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In this paper we build a theoretical model on the wage effect of skilled emigration to the fluctuations in real exchange rate through the relative prices of nontradables. Our theoretical model predicts that skilled emigration is associated with an increase in the prices of nontradable, which in turn appreciates the exchange rate. We provide robust empirical support to a higher skilled emigration associated with higher prices in nontradables and appreciation of the real effective exchange rate. Based on two samples of countries with 51 and 67 observations, in 1990 and 2000 respectively, we find robust empirical support to a higher skilled emigration associated with higher prices in nontradables and appreciation of the REER. In addition, the support for the remittance-channel of the Dutch disease is also significant; overall, our findings corroborate the remittance-based Dutch disease phenomenon by providing an additional channel through which the labor mobility across borders affects the real exchange rate volatility.

Keywords: Emigration, Exchange Rate, the Dutch Disease
JEL Classification: F22, F24, F3, J3

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* Saumik Paul is the corresponding author. This version is completed during his visit to Institute of Developing Economies (IDE-JETRO) as a visiting Research Fellow in 2014, June-September.

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Skilled Emigration and Exchange Rate: Theory and Empirics

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Abstract

In this paper we build a theoretical model on the wage effect of skilled emigration to the fluctuations in real exchange rate through the relative prices of nontradables. Our theoretical model predicts that skilled emigration is associated with an increase in the prices of nontradable, which in turn appreciates the exchange rate. We provide robust empirical support to a higher skilled emigration associated with higher prices in nontradables and appreciation of the real effective exchange rate. Based on two samples of countries with 51 and 67 observations, in 1990 and 2000 respectively, we find robust empirical support to a higher skilled emigration associated with higher prices in nontradables and appreciation of the REER. In addition, the support for the remittance-channel of the Dutch disease is also significant; overall, our findings corroborate the remittance-based Dutch disease phenomenon by providing an additional channel through which the labor mobility across borders affects the real exchange rate volatility.

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1. Introduction

The Dutch Disease theory corroborates the discovery of new resources relative to the size of the recipient economy resulting in the possibility of real exchange rate appreciation and loss of competitiveness in the tradable sector of the economy (Corden and Neary, 1982). Remittances sent by migrant workers to their home countries correspond to a capital inflow that is analogous to the discovery of new resources.[1] Amuedo-Dorantes and Pozo (2004), using a sample of 13 Latin American countries, find that doubling of workers remittances would lead on average to a real exchange rate overvaluation of about 22 percent. A recent paper by Lartey, Mandelman and Acosta (2012) found that flow of inward remittances cause real exchange rate appreciation in a comprehensive sample of 109 countries over the time period 1992–2003. Focusing on the high remittance economies, Hassan and Holmes (2012) also find a small inelastic, but significant, long-run relationship between multilateral real effective exchange rate and the flow of remittances. However, Rajan and Subramanian (2005) find that unlike other types of capital flows (particularly aid flows) remittances do not seem to have a negative impact on external competitiveness. Moreover, Barajas et al (2010) find that the Dutch Disease results of REER appreciation are substantially weakened by the degree of openness, factor mobility between domestic sectors, counter-cyclicality of remittances, the share of consumption in tradables and the sensitivity of a country's risk premium to remittance flows.

The existing literature suggests that the empirical evidence on the remittance channel of the Dutch Disease is, at best, mixed. This motivates us to look at this phenomenon from a fresh perspective. We offer an extension of the remittance -based Dutch Disease theory. Building on a theoretical model supported by empirical evidence, we provide an alternative explanation - the wage effect of skilled emigration - to the fluctuations in real exchange rate through the relative prices of nontradables. Our theoretical framework draws upon two broad strands of literature. We first discuss the underpinning of the relative prices of nontradables in determining real exchange rate fluctuations. Next, we look at the relevance of the wage effect of emigration. Then we discuss our theoretical framework encompassing both theories.

[1]The ratio of remittances to GDP exceeds 1 percent in 60 countries. See Hassan and Holmes (2012).

In a recent study, Ouyang and Rajan (2013) studying a panel of 51 economies over the period 1990–2010, found that internal relative prices (i.e. nontradable-to-tradable price changes) contribute relatively more to real effective exchange rate volatility than external prices (deviation from purchasing power parity) in economies that are larger, faster-growing, more open to trade flows, and those that experience larger increases in government consumption. The literature on the decomposition of real exchange rate volatility into the deviation from PPP and relative price of tradables and nontradables dates back to Engel (1999)'s influential work. His study showed that about 90 percent of the fluctuations in the US bilateral real exchange rates vis-à-vis other OECD economies (Canada, France, Germany, Italy, Japan) during the period 1962–1995 was driven by changes in the traded goods component. Burstein et al. (2006) refute Engel (1999)'s findings on the ground that the price of tradables were measured using unsuitable proxies. According to Burstein et al. (2006), about 50 percent of movements in the real exchange rates of the US vis-à-vis selected OECD economies over the period 1980–2001 can be explained by changes in the relative price of tradables and nontradables, while the rest occurs due to changes in competitiveness (relative price of tradables). Along the same line, closest to ours in spirit, Lartey, Mandelman and Acosta (2012) show that a rise in the relative price of nontradable goods corresponds to a real exchange rate appreciation.

Moving on, the competitive labor market model has clear and unambiguous implications for a migration-induced reduction in labor supply.[2] A reduction in the supply of labor outflows because of migration is likely to increase the wages of those workers remaining behind, at least in the short run. The literature on emigration and wages show empirical evidence both at the individual regional or sector specific wages. Lucas (1987, 2005) finds that mine worker emigration to South Africa has raised wages in Malawi and Mozambique. In another study, Hanson et al (2002) find a marginal negative impact of border enforcement on wages in cities along the US-Mexican border. Hanson (2006) suggests that average hourly earnings in states with high emigration rates increased by 6 to 9 percent, compared to states with low-emigration rates. A

[2]In many developing economies where resource reallocation is still taking place, a number of sectors could be contracting where labor shedding occurs. Under these circumstances, the impact on employment is unambiguous

similar study documents that the impact of emigration on wages in Mexico has been largest in states with well-developed US emigrant networks (Munshi, 2003).

At the individual level, Mishra (2007) building on an approach introduced by Borjas (2003) uses the supply shifts in education-experience groups to assess the labor market impact of emigration (i.e., a negative labor supply shock) on individual wages in Mexico. This study finds that a 10 percent increase in emigration, on average, increases wages in Mexico by almost 4 percent. In a similar paper, using data drawn from the Canadian, Mexican, and U.S. Censuses, Aydemir and Borjas (2007) find that a 10 percent decrease in labor supply is associated with a 3 to 4 percent increase in wages. Similar evidence has been found in regions, including Eastern Europe and Latin America, among others. Bouton, Paul and Tiongson (2010) find that a 10 percent increase in the emigration rate is associated with 3.2 percent increase in wages. Using data from the Lithuanian Household Budget Survey and the Irish Census, Elsner (2010) finds a significant positive effect of emigration on the wages of men who stayed in the country, however no such effect is visible for women. In a recent study, Gagnon (2011) shows that the sudden and intense emigration period from Honduras following Hurricane Mitch resulted in an increase in wages between 2001 and 2007. One notable exception to this burgeoning literature on the positive effect emigration is a recent study by Pryymachenko (2011), which analyses the effects of emigration on unemployment and wages in Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovak Republic (2004 EU accession), Bulgaria, and Romania (2007 EU accession). This paper did not find any evidence that emigration affects wages in the countries being studied.

