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REAL EXCHANGE RATE (RER) AS A POLICY TOOL FOR INDUSTRIAL DIVERSIFICATION AND GROWTH IN AFRICA

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Abstract
Appropriate exchange rate (ER) policies in some Asian and Latin American countries have led to improvement in industrial diversification and growth. The growth 'miracle' of the Asian countries centres on the effective use of ER and trade policies, specifically the adoption of depreciation of real exchange rate (RER). However, the case of Africa is different, as the continent is yet to adopt an appropriate ER policy that enhances industrial diversification and growth. Examining the effectiveness of the RER as a policy tool for industrial diversification and growth in 36 African countries, this study applied a dynamic generalised method of moments (GMM) estimation technique to determine how changes in RER affects the growth composition of the three main productive sectors – primary, secondary, and tertiary and their response rates. Our findings suggest that the primary sector leads to appreciation of the RER, while the secondary and tertiary leads to depreciation of the RER. This result has serious policy implication for the Africa continent that has relied so much on the production of primary commodities. Rather than pursue the policy of ER depreciation which affects the primary and secondary sectors, policy shift in favour of the tertiary sector should be highly encouraged.

Keywords: *Panel Data; Exchange rate; Industrial policy; Economic growth; Africa; Productive sector; Estimation technique.*

Introduction
Unlike many developing continents such as Asia, and some countries of Latin America, where industrial revolution has assisted in transforming the entire economic space, the case of Africa has remained thought-provoking following what many have described as the "Dutch disease" syndrome and other issues as discussed

in Sachs (1999), and Collier and Gunning (1999). Although some of the factors that have led to this precarious situation are debatable, one that stands out in the literature is the issue of the "Dutch disease" syndrome – a system in which investment in the non-tradable sectors leads to appreciation of the exchange rate (ER). While the findings of different studies on the impact of ER on an economy may differ, experts agree that poorly managed industrial and trade policies negatively affect economic growth. Eichengreen (2007) and Rodrik (2008) state that a poorly managed ER policy is detrimental to economic growth.

Accordingly, if poorly managed domestic policies affect growth negatively, then internal policy reforms are required to stimulate industrial growth. This scenario has played out successfully in China's domestic policy reforms. According to Dutta (2005), through trade and industrial policy reforms, China was able to diversify its economy from the agricultural to the industrial sector with the share of GDP growing above two-thirds of the total aggregate growth in 2000. However, Africa is yet to adopt this process to diversify its economy from the agricultural to the industrial or services sectors probably due to the challenges of adopting appropriate ER policy framework needed to foster growth.

This study is significant because there is the need to assess the effectiveness of RER as a policy tool for industrial diversification within the African context. Studies have proven ER to be an important component of industrial diversification and economic growth. According to Ghura and Grennes (1993), and Collier and Gunning (1999), the growth 'miracle' of the Asian countries centres on the effective use of ER and appropriate trade policies. Specifically, the adoption of depreciation of ER as a policy framework that acts as catalyst to 'economic boom' in the region. A study by Dutta (2005) shows that China was able to diversify its economy from the agricultural to the industrial sector by leveraging on trade and industrial policy reforms through an undervalued ER regime. Rodrik (2008) also affirms that undervaluation of ER leads to growth while overvaluation in ER leads to resource reallocation to productive sectors which have less economic importance. Revising this trend therefore requires that African policymakers have additional information to enable them determine whether RER affects the sectoral composition of growth or not, and if it does, which of the sectors causes ER appreciation or depreciation.

This study has identified the following gap in the growth literature. Previous studies have been able to investigate the impact of ER on aggregate economic growth. For instance, studies by Bleaney and Greenaway (2001), Hua (2007) and Max Corden (2009) find a robust relationship between ER, trade, and economic growth. The studies state that the impact depends on the structure of the economy, and on the ER policy practice. Zhang (2001) reports that during China's central planning period, RER misalignment led to chronic overvaluation in the ER. Schnabl (2008) reports that ER volatility has direct negative impact on the economic growth of countries

with open capital accounts in the EMU periphery. While there is a plethora of studies on ER and growth, studies that have examined the impact of ER on the composition of sectoral growth are fewer especially, in African countries.

