is accurate. In 2016-17 the bilateral INR/USD at 67.07 showed 47% depreciation. S_E under-valuation while RER is over-valued suggests more short-term volatility in the nominal exchange rate. Our derivation approximation, which assumes prices are sticky in the short-run, also imputes more of volatility to the exchange rate.

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