Going one step further based on 2-goods, 3-sector model, Kar and Marjit (2005) show that emigration of skilled workers lead to an increase in wages for skilled workers who stay behind. Also, in the presence of specialization based economies, emigration of both skilled and unskilled workers can lead to a rise in wage inequality (Anwar, 2006). We build our theoretical framework on the premise that the mobility of skilled and unskilled workers has different consequences to the labour market and the economy in general. We propose a theoretical framework assuming that the non-tradable sector is more capital-intensive and hires skilled labor at a higher rate. We essentially model the

indirect general equilibrium effect of emigration using the distribution of skilled emigration rates across the tradable and non-tradable sectors. Since the nontradable sector relies more heavily on skilled labour, our model predicts that high skilled emigration generates a more acute negative labor supply shock in the nontradable sector. It results in an increase in wages in nontradable sector at a higher rate than tradable sector. This leads, overall, to an appreciation of the real exchange rate, aggravating the Dutch Disease phenomenon.

In particular, we hypothesize that the more skilled emigration, the more likely it is to experience an appreciation of the real exchange rate. We find robust empirical evidence supporting out theoretical prediction. To our knowledge, this is the first study to provide theoretical and empirical support to the effect of skilled emigration on the real exchange rate fluctuation. We plan the rest of the section in the following manner. Section 2 provides a theoretical framework. In section 3, we discuss the empirical model, econometric issues and data sources. Section 4 summarizes the empirical outcomes, which is followed by a concluding remark as section 5.

2. Theoretical Model on the Indirect Wage Effect of Emigration

In this section we use a simple theoretical framework to discuss the indirect general equilibrium effect emigration on exchange rates through fluctuations in wages across tradable and nontradable sectors. Based on Katz and Murphy (1992) and Card and Lemieux (2001) the labor in efficiency unit as a nested CES function can be expressed as

$$L_t = \left[\theta L^H{}^{\frac{\sigma-1}{\sigma}} + (1-\theta)L^L{}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \qquad (1)$$

where L^H and L^L represent high-skilled and low-skilled workers, respectively. The relative productivity level of high skilled workers is distinguished by the parameter θ, and σ is the elasticity of substitution between two groups of workers. For the sake of simplicity we assume here that natives and emigrants have the same distribution in both groups. This is to keep the effect of emigration across skill groups constant, since our main focus is to find the changes in average wages of non-migrant natives. Equation (2)

provides the changes in average wages of non-migrant natives due to the emigration flow from *t-1* to *t* period, as a function of the changes in wages for high skilled and low skilled natives (Docquier, et al., 2014).

$$\Delta W = \frac{dW^H}{dt}\sigma^H + \frac{dW^L}{dt}(1 - \sigma^H) \quad (2)$$

where $\frac{dW^H}{dt}$ and $\frac{dW^L}{dt}$ are the changes in wages in period *t* estimated by using the stock of high and low skilled emigrants from period *t-1*, respectively. The differences in the actual wage of non-migrant natives and emigrants for both skill groups are weighted by the respective population share; σ^H denotes the share of high skilled non-migrant natives. To explicitly show the relationship between emigration and changes in wages from period *t-1* to *t*, equation (3) can be expressed as

$$\frac{dW}{dt} = \frac{dW^H}{dE^H}\frac{dE^H}{dt}\sigma^H + \frac{dW^L}{dE^L}\frac{dE^L}{dt}(1 - \sigma^H) \quad (3)$$

For empirical reasons one can assume that workers with the same level of education are closer substitutes than those with a different education level. We have assumed so far that capital in this economy is fixed. If capital could fully adjust, migration would probably lead to capital outflows, since a decrease in labor supply is likely to decrease the marginal product of capital. With this caveat in mind, we move on the section on determination of exchange rate.

Assuming P denotes the domestic price level, while P^* denotes the foreign price level, the real exchange rate (Q) can be expressed as follows:

$$Q = \frac{SP^*}{P} \quad (4)$$

Denoting α (α^* for foreign) as the share of nontradables in the determination of the aggregate price level, and *S* denotes the nominal exchange rate, the domestic and foreign price levels can be redefined as follows: $P = P_N^{\alpha} P_T^{1-\alpha}$ (domestic price level) and $P^* = P_N^{*\alpha*} P_T^{*1-\alpha*}$ (foreign price level), where, P_N and P_N^* denotes the domestic

and foreign price of non-tradables while P_T and P_T^* denote the domestic and foreign price of tradables respectively. Substituting the expressions of domestic and foreign price levels into equation (4), we get the real exchange rate as a function of tradables and non-tradable prices:

$$Q = \frac{SP_N^{*\alpha*} P_T^{*1-\alpha*}}{P_N^{\alpha} P_T^{1-\alpha}} \quad (5)$$

Assuming the law of one price (LOOP) holds, i.e., $\frac{SP_T^*}{P_T} = 1$. Rearranging, we get

$$Q = (\frac{P_N^*}{P_T^*})^{\alpha*} / (\frac{P_N}{P_T})^{\alpha} \quad (6)$$

Taking log and the first differences on both sides, we get$\Delta Q = \alpha^*(\Delta P_N^* - \Delta P_T^*) - \alpha(\Delta P_{\mathrm{N}} - \Delta P_T)$. We also assume that the relative price of nontradable to tradable goods in foreign country has little effect on the fluctuation of the exchange rate in the domestic economy.[3] If the domestic country is assumed to be a developing open economy, the differences in prices across domestic sectors play an important role in determining the fluctuations in exchange rates. Hence, the equation above can be further simplified to

$$\Delta Q \approx \alpha(\Delta P_T - \Delta P_N) \quad (7)$$

The Dutch Disease impact of remittances on exchange rates implies that $\frac{\Delta Q}{\Delta P_N} < 0$. In this study, we elaborate on this relationship, considering also the indirect general equilibrium effect of emigration through the wage channel. We assume competitive labour markets. Taking W and W^* as representative of the domestic and foreign wage rates and MPL and MPL^* to represent domestic and foreign marginal products of

[3] In the empirical section we consider two components of relative prices: (1) the relative price of tradeble goods between economies and (2) the relative price of tradables and nontradables within each country that explain the fluctuation of the exchange rate. Given the main purpose of this study, in the theoretical discuss we primarily focus on the second component, which is the relative price of tradables and nontradables.

labour, the wage rates in the market for tradables/non-tradables can be written as:

$$\frac{W_{N/T}}{P_{N/T}} = MPL_{N/T} \tag{8}$$

Rearranging, $P_{N/T} = \frac{W_{N/T}}{MPL_{N/T}}$; similarly, $P^*_{N/T} = \frac{W^*_{N/T}}{MPL^*_{N/T}}$. Substituting, we obtain $Q = \left[\left(\frac{W^*_N}{MPL^*_N}\right)\left(\frac{MPL^*_T}{W^*_T}\right)\right]^{\alpha*} \Big/ \left[\left(\frac{W_N}{MPL_N}\right)\left(\frac{MPL_T}{W_T}\right)\right]^{\alpha}$. We write the changes in exchange rates resulting from changes in wages as:

$$log\ Q \approx \alpha[(log\ W_N - log\ W_T) - (log\ MPL_T - log\ MPL_N)] \tag{9}$$

