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REMITTANCES AND DUTCH DISEASE: A META-ANALYSIS

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Remittances and Dutch Disease: A Meta-Analysis

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Abstract

Remittance flows are an important source of foreign exchange for various developing countries around the world. Given their growing importance in the last decade, their role in inducing Dutch disease symptoms in the developing countries has been extensively studied. However, the results of the analyses so far have been mixed. In this study, we conduct a meta-analysis of existing literature to estimate the over all effect of remittances on receiving countries' real effective exchange rate (REER). We run fixed and random effect meta-analysis on studies taken from EconLit, Google Scholar and various working paper series and examine a total of 53 regressions taken from seven published and unpublished studies. We come up with evidence of a net appreciation of real exchange rate in the developing countries. Both the fixed and random effect models indicate a highly significant impact of foreign remittances on the REER. The results show also that the nature of the dependent variable, countries considered and the econometric technique used influence the impact of remittances REER, However the type of data (panel or times series) does not affect the results. Our investigations support the presence of selection bias. The findings support the view that in spite of their utility for the recipient households, remittances pose a challenge to the developing country on the macroeconomic level.

Keywords: Migrant remittances; real effective exchange rate; developing countries; meta-analysis.
JEL classification: Q1**,** Q18, Q19, C49

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1. Introduction

Ratha (2007) argues that remittances are the most tangible link between migration and development. Remittances received from migrants are the one of the most important sources of external finance for the majority of developing countries. According to the World Bank, remittances to developing countries are expected to exceed $406 billion in 2013. Since the 2000s, economists have been seeking to assess the impact of remittances in origin countries. For instance, economists have tried to quantify the relationship between remittances and the real exchange rate. The idea is to estimate the presence or otherwise of the phenomena of 'Dutch Disease'.

Dutch Disease occurs due to a massive influx of foreign capital. This phenomenon is characterized by an appreciation of exchange rate and loss of competitiveness of the sector exposed to the international competition. This phenomenon was analyzed for the first time by Corden and Neary (1982) and Corden (1984) in the case of a massive return of currencies. They can make further adjustments on the received economy, particularly the spending effect

The impact of remittances on exchange rate is deeply disputed in the recent literature. It is useful to understand the feature, whether the effect of remittances is negative or positive and through which channel these effects operate. This paper applies meta-analysis to the empirical studies that investigate the effect of remittances on exchange rate. The observed relationship between remittances and exchange rate may be influenced by model specification choices, heterogeneity, and the no addressed of endogeneity of remittances. We use a meta-analysis for investigating plausible causes of differences in findings and relate studies characteristics to their size of effect. The questions that we try to respond in this paper are: Does remittances appreciate the real exchange rate? Are the negative effects observed in certain specific countries? Does the type of estimation influence the results? In other terms, this article has a double objective: firstly it uses the empirical studies to explore whether there exists a genuine relationship between remittances and Dutch disease; secondly it investigates the source of heterogeneity. Conditions under investigation and the nature of remittances as: intensity; mode of transfer; nature of variable control used in estimations. Heterogeneity may occur due to methodological diversity and countries diversity.

The narrative literature review suggests that the impact of remittances on exchange rate is ambiguous. But it does not tell us the reasons of this equivocalness.

The next section presents the methodology. Then, I discuss the results about the fixed and the random effects and the choice of models. In the subsequent section, I explain the heterogeneity by doing a meta-regression and I discuss the bias selection. Conclusions follow.

2. Methodology

The advantage of meta-analysis is to lead to sharper results. We average the results of previous studies on the Dutch disease, although these studies use different techniques to measure the effect of remittances. This technique allows us to draw objective conclusions from the literature review. The idea of this technique is to combine different results to produce a general answer to the research question (the impact of remittances on exchange rate). This procedure is increasingly used by researchers, because it gives a more objective view of the literature (Everitt and Hothorn, 2006). In meta-analysis, fixed effects or random effects can be used. In the fixed effects model, I assume that there is one true effect. However, random effects model states that the true effect may vary according to the study. This model requires the existence of heterogeneities between studies (Everitt and Hothorn, 2006). In this paper I treat the two models and by using homogeneity test, I'll choose the appropriate model. To do this, I will take a sample that has 53 regressions from 7 papers (published and unpublished). My database includes: EconLit, working papers, Google Scholar according to the methodology followed by Stanley (2001). To reduce selection bias, we selected papers published and unpublished, as Stanley (2001) suggests. The studies considered in our sample using a linear estimation following: $Q_i = \alpha Remit_i + X_i\beta + \varepsilon_i$

Where:

i={1,.., N) N the number of regressions ; Q : Exchange rate certain date ;

$Remit$: Remittances;

X : Matrix of explanatory variables supposed influenced exchange rate.

