

# Effect of Poverty on Real Exchange Rate in Developing Countries

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## Research Article

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# Abstract

A strand of the literature has shown that a depreciation of the real exchange rate contributes to poverty reduction. The current paper considers the issue in the other way around, by investigating whether poverty matters for the dynamics of real exchange rate. The analysis has been performed using a panel dataset of 106 countries over the period 1980-2017, and relied on the two-step system Generalized Methods of Moments (GMM). The findings are quite interesting. A rise in the level of poverty is associated with an appreciation of the real exchange rate over the full sample. However, countries with a high real per capita income experience a real exchange rate depreciation effect of poverty, while for countries with a relatively low real per capita income (such as poor countries), poverty is associated with an appreciation of the real exchange rate. Furthermore, poverty exerts an appreciation of the real exchange rate in countries with a low degree of trade openness (including trade policy liberalization), a low level of workers' productivity, and a high degree of export product concentration.

## Introduction

It is now well established that exchange rate policies represent an important tool for achieving many public policy objectives, including for example enhancing productivity growth (e.g., Fung, 2008), promoting countries' participation in international trade (e.g., Fung and Liu, 2009; Grobar, 1993; Mao et al., 2019; Noura et al., 2011), achieving fiscal sustainability (e.g., Carrera and Vergara, 2012; Neaime, 2015), reducing poverty (e.g., Apergis, 2015; Apergis and Arusha, 2018; Diallo, 2007; Elbadawi, 2015), and more generally, influencing countries' path of economic development through multiple channels (e.g., Guzman et al., 2018). As far as the poverty reduction effect of the real exchange rate is concerned, the few existing studies tend to suggest that the depreciation of the real exchange rate is conducive to poverty reduction. The latter is at the heart of both national policies as well as international policies, as exemplified by the adoption of the Sustainable Development Goals<sup>[1]</sup> (SDGs) by the Members of the United Nations at the United Nations Sustainable Development Summit in New York in September 2015. Poverty reduction is the first SDG, which aims at ending poverty in all its forms everywhere (see page 14 of the United Nations document A/RES/70/1).

While exchange rate policies appear to matter for poverty reduction (e.g., Apergis, 2015; Apergis and Arusha, 2018; Diallo, 2007; Elbadawi, 2015), one could also question whether poverty levels prevailing in countries influence the dynamics of the exchange rate in these countries. In fact, a voluminous literature has explored the macroeconomic factors underpinning the dynamics of the real exchange rate, including in developing countries. However, to the best of our knowledge, there are no studies on the effect of poverty on the real exchange rate. This is not surprising because the literature on the macroeconomic effects of poverty is relatively limited. This literature includes for example, studies on human capital effect of poverty (e.g., Azariadis and Stachurski, 2005; Bain et al. 2013; Haushofer and Fehr, 2014); effect of poverty on economic growth (e.g., Breunig and Majeed, 2020; López and Servén, 2015; Ravallion, 2012); on trade openness (Gnangnon, 2019a); and on export product diversification (Gnangnon, 2019b).

The present paper investigates the effect of poverty on the real exchange rate in developing countries. It intends to contribute to both the literature on the macroeconomic effects of poverty and the macroeconomic determinants of the real exchange rate. It builds on these two strands of the literature to address the issue.

The analysis focuses on a set 106 countries over the period 1980-2017, and primarily uses the two-step system Generalized Methods of Moments (GMM) technique. Empirical outcomes have shown that higher poverty levels tend to be associated with an appreciation of the real exchange rate in countries with low per capita income, and a depreciation of the real exchange rate in countries with a relatively high real per capita income. Furthermore, the paper has explored whether the effect of poverty on the real exchange rate translates through the channels of trade openness (trade policy liberalization), workers' productivity, and export product concentration. The findings indicate that it does. Specifically, poverty exerts an appreciation of the real exchange rate in countries with a low level of trade openness (or low degree of trade policy liberalization), a low level of workers' productivity, and a high degree of export product concentration.

The rest of the analysis proceeds as follows. Section 2 provides a theoretical discussion on the effect of poverty on the real exchange rate. Section 3 presents the model specification that would help investigate empirically the issue at hand. Section 4 discusses the econometric approach suitable for the empirical analysis. Section 5 discusses empirical results, and Section 6 undertakes an additional analysis. Section 7 concludes.

[1] The 17 SDGs were adopted by the General Assembly of the United Nations, and contained in the document "*Transforming our world: the 2030 Agenda for Sustainable Development*", whose reference number is A/RES/70/1. The SDGs replaced the Millennium Development Goals (MDGs) (adopted in September 2000 by United Nations Members), the first of these goals being to halve extreme poverty by the target date of 2015.