Thus, we show that the exchange rate in domestic economy is composed of two factors: differences in wages between nontradable and tradable sectors and differences in the marginal productivity of labor (MPL) between nontrdable and tradable sectors. Like before, as in equation (9), both of these effects for the foreign country is ignored considering their insignificant effects on the exchange rate in domestic country. However, following an assumption that MPL doesn't change with respect to emigration (only wages change), we write the relationship between the real exchange rates and changes in wages from period *t-1* to *t*, both in tradable and nontradable sectors, as equation (10).

$$\frac{dlogQ}{dt} = \alpha\left[\frac{dlogW_T}{dt} - \frac{dlogW_N}{dt}\right] \tag{10}$$

Now we introduce emigration in equation (10). Let σ_N^H be the share of skilled labour after emigration in the non-tradable sector. Similarly, let σ_T^H be the share of skilled labour after emigration in the tradable sector. In light of equation (5), following Docquier, et al. (2014), the equation on wage rates in the tradable sector can be written as

$$\frac{dW_T}{dt} = \frac{dW_T^H}{dE_T^H}\left(\frac{dE_T^H}{dt}\right)\sigma_T^H + \frac{dW_T^L}{dE_T^L}\left(\frac{dE_T^L}{dt}\right)(1 - \sigma_T^H) \tag{11}$$

where, $\frac{dE_T^H}{dt}$ is the rate of high skilled emigration in the tradable sector and $\frac{dE_T^L}{dt}$ is the rate of low skilled emigration in the non-tradable sector. Similarly, for wages in the non-tradable sector:

$$\frac{dW_N}{dt} = \frac{dW_N^H}{dE_N^H}\left(\frac{dE_N^H}{dt}\right)\sigma_N^H + \frac{dW_N^L}{dE_N^L}\left(\frac{dE_N^L}{dt}\right)(1 - \sigma_N^H) \quad (12)$$

Substituting equation (11) and (12) into equation (10), we get:

$$\frac{dQ}{dt} = \alpha\left[\left(\frac{dW_T^H}{dE_T^H}\left(\frac{dE_T^H}{dt}\right)\sigma_T^H + \frac{dW_T^L}{dE_T^L}\left(\frac{dE_T^L}{dt}\right)(1 - \sigma_T^H)\right) - \left(\frac{dW_N^H}{dE_N^H}\left(\frac{dE_N^H}{dt}\right)\sigma_N^H + \frac{dW_N^L}{dE_N^L}\left(\frac{dE_N^L}{dt}\right)(1 - \sigma_N^H)\right)\right] \quad (13)$$

Thus, the sign and magnitude of $\frac{dQ}{dt}$ depends on the value of α, σ_T^H, σ_N^H and the wage elasticity of emigration $\left(\frac{dW}{dE}\right)$ and the flow of migrants $\left(\frac{dE}{dt}\right)$ from both tradable and nontradable sectors.

Previous literature has shown that the mobility of skilled and unskilled workers has different consequences to the labour market, and the economy in general. In a 2 goods, 3 sector model proposed by Kar and Marjit (2005), emigration of unskilled workers lead to an increase in wages for both unskilled and skilled workers, reducing wage inequality. Emigration of skilled workers, however, has the opposite effect. Anwar (2006), on the other hand, found that in the presence of specialization based economies, emigration of both skilled and unskilled workers can lead to a rise in wage inequality. Based on these studies, we can plausibly assume that the non-tradable sector is more capital intensive and thus, employs more skilled labour, thus $\sigma_N^H > \sigma_T^H$. Our model essentially shows different impacts arising from emigration of both skilled and unskilled workers. To illustrate it further, we consider two cases:

Case 1: High skilled emigration

If the rate of skilled emigration is high then based on the model, it follows that

$\frac{dE_T^H}{dt} > \frac{dE_T^L}{dt}$ and $\frac{dE_N^H}{dt} > \frac{dE_N^L}{dt}$

Thus, in both tradable and nontradable sectors, the skilled laborers are migrating at a large number. Since, the nontradable sector relies more heavily on skilled labour, high skilled emigration generates a more acute negative labor supply shock in the nontradable sector. It results in an increase in wages in nontradable sector at a higher rate than tradable sector, indicated by $\Delta W_N > \Delta W_T$ based on our model. This leads, overall, to an appreciation of the real exchange rate, aggravating the Dutch Disease phenomenon. We consider a numerical example to illustrate this case. Assume that, $\sigma_T^H = 0.2$ and $\sigma_N^H = 0.6$ following $\sigma_N^H > \sigma_T^H$. This implies that the share of slow skilled labor in tradable and nontradable sectors, are 80% and 40%, respectively. We also consider other baseline values, as, $\frac{dW_T^H}{dt} = \frac{dW_N^H}{dt} = 0.6$ and $\frac{dW_T^L}{dt} = \frac{dW_N^L}{dt} = 0.4$. Based on our model, a simple algebraic calculation of equation (15)

$\frac{dQ}{dt} = \alpha\,[(0.2 \times 0.6 + 0.8 \times 0.4) - (0.6 \times 0.6 + 0.4 \times 0.4)] = -0.8\alpha$. This leads to a real appreciation of the exchange rate.

Case 2: Low skilled emigration

On the other hand, a high rate of low skilled emigration implies:

$\frac{dE_T^L}{dt} > \frac{dE_T^H}{dt}$ and $\frac{dE_N^L}{dt} > \frac{dE_N^H}{dt}$.

Since the tradable sector relies more heavily on unskilled labour, low skilled emigration results in an increase in wages in tradable sectors at a higher rate than nontradable sector, i.e., $\Delta W_T > \Delta W_N$.This overall, based on our model prediction, may lead to a depreciation of the real exchange rate. Emigration of the unskilled, in this setting, is likely to dampen the effect of the Dutch Disease. We consider a similar numerical example here. The share of slow skilled labor in tradable and nontradable

sectors remains the same at 80% and 40%, respectively. We assume the baseline values under low skilled emigration case as, $\frac{dW_T^H}{dt} = \frac{dW_N^H}{dt} = 0.4$ and $\frac{dW_T^L}{dt} = \frac{dW_N^L}{dt} = 0.6$.

Based on equation (15), simple algebraic calculation shows $\frac{dQ}{dt} = \alpha\,[(0.2 \times 0.4 + 0.8 \times 0.4) - (0.6 \times 0.4 + 0.4 \times 0.4)] = 0.8\alpha$. This leads to a real depreciation of the exchange rate

3. Empirical Model and data

For the empirical purpose, we consider the real exchange rate fluctuations decomposed into two sets of relative prices, viz. the relative price of traded goods between economies (so-called price competitiveness) and relative price of tradables and nontradables within each country. The (log) aggregate price index can be expressed as a weighted-average of the price of tradables (*T*) and nontradables (*N*):

$p_t = (1-\alpha){p_t}^T + \alpha {p_t}^N$, for the domestic country and
$\mathrm{p_t^*} = (1\text{-}\alpha^*)\mathrm{p_t^{T*}} + \alpha^* \mathrm{p_t^{N*}}$, for the foreign country.