Furthermore, studies that have examined ER and growth either adopted aggregate growth or sector value added in GDP. However, these studies did not take into account the fact that there is inter-sectoral dependence among sectors and the activity of sectors tends to spill over into each other. Consequently, economic activity in one sector tends to spill-over into others. This confounds the estimates of change in ER on growth composition. Rodrik (2008) examines the impact of RER and economic growth in selected countries and finds that change in RER affects the growth of homogenous economies in a similar trend. Hua (2007) investigates the impact of RER employment in the manufacturing sector of China and finds that depreciation of ER negatively affects manufacturing employment. However, while some of these studies are regional and cross-country analyses, literature is scarce on studies that specifically focus on the African continent.

The contribution of this research therefore is as follows: Firstly, rather than adopt aggregate growth as the dependent variable as is the case with previous studies, this study shall adopt sectoral growth as the dependent variable. Secondly, in order to show how sectors' growth respond to changes in ER, this research will first identify the 'real' contribution of each sector in GDP by filtering out the spill-over effects of one sector to another through the partial regression approach and isolate the 'pure' sectors. The result obtained will then be adopted as the 'real' contribution of that sector to gross domestic product (GDP). Lastly, this research shall specifically be conducted for African countries to fill the literature gap, and to determine whether RER affects the composition of sectoral growth in the region.

Literature Review

There have been debates among researchers over which ER shift (under- or overvaluation) promotes aggregate growth. Much of the evidence is in favour of undervaluation; only a few studies support overvaluation. Sachs and Warner (1997) show that depreciation (or undervaluation) of domestic currency impacts positively on growth and investment for countries that export manufactured goods. Hua (2007) investigates the impact of RER in China's manufacturing sector between 1993 and 2002. The study finds that in China, appreciation of the domestic currency creates distortion on employment generation in the manufacturing sector. Similarly, Galindo Izquierdo and Montero (2007) examine the impact of ER depreciation in Latin America, using econometric evidence supports. The study finds that depreciation of ER negatively impacts on employment growth in countries whose manufacturing sector activities are under the liability of a foreign currency.

Paudel and Burke (2015) examine the implications of ER policy on export performance in Nepal between 1980 and 2010. The study finds that appreciation (or overvaluation) of RER is associated with a reduction in the country's merchandise exports by around two-fifths. Studies have shown why there is bound to be distortion in the tradable sector when domestic currency appreciates. According to Cherif (2013) and Van der Ploeg and Venables (2013), as domestic currency appreciates, it leads to a decrease in the prices of imports and an increase in the prices of exports, and this crowds out production factors from tradable to non-tradable sectors. This view is similar to that expressed by Rodrik (2008), who stated that overvaluation is 'associated with foreign currency shortages, rent-seeking and corruption, unsustainably large current account deficits, balance of payment crises, and stop-and-go macroeconomic cycles' (p.366).

According to Thomas (1999), when a country's economy is faced with a balance-of-payments challenge, it leads to a drop in demand for that country's currency which creates downward pressure in the currency market. Aguirre and Calderón (2005) argue that economies with the highest inflation rates suffer the largest RER appreciation in the succeeding periods. The effectiveness of ER and its impact on economies depends on the appropriate management of policies of different ER regimes (under- or overvaluation). However, empirical investigations have shown that the policy swing under different ER regimes throws up different outcomes for different countries. Rodrik (2008), in a cross-country study confirms this view. The study reports that an overvalued ER regime practice in Tanzania and Uganda between 1960 and 2000 affected the two countries' trade and economic growth negatively. However, for Mexico, the findings show inconsistent results as the economy experienced growth during the period of currency appreciation.

A similar cross-regional study by Fang, Lai and Miller (2009) further confirms Rodrik's findings which show that different forms of ER regimes affect the export revenue of the eight Asian countries studied differently. While ER appreciation affected the Japanese currency market negatively, depreciation (or undervaluation) had no impact on Malaysia and Singapore's currency markets. Many more studies have been linked to different regime outcomes of RER (that is, over- or undervaluation) on exports and aggregate growth. In the study by Dekle and Ryoo (2007), their findings show that among the major industries in Japan, an appreciation in the domestic currency by 1% reduces export volume by 0.02 to 2.9%. Also Mohamad and Jusoff (2008) find exchange rate variability and misalignment to have significant impact on export growth in Southeast Asian economies.