A positive and significant sign of the parameter (α) implies an appreciation of the exchange rate. Other studies that analyze the relationship between the Dutch disease and transfers differently are not considered in our study. Table A4.1 in the appendix outlines the data used in the meta-analysis.

2.1. Fixed Effect model

The fixed effects model supposes that there is one true effect of remittances on exchange rate. The differences in observed effects are therefore due to sampling error. In this case, there is only one effect of remittances on the exchange rate regardless of the context of study. The objective is to estimate the combined effect of the impact of remittances on the exchange rate. To do this, I calculate the weighted average of the effects from 53 trials (regressions). The idea is to give more weight to studies with high accuracy. Therefore, the weighting parameter is the inverse of the variance (precision) of each effect. The fixed effects model can be modeled as follows:

Let $\overline{Y}$ combined effect,

$$\overline{Y} = \frac{\sum_{i=1}^{k} W_i Y_i}{\sum_{i=1}^{k} W_i} \quad (1)$$

With:

k, a number of regressions ;

Y_i, the impact of remittances on exchange rate in regression i ;

$W_i = 1/V_i^2$;

V_i^2 , Variance of Y_i.

The variance of $\overline{Y}$ is calculated by this formulate: $\sigma_{\overline{Y}}^2 = \frac{1}{\sum_{i=1}^{k} W_i}$ (2)

By combined equations (1) and (2), I can simply calculate the confidence level of $\overline{Y}$ at 95% $\left[\overline{Y} - 1{,}96\sigma_{\overline{Y}}; \overline{Y} + 1{,}96\sigma_{\overline{Y}}\right]$.

Despite the fact that the studies selected in our sample share a number of characteristics (developing countries, sending countries, intervention in the foreign exchange market, etc.), They may be heterogeneous. For this reason, we also estimate the model variable effects presented below.

2.2. Random Effects model

In the random effects model, I assume that the true parameter varies according to the study. For example, the parameter is stronger in the case where the exchange rate is flexible or the share of remittances to GDP is greater. This hypothesis is more plausible than other factors involved in the occurrence of Dutch Disease. This means that the intensity of the impact of remittances in the long term depends on other factors (the share of remittances used in the consumption of tradable goods, the opening rate of the exchange rate regime, etc.). The use of remittances is a key element in determining the Dutch disease. While most of them are used in investment, this may reduce the likelihood of the occurrence of Dutch Disease. The random effects model can be written as follows:

$$\begin{aligned} &Y_i = \mu_i + \sigma_i \varepsilon_i; \quad \varepsilon_i \sim \mathrm{N}(0,1), \\ &\mu_i \sim \mathrm{N}(\mathrm{u}, \tau^2), i = 1,...,k \end{aligned} \qquad (3)$$

With:

Y_i , a combined effect which depended on mean μ_i and the variance σ_i ;

u is calculated follow the equation (1).

The weighting of each study changes in this model. In this model the between-study variance is considered.

The weighting $W_i^{'}$ can be written as follows:

$W_i' = 1/(V_i^2 + \hat{\tau}^2)$ with $\hat{\tau}^2$ the variance inter-studies estimated.

$$\hat{\tau}^2 = \begin{cases} 0 & si\ Q < k-1 \\ (Q-k+1)/U & si\ Q > k-1 \end{cases}$$

$$Q = \sum_{i=1}^{k} (Y_i - \bar{Y})^2$$

$$U = \sum W_i - \frac{\sum W_i^2}{\sum W_i}$$

The test of homogeneity is provided by the Q with the distribution of χ^2_{k-1}.