Then the (log) real exchange rate, $q_t = s_t + p_t^* - p_t$, can be written as the sum of the relative price of traded goods between economies (rer_t^T) and the relative price of nontraded to traded goods within each economy (rer_t^N).

$$\begin{aligned} \mathrm{q_t} &= \left(\mathrm{s_t} + \mathrm{p_t^{T*}}\text{-}\mathrm{p_t^T}\right) + \alpha^*\left(\mathrm{p_t^{N*}}\text{-}\mathrm{p_t^{T*}}\right)\text{-}\alpha\left(\mathrm{p_t^N}\text{-}\mathrm{p_t^T}\right) \\ &= \underbrace{\mathrm{s_t} + \mathrm{p_t^{T*}}\text{-}\mathrm{p_t^T}}_{(\mathrm{rer_t^T})} + \underbrace{\left(\mathrm{p_t^*}\text{-}\mathrm{p_t^{T*}}\right)\text{-}\left(\mathrm{p_t}\text{-}\mathrm{p_t^T}\right)}_{(\mathrm{rer_t^N})} \end{aligned}$$

A CPI-based Real Effective Exchange Rate (REER), geometrically-weighted by bilateral trade with a set of sample economies is used to proxy the real exchange rate for each sample economy. However, due to data limitation, we have two different set of sample economies used to calculate REER for 1990-1999 and 2000-2009, respectively.[4] The data on bilateral trade are taken from the IMF's *Direction of Trade Statistics*

[4]Please see section 4 for details.

(*DOTs*) database. To track the dynamic movement of the trade weights over time we use the shares of exports and imports in the total trade under consideration each year to calculate the effective exchange rate. The formula for calculating the trade weights is as follows:

$$w_{i,j,t} = \left[\frac{Export_{i,j,t}+Import_{i,j,t}}{\sum_{j=1}^{50}(Export_{i,j,t}+Import_{i,j,t})}\right]$$

where $w_{i,j,t}$ is the trade weight between domestic economy *i* and country *j* in year *t*; $Export_{i,j,t}$ is the free on board (f.o.b.) merchandise exports from domestic economy *i* to country *j* in year *t*; $Import_{i,j,t}$ is the cost insurance and freight (c.i.f.) imports from country *j* to domestic economy *i* in year *t*. We attribute equal weights to both exports and imports. The REER for country *i*is calculated as follows:

$$Q_{i,t} = \prod_{j=1,j\neq i}^{51}\left(\frac{E_{i,j,t}\times P_{j,t}^{*}}{P_{i,t}}\right)^{w_{i,j,t}}$$

where$E_{i,j,t}$ is nominal bilateral exchange rate of the domestic currency *i* to the currency *j* for time *t*. $P_{i,t}$ and $P_{j,t}^{*}$ are domestic and foreign prices, respectively. While the CPI is generally used to compute the real exchange rate, PPI is used to proxy the price index for tradable goods.[5] We rescaled all the price indices to the base year of 1997. All the CPI and PPI prices are taken from the IMF *International Financial Statistics* (*IFS*) database. Our baseline regression model:

[5] We have little consensus on the appropriate price index for tradable goods. While CPI-based retail prices of tradable goods have been widely used in the past literature, Betts and Kehoe (2006, 2008) argue that sectoral gross output deflators may be preferable as it measures the output value of the production side. In addition, it excludes the non-traded marketing and final consumption services that tend to be included in the CPI component data. But, the data for sectoral gross output deflators are only available on an annual basis. As a result, it is generally recommended to use the PPI even though not all components of the PPI are tradable (Engel, 1999).

$$\Delta q_i = \beta_0 + \beta_1 \text{SkillEmig}_i + \beta_2 \text{Remit}_i + \beta_3 \Delta \text{RGDP}_i + \beta_4 \Delta \text{Govt}_i + \beta_5 \Delta \text{Money}_i + e_i$$

where the dependent variable, Δq, is the REER growth. A rise of REER indicates a real exchange rate depreciation.

The set of explanatory variables are as follows: SkillEmig is the share of skilled emigration over total population (in logarithm); Remit is the average share of remittance inflow over GDP (in logarithm) within the sample period; ΔRGDP is the real GDP growth rate; ΔGovt accounts for the change of general government final consumption expenditure (percentage of GDP) and ΔMoney is the change of broad money as a percentage of GDP.

Based on the "Dutch Disease" literature, a rise of remittances received from foreign countries could cause an appreciation of real exchange rate. A rise of remittances allows capital inflows, increasing the demand for domestic currency. Also, a higher real household income triggers an expansion in higher relative prices of nontradable goods. Together, both effects cause further movement of resources toward nontradable sectors and a real exchange rate appreciation (Lartey, Mandelman and Acosta, 2012). Following the Harrod-Balassa-Samuelson effect a higher GDP growth rate increases incomes and the demand for nontradables, causing a real appreciation. Both trade openness and capital account openness variables proxies the restrictions for both current account and capital account, and captures how such policies influence the real exchange rate through their impact on the price of nontradables. Insofar, as government spending tends to be largely biased to the nontradable sectors, we expect that an increase in the share of government expenditure tends to cause an appreciation of real effective exchange rate. Higher money issuance tends to raise the inflation, and results in a depreciation of the real exchange rate. Finally, we want to demonstrate our theoretical analysis, and prove that a higher skilled emigration can raise the wage in nontradable sectors and cause a real effective exchange rate appreciation.

Since there are many missing data for PPI in early period, two groups of sample

economies are used to calculate the REER for 1990-1999 and 2000-2009, respectively. The first group of sample economies includes 67 economies, using for the REER calculation of 1990-1999, while the second group covers 79 economies, using for the REER calculation of 2000-2009. The two groups of sample economies are listed in Appendix 1. We apply feasible *generalized least squares* (F*GLS*) with heteroscedastic correction to deal with heteroscedastic problems. Most of the data are taken from World Development Index (WDI), except skilled emigration ratio. Skilled emigration data is taken from Docquier, Ozden and Peri (2014).

Since the data for the share of skilled emigration is available for two years (i.e. 1990 and 2000) only, we use year 1990 and 2000 as the base years, and calculate the growth rate of real effective exchange rate from both base years, respectively. To examine the short run and long run effects of skilled emigration on real effective exchange rate growth, one-year to nine-year REER growth rates are used as the dependent variables. Furthermore, we calculate the relative price of nontradable goods to tradable goods based on equation (3), and use the one-year to nine-year growth rates as the dependent variables to demonstration our theory as well.

4. Empirical outcomes

A. Full sample

The empirical outcomes of impacts of skilled emigration in 1990 on short-run and long-run REER growth are reported in Table 1. The higher skilled emigration in 1990 tends to be associated with an appreciation of real effective exchange rate, supporting our theoretical prediction. We consider nine lag-year models, from one-year lag to nine-year lag, to examine both the short-run and the long-run effects of skilled emigration. The outcome is robust from one-year lag to eight-year lag; only the nine-year lag model show insignificant estimated coefficient. We also find statistically significant evidence of the Dutch disease effect. The more remittances received from foreign economies the more appreciation of real effective exchange rate. However, it is

interesting to note that the association between skilled emigration rate and appreciation of exchange rate is stronger than the association between remittances received and appreciation of exchange rate. This implies that the emigration-wage channel perhaps is more closely linked to the fluctuation in the exchange rate. A higher real GDP growth rate within the sample period is also associated with an appreciation of real effective exchange rate, in accordance with the Harrod-Balassa-Samuelson effect. We also find that the greater the rise in government expenditure, the greater the appreciation of real effective exchange rate. The rise in broad money tends to increase the REER depreciation rate.