Aguirre and Calderón (2005) examine the growth effects of RER misalignments and economic performance in 60 countries over the period 1965-2003. Using a panel and time series co-integration approach, the study finds that while the large size of RER misalignments and undervaluation reduces growth, low-size undervaluation

promotes growth. Reporting further, the study states that a reduction of the average degree of overvaluation of RER from 5 to 2% will stimulate developing economies' aggregate growth rate by up to 30%. Conversely, if overvaluation increases by 5%, growth will be reduced by 56%.

The relationship between ER uncertainty and export growth has also been examined. Although the findings of the foremost studies on this relationship are ambiguous, growth literature have not been able to provide a standard reason for the ambiguity. De Vita and Abbot (2004) suggest that the reasons for the ambiguity could either be the choice of proxy of ER risk/uncertainty or as a result of inappropriate estimation techniques. While the search for the cause of ambiguity in still on-going, evidence abounds in the growth literature on the different ways in which ER uncertainty impacts export growth. Arize, Osang and Slottje. (2000) reported that an increase in ER uncertainty had significant negative effects on export demand for 13 less-developed countries (LDCs), both in the short-run and in the long-run. Chou (2000) however reports that ER uncertainty showed a long-run negative impact on exports of manufactured goods and mineral fuels in China.

Eichengreen and Gupta (2013) examine the response rate of merchandise, as well as traditional and modern services exports to changes in RER for 66 countries. The study finds that the modern services export response to change in RER is almost twice those of merchandise and traditional services exports. Specifically, a 10% depreciation in RER accelerates modern services' growth by 2.3%. Caglayan and Demir (2014) investigate the impact of exchange rate uncertainty and currency appreciation on firm level productivity growth in Turkey and find that RER volatility and appreciation affect the productivity growth of export-oriented firms negatively. This view aligns with that of Eichengreen (2007), who stated that "keeping the real exchange rate at competitive levels and avoiding excessive volatility are important for growth" (p.9).

Bleaney and Greenaway (2001) investigate the impact of terms of trade and RER volatility on investment and growth in 14 sub-Saharan African countries. The study finds that growth and investments are enhanced with depreciation of RER when production and export of primary commodities are improved. Serven (2003) examines the empirical link between RER uncertainty and private investment in least developed countries (LCDs). The study finds that RER uncertainty has a significant negative effect on investment for countries with high trade openness and less developed financial systems.

The Model and Estimation Methodology

The model for this study is built on a theoretic growth model adopted by Rodrik (2008). The framework shows how the aggregate growth rate of a country can be affected by a change in ER (that is, under- or overvaluation). Although, the effects of

a change in ER on the composition of growth are ambiguous among theoretic and empirical studies, received literature show that the impact of ER on growth depends on the ER, growth, and the investment policy objectives of a country. For instance, Sachs and Warner (1997) report that depreciation of ER stimulates growth and investments in countries that export manufactured goods. Among countries that engage in primary commodities export, Cherif (2013) posits that overvaluation of RER worsens the growth structure of economies that depend on primary commodities, while it boosts the growth of other primary commodity countries that are technologically advanced. Therefore, in order to determine the effectiveness of the real exchange rate on Africa's growth composition, the index of over- or undervaluation will be estimated first. Rodrik (2008) reports that adopting this approach will effectively determine the impact rate of ER policy on economic growth.

Index of under- or overvaluation of exchange rate: The Balassa–Samuelson effect

Since ER is the measure of domestic currency per foreign currency, arriving at an index of under- or overvaluation for domestic currency requires that a generally acceptable standard is adopted taking into account the differences in price levels across countries. According to Sekkat and Varoudakis (2000), domestic prices of tradables and non-tradables are influenced by the RER; which is a measure of the relative prices of tradables to non-tradables in an economic space. Rodrik (2008) reports that RER plays a significant role in the convergence of national income between various forms of economies. Arriving at an acceptable price index therefore, requires that the price level is adjusted for the Balassa-Samuelson effect (BSE).