The results (Table 1) of the two models (fixed effects and mixed effects) show that remittances generate an appreciation of the real exchange rate. The homogeneity study recommends the variable effects model. This led to the validation of the hypothesis that remittances cause an appreciation of the exchange rate. We can say that the impact of remittances on the exchange rate is positive. The findings imply that the studies are

heterogeneous. This means that the context of the study may affect the relationship between remittances and the exchange rate.

2.3. Heterogeneity Test

Under the fixed model, I assume that the truth effect is the same for all studies, and under the random effects, I suppose that there is not one truth growth effect on remittances. So each study gives information about the effect size. The question is to know which model should be used? I use the test of homogeneity of studies. The test is given by the statistic Q. the hypothesis of common effect is rejected if Q surpasses the quintile of χ^2_{k-1} distribution whih k-1 degree of freedom at the selected level of significance.

Table 1: Fixed effect versus random effects model

Number of trials combined: 53

	95%-CI	z	p.value
Fixed effect model	0.0205 [0.0181; 0.0229]	16.6144	< 0.0001
Random effects model	0.0376 [0.0249; 0.0503]	5.8061	< 0.0001

Quantifying heterogeneity:

tau^2 = 0.0013; H = 3.8 [3.47; 4.16]; I^2 = 93.1% [91.7%; 94.2%]

Test of heterogeneity:

Q	d.f.	p.value
750.22	52	< 0.0001

The results show that the size of the combined empirical effect in literature is significant and different from zero. Results above show also that remittances induce an appreciation of exchange rate. The homogeneity test tends to validate the random effect. This led to the validation of the hypothesis that remittances cause an appreciation of the exchange rate.

To better explain the causes of heterogeneity found in the data, we carry out a meta-regression. The test of heterogeneity confirms our suspicion. More investigations is needed to understand the reasons of this heterogeneity and explain the differences between the studies.

3. Explain Heterogeneity: Meta-Regression

To explain the heterogeneity of studies in meta-analysis, I use a meta-regression to estimate how these factors impact the observed effect of remittances on exchange rate. I describe the linear relationship between two characteristics: the outcome (the impact of remittances on exchange rate) and explanatory variables such as the number of observations, the approach used in the study, the econometric method used in the estimation and some summary description of the study.

Meta regression is generally used in meta-analysis to evaluate the potential impact of moderator variables in the partial correlation (Jackson, 2008). It provides a useful tool to identify moderating effects of variables, and thus to set up the boundary conditions for a scientific inquiry (Meyer and Sinani, 2008). To understand the difference between studies, each regression is coded for the variables noted in table 2 all of these variables are important to understand for meta-regression.

Table 2 : variables used in meta-regression

Yi (dependent variable)	study i's estimate of impact of remittances on exchange rate
Vi	Standard error of study i
ALLC	Dummy variable for studies which used all countries
LIC	Dummy variable for low income countries
LMC	Dummy variable for low and middle income countries
Journal	Dummy variable for published studies
Panel	Dummy variable for panel studies
Tseries	Dummy variables for time series studies
Remitgdp	Dummy variable for studies which used remittances to GDP as explanatory variable
Remitcapita	Dummy variable for studies which used remittances per capita as explanatory variable
GMM	Dummy variable for studies which used GMM technique in estimation
COINT	Dummy variable for studies which used co-integration technique in estimation
OLS	Dummy variable for studies which used OLS technique in estimation

This section explores whether there exists the genuine relationship between remittances and exchange rate. Secondly, it investigates the source of heterogeneity among studies.

To explain the eventual source of heterogeneity we estimate the equation below.

$$V_i = \beta_0 + \beta_1 AllC + \beta_2 LIC + \beta_3 LMC + \beta_4 Journal + \beta_5 Panel + \beta_6 Tseries + \beta_7 GMM + \beta_8 OLS + \beta_9 COINT + \beta_{10} Remitgdp + \beta_{11} Remitcapita + \varepsilon \quad (4)$$

Equation (4) allows us to detect the variables that influence the size effect. In other words, I detect the variables cause the size effect. The results on impact of remittances on exchange rate can be influenced by the econometric technique used in estimation. For example, the methods not dealing with endogeneity may lead to spurious results. This problem can be detected by equation (4). Other elements that may influence results are included in the same equation as the category of the countries (low income and middle income).