The regressions outcomes are in accordance when we change the base year of skilled-emigration from 1990 to 2000 (as reported in Table 2). The higher skilled emigration in 2000 tends to be associated with an appreciation of real effective exchange rate. The results are robust in terms of both base years and all time intervals.

B. The relative price of non-tradable to tradable channel

To demonstrate that a rise of skilled emigration tends to appreciate real effective exchange rates viz. increasing the wages in nontradable sectors, we decompose the real effective exchange rate into the relative price of tradable goods and the relative price of nontradable to tradable goods. We assume that PPP holds in the relative price of tradable goods. So a real effective exchange rate appreciation is contributed by the relative price of nontradable to tradable goods. We use the growth rates of relative price of nontradable goods to tradable goods as the dependent variables to examine the impact of skilled emigration and remittances on the relative price of nontradable sectors. The results are summarized in Table 3 and Table 4. The estimated coefficients of skilled emigration in both base years are negative and statistically significant, indicating higher skilled emigration tends to raise the wages and prices in nontradable sectors, and further appreciates the real effective exchange rate. The more remittances flow into the economies increase the domestic income and push up the aggregate demand, and further appreciate the currency. The estimated coefficients of other control variables are mostly in line with priors. Again, the results are robust in terms of both base years (1990 and

2000) and across the year-lag models.

C. Non-OECD sample

In Tables 5, 6, 7 and 8 we report empirical results for the non-OECD countries. The sample sizes in 1990 and 2000 are 23 and 43, respectively. Tables 5 and Table 6 show the outcomes on the growth of exchange rates. With base year in 1990, the results are robust and show an appreciation of exchange rates as a result of skilled emigration. However, the outcomes are not robust when the base year of skilled emigration is changed to 2000. Only models with one-year lag and nine-year lag show significant outcomes. One possible explanation for this could be the inclusion of additional countries in 2000, where the wage effect of emigration is weaker. The other possibility is any structural changes over time, such as the growing evidence of skilled emigration between developing countries. This could too some extent lower the negative supply shocks of emigration.

In Table 7 and Table 8, we report outcomes on the growth of relative prices between nontradables and tradables for non-OECD countries. The outcomes are in line with what we find for overall growth of exchange rates, in both 1990 and 2000 as base years of skilled emigration. On the contrary, the effect of the Dutch disease is more prevalent among the non-OECD countries. For most of the time-lag models, we find statistically significant evidence of an appreciation of exchange rate resulting from remittance measured as a share of GDP.

D. Long-run versus short-run effects

Based on our theoretical prediction, the interaction effect of remittances inflow and real exchange rate may fade away in the long-run compared to the short-run. The appreciation of the real exchange rate and deterioration of the country's competitiveness because of remittances flow may be offset if such flows boost capital accumulation by augmenting savings and investments in the long run which can increase the production of both tradables and nontradables where the relative increase will vary from country to country depending on the structure of the economies. Whilst many of the current

empirical literature provide evidences for the short-run effect of remittances and real exchange rate, there are almost none which tested the long run relationship. In this paper we use nine year-lag models to investigate the long-run relationship between inflow of remittances and the growth of real exchange rate. For the full sample with base year of skilled emigration as 1990, we find a stronger effect of skilled emigration on exchange rate appreciation as the lag increases, i.e., in the long run. However, with bases year as 2000, there is no such trend. For non-OECD countries sample, we do not find any particular trend either.

Overall, with some caveats the empirical models provide robust evidence to our theoretical model prediction that a growth in skilled emigration is correlated with the appreciation of exchange rate. Conceivably, it corroborates the remittance-based Dutch disease phenomenon by providing an additional channel through which the mobility across borders affects the real exchange rate volatility.

5. Conclusion

In this paper, we offer an extension of the remittance -based Dutch disease theory. We build a theoretical framework modelling the relationship between emigration and exchange rate, analogous to the remittance channel of the Dutch disease phenomenon. Building on the premise that the mobility of skilled and unskilled workers has different consequences to the labour market and the economy in general, we contend that the non-tradable sector is more capital-intensive and hires skilled labor at a higher rate. Then we bring in the indirect general equilibrium effect of emigration using the distribution of skilled emigration rates across the tradable and non-tradable sectors. Since the nontradable sector rely more heavily on skilled labour, our model predicts that high skilled emigration generates a more acute negative labor supply shock in the nontradable sector. It results in an increase in wages in nontradable sector at a higher rate than tradable sector. This leads to an appreciation of the real exchange rate, aggravating the Dutch Disease phenomenon.

To test out theoretical predictions we consider cross country data available for two periods, 1990 and 2000. Based on two samples of countries with 51 and 67 observations, in 1990 and 2000 respectively, we find robust empirical support to a higher skilled emigration associated with higher prices in nontradables and appreciation of the REER. In addition, the support for the remittance-channel of the Dutch disease is also significant; albeit, the effect of emigration-wage channel shows a much stronger effect. Overall, our findings corroborate the remittance-based Dutch disease phenomenon by providing an additional channel through which the mobility across borders affects the real exchange rate volatility.

References

Barajas, Adolfo, Ralph Chami, ConnelFullenkamp, and Anjali Garg (2010), "The Global Financial Crisis and Workers' Remittances to Africa: What's the Damage?" IMF Working Papers, WP/10/24

Amuedo-Dorantes, Catalina &Pozo, Susan, (2004); "Workers' Remittances and the Real Exchange Rate: A Paradox of Gifts," World Development, Elsevier, vol. 32(8), pages 1407-1417, August.

Anwar, Sajid (2006), "Factor mobility and wage inequality in the presence of specialisation-based external economies", Graduate School of Business, University of Adelaide

Bouton, Lawrence and Paul, Saumik and Tiongson, Erwin R., (2011)"The Impact of Emigration on Source Country Wages: Evidence from the Republic of Moldova", World Bank Policy Research Working Paper Series.

Docquier, F., C. Ozden, G. Peri (2014),The labor market impact of immigration and emigration in OECD countries, Economic Journal(Article in Press)

Lartey, Emmanuel K. K. & Federico S. Mandelman and Pablo A. Acosta, (2012) "Remittances, Exchange Rate Regimes and the Dutch Disease: A Panel Data Analysis," Review of International Economics, vol. 20(2), pages 377-395.

Marjit, S. and S. Kar, (2005), "Emigration and wage inequality", Economics Letters 88, 141–145

Mishra, P. (2007), "Emigration and wages in source countries: Evidence from Mexico", Journal of Development Economics, 82: 180-99.

Ouyang, Alice and Ram KishenRajan (2013) "Real Exchange Rate Fluctuations and the Relative Importance of Nontradables", *Journal of International Money and Finance*, 32 (C), 2013, pp.844-855

Rajan, Raghuram, and Arvind Subramanian (2005) "What Undermines Aid's Impact on Growth?" mimeo, IMF, Washington D.C.