BSE adjusts for domestic price level across board using the purchasing power parity (PPP) index – an index measure of ER between countries so that the purchasing power of their currencies are at par. According to Frankel (2006), relative PPP presents less difficulty when comparing price levels across countries. Therefore, following the early works of Frankel (2006), Rodrik (2008), and Berg and Miao (2010) in computing for index of under- or overvaluation, first RER is expressed as a ratio of nominal exchange rate (NER) and purchasing power parity (PPP). Thus,

$$ln\tau_{it} = ln\left[\frac{X_{it}}{P_{it}}\right]$$

Where *i, t,* is the index for countries and time respectively, $In\tau_{it}$ represents log of real exchange rate (RER), X_{it} stands for logNER and P_{it} represents log of PPP. Both values of NER and PPP are expressed in unit per US dollar. Given that prices of non-tradables are cheaper in developing countries, there is the need to adjust for BSE. Therefore, in accounting for BSE, the value of RER on GDP per capita (γ) for all countries is regressed following Rodrik (2008) thus:

$$ln\tau_{it}^{*} = \delta + \varphi ln \sum_{j}^{1} y_{it} + f_t + r_t + \varepsilon_{it} \quad (1)$$

Where $ln\tau_{it}^{*}$ represents the Balassa-Samuelson (BS) adjusted; δ stands for intercept; y_{it} represents GDP per capita; f_t , r_t stands for fixed and random effects for time period[1] and ε_{it} stands for error term. The value and sign of φ determine the magnitude and direction of BSE which indicates whether RER is undervalued or overvalued. Following the above equation therefore, the value of φ is estimated as 0.043 (see Table 1). In arriving at the index of under– or overvaluation (ω), the difference between log sum of RER and log fitted value is taken from BS adjusted as in Rodrik (2008), and Eichengreen and Gupta (2013). Hence,

$$ln\omega_{it} = In\tau_{it} - ln\tau_{it}^{*}$$

According to Rodrik (2008), if $ln\omega_{it}$is greater than one (unity), it indicates that the value of the domestic currency to foreign currency is lower (that is, undervaluation) showing that prices of goods and services are cheaper relative to that of the foreign currency. However, If $ln\omega_{it}$is below unity (i.e. less than one), it then signifies that that the domestic currency is overvalued; meaning that prices of goods and services are expensive relative to foreign goods and services. Following the above procedure, the study estimate shows an undervaluation of ER with value greater than unity (2.9). Taking a logarithm transformation of the value yields 0.46[2]

Table 1: Balassa-Samuelson Effect (BSE). OLS panel estimation. Dependent variable: Log (RER)

Variable	Coefficient	Standard Error	t-Statistic	Prob.
C	1.263918	0.115223	10.96931	0.0000*
LOG(GDPPC)	0.043409	0.015250	2.846396	0.0046*
R-squared	0.017960	Mean dependent var		1.591631
Adjusted R-squared	-0.064061	S.D. dependent var		0.097088
S.E. of regression	0.100150	Akaike info criterion		-1.688589
Sum squared resid	4.443299	Schwarz criterion		-1.358687
Log likelihood	444.1056	Hannan-Quinn criter.		-1.558923
F-statistic	0.218972	Durbin-Watson stat		0.659832
Prob(F-statistic)	1.000000			

*1% significant level. Total panel (balanced) observation: 481

Real exchange rate and the composition of growth equation

In this section, the effect of RER on the composition of growth is analysed. Traditional and modern theories (e.g. Rodrik, 2008 and Paudel and Burke, 2015) that examine

[1]Equation (1) shall be estimated through the ordinary least squares (OLS) approach.
[2] Rodrik (2008) report 0.48 even though the study is a single panel cross-country analysis

the impact of ER export and aggregate growth are contrasted by comparing how different productive subsectors of the economy respond toward changes in ER. The regression specification follows the pioneer work of Rodrik (2008) but with slight modifications. The equation is stated as follows:

$$g_{it} = \alpha_i + \beta g_{i,t-1} + \rho lnY_{i,t-1} + \delta lnE_{it} + \vartheta lnX_{it} + u_{it} \quad (2)$$