3.1. Results and Comments

Table 3 : Meta-regression' results					
	(1)	(2)	(3)	(4)	(5)
(Intercept)	-0.368 (-2.493)	-0.255 -2.370)	-0.224 (-1.902)	-0.224 (-1.902)	0.042 (0.460)
Journal	0.260 (5.827)	0.303 (6.826)			0.303 (6.826)
Tseries	0.026 (0.385)				
Allcount	0.120 (1.181)	0.006 (0.096)	0.075 (0.984)	0.075 (0.984)	-0.022 (-0.442)
LIC	0.116 (1.287)	0.002 (0.050)	0.092 (1.854)	0.092 (1.854)	-0.026 (-0.556)
LMC	0.142 (1.640)	0.028 (0.713)	0.102 (2.216)	0.102 (2.216)	
Remitgdp	0.256 (3.245)	0.240 (3.446)	0.156 (1.638)	0.1567 (1.638)	
Remitcapita					-0.247 (-3.446)
GMM	-0.114 (-1.445)				
Panel		0.016 (0.239)			0.016 (0.239)
OLS			0.213 (2.229)	0.213 (2.229)	
COINT					-0.028 (-0.731)
() : t-value					

The results show that the choice of type of data (time series, panel) do not influence the impact of remittances on the exchange rate. The results also show that remittances have a

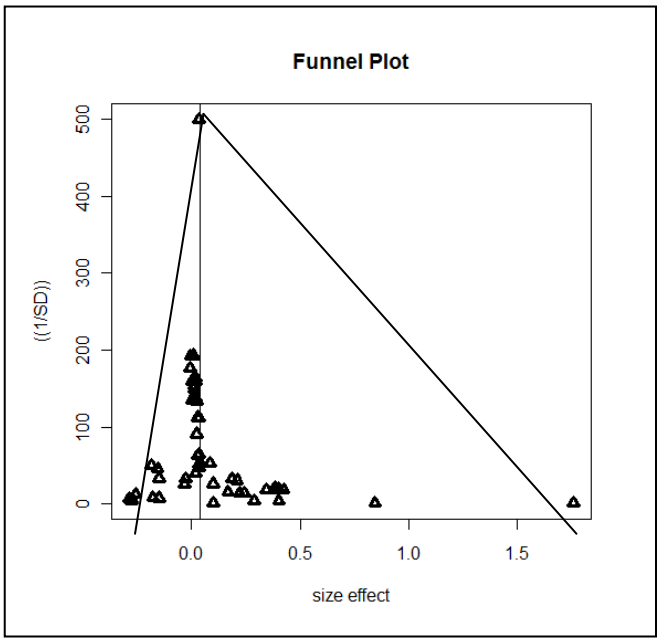
greater impact in developing countries compared to the least developed countries (LDCs). This can be explained by the large volume of remittances going to the developing countries (Makhlouf and Mughal, 2013).

As regards the techniques used, OLS significantly increases the impact of remittances on the exchange rate. This is due to the endogeneity of remittance transfers. Indeed, GMM and Co-integration techniques are neutral estimates. Because they deal with the problem of endogeneity. Use of ratio of remittances to GDP as remittances per capita positively influences the results.

3.2. Publication Bias

Publication bias occurs when the published papers results depends on their nature. The source of this bias can appear for manuscripts submitted with similar finding (positive or negative), Failure to publish a negative and non revelatory results. The publication bias induces in some cases false conclusions and key findings remain the same. Every meta-analysis should therefore contain an analysis of publication bias. To assess the publication bias, funnel plot is the technique usually used in meta-analysis. Funnel plot is used to detect bias selection (Tang and LY Lue, 2000). In this case, the asymmetrical plot is a consequence of bias selection. The figure below shows that the plot is symmetrical. The funnel plot associates significance test to asymmetry of the plot.