Table 1: The Impact of Skill-Emigration Share in 1990 on Δq_t in Short Run and Long Run

	Δq_t								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	0.00896	**0.0430*** **	0.0118	0.00344	-0.00184	0.0200	**0.105** **	**0.0758** **	0.0417
	(0.00875)	(0.0128)	(0.0211)	(0.0223)	(0.0487)	(0.0322)	(0.0475)	(0.0380)	(0.0355)
SkillEmig-1990	**-0.0260*** **	**-0.0339*** **	**-0.0742*** **	**-0.107*** **	**-0.114*** **	**-0.130*** **	**-0.102*** **	**-0.121*** **	0.0119
	(0.00757)	(0.00605)	(0.0149)	(0.0194)	(0.0393)	(0.0148)	(0.0243)	(0.0191)	(0.0231)
Remittances	**-0.00802*** **	**-0.00605***	**-0.0164*** **	**-0.0114*** **	-0.00488	**-0.0149***	0.000304	0.00709	**0.0392*** **
	(0.00243)	(0.00344)	(0.00544)	(0.00425)	(0.00892)	(0.00767)	(0.00890)	(0.00605)	(0.00505)
ΔRGDP	**-1.201*** **	**-1.182*** **	**-0.922*** **	**-0.791*** **	**-0.485*** **	**-0.806*** **	**-0.778*** **	**-0.705*** **	-0.0232
	(0.0879)	(0.0990)	(0.0545)	(0.101)	(0.109)	(0.0827)	(0.142)	(0.101)	(0.123)
ΔGovt	**-0.0599*** **	**-0.0319*** **	**-0.0442*** **	**-0.0407*** **	**-0.0234*** **	**-0.0177*** **	**-0.0356*** **	**-0.0347*** **	**-0.0186*** **
	(0.00570)	(0.00268)	(0.00107)	(0.00311)	(0.00475)	(0.00225)	(0.00487)	(0.00180)	(0.00194)
ΔMoney	**0.0104*** **	**0.00331*** **	**0.00122*** **	0.00102	0.000110	**0.00256***	0.00177	**0.00338*** **	**0.00262*** **
	(0.00121)	(0.000707)	(0.000115)	(0.000682)	(0.00140)	(0.00139)	(0.00130)	(0.000722)	(0.000558)
Observations	35	36	35	38	39	39	39	38	36
R-squared[#]	0.47	0.38	0.52	0.35	0.24	0.28	0.32	0.28	0.26

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.
1-RSS/TSS reported for GLS regression.

Table 2: The Impact of Skill-Emigration Share in 2000 on Δq_t in Short Run and Long Run

	Δq_t								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	-0.00157	**0.0308*** **	**0.0204***	-0.00516	**0.0118***	0.0140	**-0.0703*** **	**0.0286** **	**-0.0575** **
	(0.00658)	(0.0119)	(0.0115)	(0.0122)	(0.00659)	(0.0265)	(0.0252)	(0.0139)	(0.0253)
SkillEmig -2000	**-0.0184*** **	-0.00333	**-0.0329*** **	**-0.0502*** **	**-0.0287*** **	-0.0236	**-0.0694*** **	-0.0187	**-0.0382***
	(0.00286)	(0.00879)	(0.0114)	(0.0108)	(0.00790)	(0.0190)	(0.0226)	(0.0120)	(0.0222)
Remittances	**0.00205*** **	**-0.0109*** **	**-0.0137*** **	**-0.0157*** **	**-0.0164*** **	**-0.0175*** **	**-0.0217*** **	**-0.0208*** **	**-0.0164*** **
	(0.000684)	(0.00181)	(0.00314)	(0.00103)	(0.00246)	(0.00330)	(0.00579)	(0.00419)	(0.00399)
ΔRGDP	**-0.448*** **	**-0.540*** **	**-0.345*** **	**-0.215*** **	**-0.218*** **	**-0.186*** **	**-0.171*** **	**-0.238*** **	**-0.143*** **
	(0.127)	(0.0509)	(0.0480)	(0.0323)	(0.0292)	(0.0391)	(0.0366)	(0.0148)	(0.0227)
ΔGovt	**-0.00763*** **	**-0.0123*** **	**-0.0203*** **	**-0.00990*** **	**-0.0147*** **	**-0.0174*** **	**-0.0122*** **	**-0.00751*** **	**-0.00409*** **
	(0.00196)	(0.00210)	(0.00241)	(0.00273)	(0.00125)	(0.00242)	(0.00258)	(0.00251)	(0.00130)
ΔMoney	-0.000230	**0.000577***	0.000379	-8.16e-05	**-0.000417*** **	**-0.000280***	**0.00118*** **	**0.00154*** **	**0.00285*** **
	(0.000468)	(0.000333)	(0.000269)	(0.000188)	(8.15e-05)	(0.000148)	(0.000323)	(0.000346)	(0.000280)
Observations	61	60	59	59	61	60	58	57	55
R-squared[#]	0.06	0.15	0.17	0.08	0.10	0.15	0.09	0.23	0.22

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.

Table 3: The Impact of Skill-Emigration Share in 1990 on Δrer_t^N in Short Run and Long Run

	Δrer_t^N								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	**-0.0241*** **	**-0.0332*** **	0.0137	**-0.0480***	-0.0229	-0.00636	**0.0562** **	**0.0875*** **	0.0342
	(0.00494)	(0.00770)	(0.0171)	(0.0264)	(0.0328)	(0.0238)	(0.0257)	(0.0154)	(0.0343)
SkillEmig-1990	**-0.0155*** **	**-0.0183*** **	-0.000952	**-0.0697*** **	**-0.0507*** **	**-0.0518*** **	**-0.0424** **	**-0.0356*** **	**-0.0736*** **
	(0.00292)	(0.00576)	(0.0105)	(0.0116)	(0.0172)	(0.0144)	(0.0170)	(0.00605)	(0.0131)
Remittances	**-0.00656*** **	**-0.00616*** **	0.00279	**-0.0200*** **	**-0.0155*** **	**-0.0217*** **	**-0.0160** **	**-0.0189*** **	**-0.0327*** **
	(0.000608)	(0.00172)	(0.00331)	(0.00208)	(0.00495)	(0.00270)	(0.00711)	(0.00322)	(0.00632)
ΔRGDP	**0.219*** **	**0.223*** **	0.0150	**-0.212*** **	**-0.175** **	**-0.172*** **	**-0.296*** **	**-0.324*** **	**-0.280*** **
	(0.0325)	(0.0549)	(0.0672)	(0.0735)	(0.0701)	(0.0501)	(0.0697)	(0.0451)	(0.0849)
ΔGovt	**-0.00864*** **	-0.00172	-0.000460	**-0.0113*** **	**-0.0149*** **	**-0.0181*** **	**-0.0225*** **	**-0.0268*** **	**-0.0267*** **
	(0.00127)	(0.00284)	(0.00331)	(0.00351)	(0.00463)	(0.000975)	(0.00360)	(0.00147)	(0.00259)
ΔMoney	**0.00349*** **	**0.00179*** **	**0.00180*** **	**-0.00239***	**-0.00206** **	**-0.00291*** **	-0.000645	-0.000174	-4.47e-06
	(0.000431)	(0.000543)	(0.000587)	(0.00126)	(0.000817)	(0.000706)	(0.000554)	(0.000457)	(0.000674)
Observations	35	36	37	39	40	40	40	39	37
R-squared[#]	0.22	0.15	0.06	0.19	0.16	0.21	0.24	0.30	0.35

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.