In equation 2, the dependent variable g represents the annual growth rate of share of sectors i in GDP for each of the seven subsectors – agriculture, manufacturing, mining, construction, and those of the services sectors, as classified by the International Standard Industrial Classification (ISIC, Rev. 4) at time t; α, stands for intercept; the independent variables include Y, which represents growth rate of real GDP per capita for country i and the log level t; and E represents change in exchange rate type for country i at time t and the log level. u_{it} is reported as the error term and corrected for possible autocorrelation. Following Eichengreen and Gupta (2007), this model is extended by including other control variables and the interaction of these controls with change in ER. Thus,

$$g_{it} = \alpha_i + \beta g_{i,t-1} + \beta \Delta . lnY_{i,t-1} + \delta \Delta . lnE_{it} + \vartheta X_{it} + \emptyset X_{it} . \delta \Delta . lnE_{it} + u_{it} \quad (3)$$

Where X represents sets of control variables that interact with change in ER and economic growth. The value of ER that would be utilized for estimation will be that obtained from the difference in value of the index of under- or overvaluation, which is, $ln\omega_{it}$. As established in the growth literature, different relationships exist for the parameters due to country differences. The regressions are estimated using a panel GMM for 36 countries for 14years. The economic criterion between ER and sectoral growth depends on the ER regime and its management. Doganlar (2002) and Galindo et al. (2007) report that when ER is effectively managed, it enhances economic growth; but when poorly managed, it affects growth negatively. However, *a priori* expectation for the sign and magnitude of RER is positive as this underlines undervaluation. Meanwhile, for openness, government effectiveness and per capita GDP the sign is expected to be positive, while inflation is expected be negative because, according to Mejı´a-Reyes et al. (2010) negative inflation 'provokes inefficient allocation of resources due to distortions in relative prices and higher administration costs for firms' (p.2492).

Data specification and estimation technique

Data for the research are annual time-series data spanning the period 2000 to 2015 for 36 African countries[3]. Data on purchasing power parity (PPP), official ER,

[3]The following countries were examined: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central Africa Republic, Congo, Congo DR, Cote d'Ivoire, Djibouti, Egypt, Ethiopia,

inflation and openness (defined as import plus export divide by GDP) were obtained from the World Bank (2014). Real GDP and sectoral values were sourced from the UNCTAD database (2014). The economic criterion between ER and real GDP is ambiguous given that different forms of exchange rate regimes impact differently on the growth model for the various economies which, according to Rodrik (2008), is due to dissimilarities in domestic activities. Following Siddiqui and Ahmed (2013), the estimation of the model is conducted using the generalized method of moments (GMM)-based Arellano-Bond (19991) linear dynamic panel approach. The GMM was adopted because, unlike other estimators, it provides the framework to control for endogeneity bias caused by unobserved country-specific effects, and other misspecifications or over-identification of parameters challenge.

Empirical Results

Tables 2, 3 and 4 present the results of the response rate of the three key sectors (agriculture, industry and services) percentage change in RER and log RER. The results of the coefficient of change in log RER are negative for the three sectors. However, in the case of log RER, even though the results almost show a similar trend, only the industrial sector came out positive. A critical observation of the results shows that although the measures of change in log RER are negative for the three sectors, the response rate of the services sector is significant at 1%. This result also reflects the findings of Smith (2004) who reports that exports of the services sectors are much more sensitive to ER that those of other sectors.

However, a negative sign for RER suggests that these sectors lead to appreciation of the RER. It also suggests that the output of these sectors depends so much on imported inputs. When an economy is faced with such a situation, the implication is that the trade balance effect of the exchange rate dominates the possible negative supply-side effect thereby leading to an increase in aggregate output (see Rasaki and Malikane, 2015). Although this increase in output may be beneficial to the domestic economy in the short to medium term, in the long run, when the economy has generated much more resources, consumption pattern may shift to demand for foreign goods, which will in turn be detrimental to domestic production.