Figure 1



A Selection bias may appear where publication of studies depends on the significance of the research (Sutton et al., 2000). Several studies have shown that some journals tended to publish studies that are significant (Begg, 1994). Authors therefore submit only significant results to get published. This behavior leads to selection bias. Selective publication may reflect a theoretical or ideological positioning (Laroche, 2007) Funnel plot is the most common method used to detect selection bias (Laroche, 2007). In the absence of selection bias, the points cloud will be symmetric. More the asymmetry is important more the selection bias is important. However figure 1 shows that the plot is not symmetrical, so I can conclude that the studies used in this meta-analysis include bias selection.

4. Conclusion

This study is a part of a large set of studies that assess the impact of remittances on exchange rate. To do this study, a quantitative survey of 7 studies includes 54 regressions of remittances effect on exchange rate. This paper tries to explain how do remittances and exchange interact especially in developing countries? Which method affects the results? By estimating the persistence coefficient and their associated standard error are both used to summarize and explain the impact of remittances on exchange rate. Our results support the view that the impact of remittances on exchange rate is influenced by the specific context of study. In other words, we proposed that this impact may be influenced by the income, the technique used and the type of the dependant variable.

The results confirm the theoretical argument that a massive foreign flow induces loss of competitiveness. Our study suggests that both in low and middle income economies remittances stimulate an appreciation of exchange rate. Dutch disease result from complex interaction between remittances and exchange rate, this one is influenced by monetary policy. Further, monetary policy vis-à-vis exchange rate has to consider remittances.

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Annex:

Tableau 2

Authors	Effect	Standard error (VI	Authors	Effect	Standard error (VI
Amuedo-Dorantes et Pozo (2004)	0,22	0,071	**Barajas et al. (2010)**	0,032	0,009
Lartey et al. (2012)	0,403	0,239	**Barajas et al. (2010)**	0,016	0,007
Lartey et al. (2012)	0,085	0,019	**Barajas et al. (2010)**	0,017	0,007
Lartey et al. (2012)	0,346	0,054	**Barajas et al. (2010)**	0,017	0,006
Lartey et al. (2012)	0,033	0,002	**Barajas et al. (2010)**	0,029	0,009
Lartey et al. (2012)	0,424	0,055	**Makhlouf et Mughal (2013)**	0,29	0,27
Lartey et al. (2012)	0,243	0,07	**Makhlouf et Mughal (2013)**	0,022	0,011
Lartey et al. (2012)	0,403	0,05	**Makhlouf et Chainai (2011)**	0,386	0,05
Lartey et al. (2012)	0,168	0,066	**Fayad (2010)**	0,38	0,053
Barajas et al. (2010)	-0,005	0,005	**Fayad (2010)**	1,762	1,666
Barajas et al. (2010)	-0,005	0,006	**Fayad (2010)**	-0,149	0,03
Barajas et al. (2010)	0,01	0,005	**Fayad (2010)**	-0,286	0,146
Barajas et al. (2010)	0,023	0,008	**Fayad (2010)**	0,385	0,054
Barajas et al. (2010)	0	0,007	**Fayad (2010)**	0,101	1,149
Barajas et al. (2010)	0,001	0,006	**Fayad (2010)**	0,21	0,033
Barajas et al. (2010)	0,018	0,007	**Fayad (2010)**	0,846	0,94
Barajas et al. (2010)	0,02	0,007	**Fayad (2010)**	0,04	0,019
Barajas et al. (2010)	0,035	0,016	**Fayad (2010)**	-0,274	0,192
Barajas et al. (2010)	0,03	0,016	**Fayad (2010)**	0,184	0,031
Barajas et al. (2010)	-0,027	0,031	**Fayad (2010)**	-0,151	0,137
Barajas et al. (2010)	0,033	0,019	**Fayad (2010)**	0,101	0,038
Barajas et al. (2010)	0,034	0,021	**Fayad (2010)**	-0,178	0,12
Barajas et al. (2010)	0,018	0,025	**Fayad (2010)**	-0,157	0,022
Barajas et al. (2010)	-0,033	0,039	**Fayad (2010)**	-0,259	0,081
Barajas et al. (2010)	0,01	0,006	**Fayad (2010)**	-0,186	0,02
Barajas et al. (2010)	0,01	0,007	**Fayad (2010)**	-0,277	0,214
Barajas et al. (2010)	0,017	0,006			