Table 4: The Impact of Skill-Emigration Share in 2000 on Δrer_t^N in Short Run and Long Run

	Δrer_t^N								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	0.00497	**0.0641*** **	**0.0378*** **	0.0177	0.0118	-0.00825	-0.0312	-0.0294	0.00715
	(0.00448)	(0.00851)	(0.0140)	(0.0135)	(0.0100)	(0.0185)	(0.0227)	(0.0223)	(0.0128)
SkillEmig-2000	**-0.00482***	-0.00682	**-0.0315*** **	**-0.0457*** **	**-0.0407*** **	**-0.0423*** **	**-0.0440*** **	**-0.0845*** **	**-0.0417*** **
	(0.00267)	(0.00550)	(0.00796)	(0.00680)	(0.00283)	(0.00735)	(0.0128)	(0.0146)	(0.00774)
Remittances	0.000473	-0.000631	**-0.0100*** **	**-0.0177*** **	**-0.0154*** **	**-0.0194*** **	**-0.0250*** **	**-0.0282*** **	**-0.0215*** **
	(0.000301)	(0.00167)	(0.00284)	(0.00289)	(0.00259)	(0.00485)	(0.00496)	(0.00390)	(0.00513)
ΔRGDP	**-0.268*** **	**-0.787*** **	**-0.476*** **	**-0.381*** **	**-0.246*** **	**-0.139*** **	**-0.0776** **	**-0.179*** **	**-0.0733*** **
	(0.0335)	(0.0445)	(0.0650)	(0.0567)	(0.0441)	(0.0515)	(0.0393)	(0.0383)	(0.0272)
ΔGovt	**-0.00476*** **	**-0.0215*** **	**-0.0184*** **	**-0.0126*** **	**-0.00890*** **	**-0.00458** **	0.00360	**0.00457*** **	**0.00572*** **
	(0.000689)	(0.00214)	(0.00214)	(0.00371)	(0.00206)	(0.00186)	(0.00265)	(0.00176)	(0.00185)
ΔMoney	**-0.000382** **	0.000112	**0.000492***	**0.000653*** **	0.000211	0.000255	4.89e-05	-0.000401	**-0.00119*** **
	(0.000158)	(0.000164)	(0.000276)	(0.000173)	(0.000231)	(0.000309)	(0.000125)	(0.000350)	(0.000193)
Observations	61	61	60	60	62	62	61	58	55
R-squared[#]	0.08	0.44	0.34	0.27	0.18	0.15	0.15	0.14	0.17

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.

Table 5: The Impact of Skill-Emigration Share in 1990 on Δq_t in Short Run and Long Run (Non-OECD Countries sample)

	Δq_t								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	**-0.0288****	-0.0545	**-0.0740*****	0.0705	-0.0443	0.0812	0.0668	0.0379	0.0321
	(0.0126)	(0.0341)	(0.0108)	(0.0545)	(0.0323)	(0.0757)	(0.0526)	(0.0782)	(0.105)
Skill-Emig -1990	**-0.0415*****	**-0.0740*****	**-0.104*****	**-0.0874****	**-0.0812*****	**-0.122*****	**-0.0811*****	**-0.110*****	-0.0528
	(0.00781)	(0.0191)	(0.00819)	(0.0369)	(0.0184)	(0.0399)	(0.0313)	(0.0330)	(0.0335)
Remittances/GDP	**-0.0130*****	**-0.0194*****	**-0.0256*****	**-0.0316*****	0.00867	**-0.0214***	0.00390	0.0119	**0.0275*****
	(0.00298)	(0.00443)	(0.00228)	(0.0102)	(0.00984)	(0.0129)	(0.00972)	(0.0117)	(0.00875)
ΔRGDP	**-0.986*****	**-1.026*****	**-0.882*****	**-1.125*****	-0.183	**-1.018*****	**-0.630*****	**-0.682*****	**-0.360***
	(0.125)	(0.0717)	(0.0779)	(0.210)	(0.134)	(0.225)	(0.231)	(0.211)	(0.198)
ΔGovt	**-0.0767*****	**-0.0427*****	**-0.0459*****	**-0.0466*****	**-0.0394*****	**-0.0403*****	**-0.0373*****	**-0.0350*****	**-0.0265*****
	(0.00558)	(0.00596)	(0.00218)	(0.00383)	(0.00247)	(0.00437)	(0.00235)	(0.00467)	(0.00723)
ΔMoney	**0.0107*****	**0.00505*****	**0.00292*****	**0.00311*****	0.000258	**0.00348****	**0.00246****	**0.00481*****	**0.00430*****
	(0.00111)	(0.00102)	(0.000144)	(0.000950)	(0.000446)	(0.00141)	(0.00119)	(0.00121)	(0.000569)
Observations	22	22	22	23	23	23	23	23	23
R-squared[#]	0.58	0.46	0.68	0.51	0.43	0.43	0.47	0.53	0.46

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.
1-RSS/TSS reported for GLS regression.

Table 6: The Impact of Skill-Emigration Share in 2000 on Δq_t in Short Run and Long Run (Non-OECD Countries sample)

	Δrer_t								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	-0.0172	**0.0737*** **	**0.0520** **	**0.113*** **	**0.163*** **	**0.105*** **	**0.0878*** **	**0.0968*** **	-0.0108
	(0.0155)	(0.0176)	(0.0251)	(0.0288)	(0.0101)	(0.0182)	(0.0244)	(0.0320)	(0.0149)
Skill-Emig -2000	**-0.0255*** **	0.0195	-0.00713	0.0142	**0.0533*** **	0.0170	-0.0140	0.00302	**-0.0292** **
	(0.00858)	(0.0126)	(0.0153)	(0.0150)	(0.00546)	(0.0116)	(0.0210)	(0.0230)	(0.0137)
Remittances/GDP	0.00241	**-0.0117*** **	**-0.0129*** **	**-0.00959*** **	-0.000837	**-0.00678*** **	-0.0103	-0.00281	-0.00128
	(0.00161)	(0.00312)	(0.00429)	(0.00259)	(0.000881)	(0.00225)	(0.00627)	(0.00407)	(0.00401)
ΔRGDP	**-0.377***	**-0.506*** **	**-0.310*** **	**-0.285*** **	**-0.263*** **	**-0.238*** **	**-0.282*** **	**-0.310*** **	**-0.202*** **
	(0.200)	(0.0989)	(0.0425)	(0.0588)	(0.0302)	(0.0137)	(0.0279)	(0.0143)	(0.0110)
ΔGovt	-0.00486	**-0.0122*** **	**-0.0100*** **	**-0.0120*** **	**-0.0166*** **	**-0.0179*** **	**-0.0141*** **	**-0.0127*** **	**-0.00755*** **
	(0.00325)	(0.00397)	(0.00387)	(0.00256)	(0.00275)	(0.00198)	(0.00160)	(0.00203)	(0.000650)
ΔMoney	**-0.00101** **	2.23e-05	**0.00194*** **	0.00135	**-0.000965*** **	-0.000252	0.000113	**0.00208*** **	**0.00287*** **
	(0.000510)	(0.000819)	(0.000486)	(0.000923)	(0.000111)	(0.000252)	(0.000558)	(0.000493)	(0.000390)
Observations	43	42	41	41	43	42	42	42	40
R-squared[#]	0.11	0.21	0.21	0.17	0.19	0.20	0.16	0.33	0.22

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.