The interaction of the control variables with change in log RER shows slight impact in the model. Although rightly signed, the control variables affect the signs and magnitude of coefficients differently from other estimations. Income per capita (i.e. real GDP) is observed to be appropriately signed in agriculture and industry with high coefficient impact in the agricultural sector. This result is in line with the

Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Mali, Morocco, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Tunisia, Uganda, and Zambia.

findings of Rodrik (2008). It follows therefore that a 10% increase in real GDP improves agricultural growth by 2.6% over the industrial sector. However, though most of the subsectors show positive signs, they were not significant at any level. This result is similar to the findings by Eichengreen and Gupta (2013).

The results in Tables 5 - 10 show clearly how a change in log RER responds to the sectors when the three key sectors are disaggregated. Though the results differ across subsectors, in terms of sign and magnitude of the coefficients, the services subsectors ('others' and 'WRH') shows positive and significant impacts. This implies therefore, that 10% depreciation will accelerate the growth of 'others' by 1.4% and 'WRH', by 5.6%. The huge impact of RER on WRH growth could be because the subsector uses fewer imported inputs. It could also be that the sector has lower fixed cost of entry. As noted by Eichengreen and Gupta (2013), 'lower fixed cost result to elastic supply response' (p.6).

However, while RER response to construction is negative and positively signed, mining and utility is negative and non-significant. However, the coefficients of manufacturing and transport and communication are positive but not significant. The implication of these results therefore is that while the activities of the construction and mining and utility sectors lead to RER appreciation, the manufacturing, and transport and communication sectors' activities lead to RER depreciation.

Conclusion

Many developed and emerging economies have adopted the path of appropriate economic policy framework to achieve the twin objectives of economic and social prosperity. They developed frameworks that enabled them strategically move from the production of agricultural products to the production of manufactured goods through the adoption of appropriate ER policy frameworks. Specifically, these countries adopted the policy of undervaluation of the RER, which many policymakers and scholars have identified as beneficial to export and economic growth (see Sachs and Warner, 1997 and Rodrik, 2008). However, the case of Africa is quite different as the region is still fixated on the production of agricultural products with an underdeveloped industrial sector.

This study has therefore examined the effectiveness of real exchange rate as a policy tool for industrial development. Specifically, the response rates of different sectors were examined to find out if real exchange rate affects the growth composition of these sectors. The conceptual framework by Rodrik (2008) was adopted in conducting the analysis. Setting aggregate growth as the dependent variable, the study shows how under- or overvaluation of RER can affect the output of a country. The study finds that RER is a significant factor to economic growth. Similar studies

by Bleaney and Greenaway (2001); Hua (2007); and Max Corden (2009) also show comparable results.

Specifically, the findings show that while the response of sectors such as agriculture, construction, mining and utility to RER suggests appreciation of RER, the response of manufacturing, transport and communication, 'WRH' and 'Others' suggests depreciation of RER. However, out of the sectors that suggests depreciation of RER, only 'WRH' and 'Others' are significant at 5 and 10 per cent. The non-significance of the manufacturing, and transport and communication sectors may be as a result of two factors. First is the underdevelopment of the sectors which many studies have noted as a serious challenge to the continent (see AU, 2008 and Pedersen, 2001). According to Pendersen (2001), although the transport and communication sectors are growing and contributing to lower the unit cost of exports and imports, this did not apply to all forms of consignments, communications, origins and destinations. Second, this may be due to high dependency of manufacturing on agricultural inputs (Breisinger, Diao and Thurlow, 2009). Therefore, a policy framework towards the development of the industrial sectors, especially, manufacturing, transport and communication, will act as a springboard that could lunch Africa into an era of industrial revolution.

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LIST OF TABLES

Table 2: **Agricultural response to change in RER**

Variable	I	II	III
Agric(-1)	-0.303*(0.069)	-0.302*(0.069)	-0.296*(0.072)
Log Real GDP(-1)	0.026**(0.011)	0.0187(0.016)	0.073**(0.036)
Change, Log RER	-0.000(0.030)		-0.129**(0.050)
RER, Log		-0.078(0.077)	
Openness			0.047(5.827)
Inflation			0.047(0.000)
CPIA			-0.020***(0.012)
Observations	370	370	370
Number of countries	36	36	37
Instrument rank	4	4	7
J-Statistics	2.978	2.946	3.107

Note: *1%; **5%; ***10% indicates that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

Table 3: **Industry response to change in RER**

Variable	I	II	III
Industry(-1)	-0.484*(0.037)	-0.484*(0.035)	-0.479*(0.036)
Log Real GDP(-1)	0.005***(0.003)	0.007***(0.004)	-0.001(0.011)
Change, Log RER	-0.001(0.008)		0.010(0.011)
RER, Log		0.016(0.013)	
Openness			-0.587(2.276)
Inflation			-0.000(0.000)
CPIA			0.002(0.003)
Observations	370	370	370
Number of countries	37	36	37
Instrument rank	4	4	7
J-Statistics	3.236	3.190	3.443

Note: *1%; ***10% indicate that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

Table 4: **Services response to change in RER**

Variable	I	II	III
Services(-1)	-0.323*(0.051)	-0.315*(0.056)	-0.323*(0.048)
Log Real GDP(-1)	-0.003(0.005)	-0.006 (0.007)	-0.028 (0.020)
Change, Log RER	-0.032*(0.012)		-0.037**(0.016)
RER, Log		-0.011 (0.027)	
Openness			-5.704***(3.270)
Inflation			0.000**(0.000)
CPIA			-0.003 (0.004)
Observations	370	370	370
Number of countries	37	37	37
Instrument rank	4	4	7
J-Statistics	2.048	2.100	2.058

Note: *1%; **5%; ***10% indicate that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

Table 5: **'Others' response to change in RER**			
Variable	I	II	III
Others (-1)	-0.317*(0.031)	-0.312*(0.032)	-0.318*(0.031)
Log Real GDP (-1)	0.000(0.003)	0.002(0.005)	0.009(0.011)
Change, Log RER	0.014***(0.008)		0.015***(0.010)
RER, Log		0.005(0.017)	
Openness			1.914(2.024)
Inflation			-0.000(0.000)
CPIA			0.002(0.002)
Observations	370	370	370
Number of countries	36	36	37
Instrument rank	4	4	7
J-Statistics	1.896	1.927	1.902

Note: *1%; ***10% indicate that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

'Others' is comprised of other community, social and personal services; private households with employed persons and extra-territorial organizations and bodies.

Table 6: **'WRH' response to change in RER**			
Variable	I	II	III
WRH (-1)	-0.376*(0.017)	-0.378*(0.018)	-0.376*(0.017)
Log Real GDP(-1)	0.007(0.011)	0.015(0.014)	0.019(0.040)
Change, Log RER	0.056**(0.022)		0.072*(0.027)
RER, Log		0.050(0.040)	
Openness			4.009(6.429)
Inflation			-0.003(0.004)
CPIA			0.012***(0.007)
Observations	370	370	370
Number of countries	37	37	37
Instrument rank	4	4	7
J-Statistics	1.172	1.173	1.229

Note: *1%; **5%; ***10% indicate that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

'WRH' is comprised of wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; Hotel and restaurants; financial intermediation; Real estate, renting and business activities; Public administration and defence and compulsory social securities.

Table 7: **Mining and Utility response to change in RER**			
Variable	I	II	III
Mining & Utility(-1)	-0.525*(0.035)	-0.525*(0.033)	-0.521*(0.034)
Log Real GDP(-1)	-0.003(0.002)	-0.005 (0.004)	0.006(0.011)
Change, Log RER	-0.000 (0.007)		-0.012 (0.013)
RER, Log		-0.018 (0.013)	
Openness			1.045 (2.285)
Inflation			-0.000(0.000)
CPIA			-0.002 (0.003)

Observations	370	370	370
Number of countries	37	37	37
Instrument rank	4	4	7
J-Statistics	2.758	2.727	2.929

Note: *1% indicates that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period.