Table 7: The Impact of Skill-Emigration Share in 1990 on Δrer_t^N in Short Run and Long Run (Non-OECD Countries sample)

	Δrer_t^N								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	**-0.0652*** **	**-0.0984*** **	-0.0539	-0.00124	0.0926	**0.196** **	**0.283*** **	**0.276*** **	**0.210** **
	(0.0206)	(0.0272)	(0.0350)	(0.104)	(0.101)	(0.0920)	(0.0657)	(0.0505)	(0.0860)
Skill-Emig -1990	**-0.0320*** **	**-0.0402*** **	-0.0138	**-0.0774*** **	-0.0547	-0.0395	**-0.0524** *	**-0.0646*** **	**-0.0492** **
	(0.00928)	(0.0132)	(0.0239)	(0.0285)	(0.0333)	(0.0335)	(0.0271)	(0.0239)	(0.0199)
Remittances/GDP	**-0.0106*** **	**-0.00763** *	0.00708	**-0.0275*** **	**-0.0251*** **	**-0.0332*** **	**-0.0497*** **	**-0.0447*** **	**-0.0405*** **
	(0.00275)	(0.00443)	(0.00677)	(0.00513)	(0.00763)	(0.00833)	(0.0133)	(0.00764)	(0.00504)
ΔRGDP	**0.453*** **	**0.463*** **	**0.354*** **	**-0.481** *	**-0.582*** **	**-0.720*** **	**-0.969*** **	**-0.900*** **	**-0.576*** **
	(0.106)	(0.147)	(0.0881)	(0.284)	(0.149)	(0.166)	(0.220)	(0.113)	(0.139)
ΔGovt	**-0.0116** **	**-0.0130** **	0.00113	**-0.0203*** **	**-0.0203*** **	**-0.0264*** **	**-0.0315*** **	**-0.0327*** **	**-0.0296*** **
	(0.00464)	(0.00646)	(0.00658)	(0.00470)	(0.00548)	(0.00306)	(0.00711)	(0.00592)	(0.00414)
ΔMoney	**0.00513*** **	**0.00234** **	**0.00263** **	4.84e-05	-0.00196	-8.66e-05	-0.000688	6.19e-05	0.000366
	(0.00147)	(0.00118)	(0.00116)	(0.00216)	(0.00188)	(0.00197)	(0.000620)	(0.000346)	(0.000583)
Observations	22	22	23	24	24	24	24	24	24
R-squared[#]	0.35	0.40	0.18	0.29	0.29	0.33	0.55	0.57	0.54

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Note 2: A rise of REER indicates a depreciation.

Table 8: The Impact of Skill-Emigration Share in 2000 on Δrer_t^N in Short Run and Long Run (Non-OECD Countries sample)

	Δrer_t^N								
VARIABLES	1-yrs	2-yrs	3-yrs	4-yrs	5-yrs	6-yrs	7-yrs	8-yrs	9-yrs
Constant	**0.0250*** **	**0.0939*** **	**0.0980*** **	**0.102*** **	**0.0855*** **	**0.119*** **	**0.0973*** **	**0.150*** **	**0.195*** **
	(0.00964)	(0.0142)	(0.0214)	(0.0176)	(0.0102)	(0.0224)	(0.0173)	(0.0399)	(0.0315)
Skill-Emig -2000	0.00579	0.00552	-0.00719	-0.0153	**-0.0122*** **	-0.00446	-0.00368	-0.00287	0.0126
	(0.00492)	(0.0104)	(0.00892)	(0.00962)	(0.00434)	(0.00996)	(0.0112)	(0.0167)	(0.0148)
Remittances/GDP	0.000616	-0.00269	**-0.0108*** **	**-0.0233*** **	**-0.0152*** **	**-0.0108*** **	**-0.0184*** **	**-0.0134* **	**-0.0177*** **
	(0.000520)	(0.00225)	(0.00303)	(0.00401)	(0.00177)	(0.00383)	(0.00430)	(0.00721)	(0.00536)
ΔRGDP	**-0.301*** **	**-0.831*** **	**-0.513*** **	**-0.444*** **	**-0.302*** **	**-0.337*** **	**-0.258*** **	**-0.282*** **	**-0.279*** **
	(0.0682)	(0.0466)	(0.0657)	(0.0523)	(0.00672)	(0.0448)	(0.0350)	(0.0541)	(0.0363)
ΔGovt	**-0.00587*** **	**-0.0201*** **	**-0.0173*** **	**-0.00774** **	**-0.00705*** **	**-0.00475*** **	**0.00824*** **	**0.00524** **	0.00191
	(0.00149)	(0.00117)	(0.00246)	(0.00389)	(0.000770)	(0.00144)	(0.00248)	(0.00267)	(0.00191)
ΔMoney	**-0.000659* **	**-0.000576* **	-0.000451	3.94e-06	1.32e-05	**0.000349** **	**0.000930*** **	-0.000622	**-0.00171*** **
	(0.000348)	(0.000335)	(0.000296)	(0.000509)	(0.000136)	(0.000160)	(0.000346)	(0.000595)	(0.000231)
Observations	43	43	42	42	44	44	44	42	40
R-squared[#]	0.11	0.47	0.40	0.39	0.22	0.17	0.21	0.18	0.29

Note 1: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Note 2: A rise of REER indicates a depreciation.

Appendix 1 Two Groups of Sample Economies

Sample Economies that used to calculate REER for 1990-1999	Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kazakhstan, Korea, Rep., Kuwait, Latvia, Lithuania, Macedonia, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syria, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela
Sample Economies that used to calculate REER for 2000-2009	Albania, Algeria, Argentina, Armenia, Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Egypt, El Salvador, Estonia, Finland, France, Georgia, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Korea, Rep., Kuwait, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa , Spain, Sri Lanka, Sweden, Switzerland, Syria, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela

Appendix 2 Two Groups of Non-OECD Economies

Non-OECD Countries											
1990 Sample						2000 Sample					
1	Argentina	20	Mexico	39	Uruguay	1	Albania	20	Iran	39	Singapore
2	Brazil	21	Morocco	40	Venezuela	2	Algeria	21	Jordan	40	South Africa
3	Bulgaria	22	Pakistan			3	Argentina	22	Kazakhstan	41	Sri Lanka
4	Chile	23	Panama			4	Armenia	23	Kuwait	42	Syria
5	Colombia	24	Paraguay			5	Belarus	24	Kyrgyzstan	43	Tajikistan
6	Costa Rica	25	Peru			6	Brazil	25	Latvia	44	Thailand
7	Croatia	26	Philippines			7	Bulgaria	26	Lithuania	45	Trinidad and Tobago
8	Cyprus	27	Romania			8	Chile	27	Macedonia	46	Tunisia
9	Egypt	28	Russian Federation			9	China	28	Malaysia	47	Turkey
10	Hong Kong	29	Saudi Arabia			10	Colombia	29	Mexico	48	Ukraine
11	India	30	Singapore			11	Costa Rica	30	Morocco	49	Uruguay
12	Indonesia	31	South Africa			12	Croatia	31	Pakistan	50	Venezuela
13	Iran	32	Sri Lanka			13	Cyprus	32	Panama		
14	Kazakhstan	33	Syria			14	Egypt	33	Paraguay		
15	Kuwait	34	Thailand			15	El Salvador	34	Peru		
16	Latvia	35	Trinidad and Tobago			16	Georgia	35	Philippines		
17	Lithuania	36	Tunisia			17	Hong Kong	36	Romania		
18	Macedonia	37	Turkey			18	India	37	Russian Federation		
19	Malaysia	38	Ukraine			19	Indonesia	38	Saudi Arabia		

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