Table 8: Construction response to change in RER

Variable	I	II	III
Construction(-1)	1.037*(0.033)	1.038*(0.034)	1.038*(0.033)
Log Real GDP(-1)	25.933 (74.439)	27.638 (75.386)	229.975**(119.473)
Change, Log RER	-251.470*(102.054)		-828.029*(293.316)
RER, Log		58.747(78.615)	
Openness			5144.420 (13389.61)
Inflation			2.429**(1.097)
CPIA			-33.085 (53.246)
Observations	370	370	370
Number of countries	36	36	37
Instrument rank	4	4	7
J-Statistics	6.162	6.327	6.017

Note: *1%, **5% indicates that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

Table 9: **Manufacturing response to change in RER**			
Variable	I	II	III
Manufacturing(-1)	-0.235*(0.087)	-0.236*(0.086)	-0.238*(0.087)
Log Real GDP(-1)	0.001(0.009)	0.005 (0.012)	-0.016 (0.024)
Change, Log RER	0.020 (0.017)		0.016 (0.024)
RER, Log		0.032 (0.030)	
Openness			-3.384 (4.859)
Inflation			0.000 (0.000)
CPIA			0.003 (0.006)
Observations	370	370	370
Number of countries	37	37	37
Instrument rank	4	4	7
J-Statistics	6.241	6.266	6.527

Note: *1% indicates that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period.

Table 10: **Transport and Communication response to change in RER**			
Variable	I	II	III
Transport & Comm(-1)	-0.326*(0.019)	-0.325*(0.020)	-0.318*(0.019)
Log Real GDP(-1)	-0.001(0.003)	-0.001(0.004)	0.005(0.006)
Change, Log RER	0.000(0.005)		-0.005(0.006)
RER, Log		0.000(0.015)	
Openness			0.968(0.994)
Inflation			-0.000(0.000)
CPIA			-0.001(0.002)
Observations	370	370	370
Number of countries	37	37	37

Instrument rank	4	4	7
J-Statistics	4.127	4.215	4.331

Note: *1% indicates that coefficients are significant at these levels. Standard errors are in parenthesis. Dependent variables and RER are lagged by one. Change in RER and log RER are average values over the 14 years period

Appendix A: Correlation matrix between real exchange rate (RER) and different sectors[4]

Variable	Real Exchange Rate	Agriculture	Industry	Services	Construction	Mining & Utility	Manufacture	'OTHERS'	Transport & Comm.	'WRH'
Real Exchange Rate	1.000									
Agriculture	-0.031	1.000								
Industry	0.031	-0.029	1.000							
Services	0.016	0.238*	-0.063	1.000						
Construction	-0.130*	-0.001	0.046	0.038	1.000					
Mining & Utility	-0.034	0.022	-0.978*	0.046	-0.034	1.000				
Manufacture	0.021	0.129*	-0.071	0.480*	-0.058	0.028	1.000			
Others[5]	-0.035	-0.317*	0.057	-0.898*	-0.0102	-0.038	-0.434*	1.000		
Transport & Communication	0.109**	-0.177*	0.053	-0.612*	-0.078***	-0.040	-0.287*	0.401	1.000	
WRH[6]	0.040	-0.240*	0.060	-0.724*	-0.031	-0.049	-0.241*	0.538*	0.368*	1.000

*1%; **5%; ***10% significant.

[4]Appendix A shows the correlation between the real exchange rate (RER) and the different sectors in the economy. Among the sectors, agriculture, construction, mining and utility and 'Others' are negatively correlated with RER suggesting that an appreciation in RER negatively affects these sectors. While manufacturing, transport and communication and 'WRH' are positively correlated with RER, suggesting depreciation in RER. This result corroborates our earlier findings.

[5] 'Others' comprises other community, social and personal services; private households with employed persons and extra-territorial organizations and bodies.

[6] 'WRH' comprises: Wholesale and retail trade; Repair of motor vehicles, motorcycles and personal and household goods; Hotel and restaurants; Financial intermediation; Real estate, renting and business activities; Public administration and defense and compulsory social securities