## Discussion On The Effect Of Poverty On The Real Exchange Rate

A rise in poverty levels reflects the fall in people's income that either pushes them into an impoverishment situation, or into a poverty trap (e.g., Barrett and Carter, 2013; Barrett et al. 2016; Dutta and Kumar, 2016; Naschold, 2013). Thus, the lack of resources to satisfy the minimum basic necessities of life (i.e., poverty) results in lower consumption growth (e.g., Blocker et al., 2013; Chakravarti, 2006; Ravallion, 2012), and particularly, in lower investment in human capital, including education and health (e.g., Azariadis and Stachurski, 2005; Bain et al. 2013; Hanson et al. 2013; Haushofer and Fehr, 2014; Hill and Sandfort, 1995; López, 2006; Mullainathan and Shafir, 2013; Sachs, 2005), and a less productive workforce (e.g., Breunig and Majeed, 2020; Hill and Sandfort, 1995). Therefore, we first postulate that the effect of poverty on the real exchange rate (i.e., the relative price of the non-tradables to tradables) would depend on how its effect on consumption would influence the demand for tradables relatively to non-tradables.

The decline in poverty-induced consumption can reflect in lower purchases of domestically produced goods as well as lower volume of imported goods by poor people, and hence in a fall in consumption of both non-tradables goods and tradable goods. Lower consumption of (i.e., demand for) domestically products and services (i.e., non-tradables goods and services) can reflect a fall in human capital investments, including on health and education, that are essentially non-tradables in developing countries. Similarly, lower demand for imported goods can affect the relative price of tradables to non-tradables. Therefore, the effect of poverty on the real exchange rate would depend on whether the poverty-induced decline in the demand for non-tradables exceeds (or is lower than) that of tradables, and hence on the direction in which the prices of non-tradables moves relatively to that of tradables (i.e., the real exchange rate is defined here as the ratio of price of non-tradables to the price of tradables).

If the fall in the poverty-induced consumption translates into a lesser demand for non-tradables compared to tradables, then the price of non-tradables would rise relatively to that of tradables, and result in an appreciation of the real exchange rate. In contrast, if the fall in consumption results in a lesser demand for tradables than for non-tradables (i.e., due to the impoverishment of their situation, people tend to consume less domestically produced goods at the benefit of imported goods), then the price of non-tradables would decline relatively to that of tradables, thereby leading to a depreciation of the real exchange rate. Such a real exchange rate depreciation effect of a rise in poverty levels would be particularly enhanced when the country further opened-up to international trade, for example through, *inter alia*, greater trade policy liberalization (i.e. by reducing tariffs and non-tariffs barriers so as to facilitate imports by poor people). This clearly indicates that the effect of poverty on the real exchange rate might be dependent on the concerned country's level of trade openness. Let us then discuss how trade openness can affect the real exchange rate, and subsequently draw conclusion on how the effect of poverty on the real exchange rate could behave as the degree of trade openness rises.

The literature concerning the effect of trade openness (or trade liberalization[1]) on real exchange rate has reached a mixed conclusion. On the one hand, an appreciation of the real exchange rate makes domestic 'exportable' products more expensive in the international trade market, and leads to a fall in the demand (by trading partners) for the exportable goods. At the same time, the appreciation of the real exchange rate makes foreign tradable products less expensive than domestic goods. This leads to a rise in the volume of imports, unless governments levy trade barriers (tariffs or non-tariff barriers) that raise the

costs of importing those goods. Thus, restrictive trade measures reduce import volumes and induces a rise in the price of non-tradables relatively to tradables, which results in an appreciation of the real exchange rate. Conversely, greater trade openness or trade liberalization enhances foreign competition in the tradable sector, and leads to a depreciation of the real exchange rate. The theoretical work of Dornbusch (1974) and Balassa (1975) have supported these arguments. For example, Balassa (1975) has noted that lower tariffs on imported goods generate higher imports, and consequently a deterioration of the current account. A depreciation of the exchange rate is, therefore, needed to ensure the re-balancing of the current account. On the other hand, Edwards (1989a) has underlined that these initial theoretical works were too simplistic. The author has shown that the real exchange rate effect of trade liberalization is unambiguous and is the outcome of the two different effects (substitution effect and income effect) that operate in opposite directions. This finding has been confirmed by Edwards (1989b) who has used an intertemporal model of the real exchange rate, under the assumptions of substitution between tradables and non-tradables, and where the substitution effect is greater than the income effect. Along the same lines, Khan and Ostry (1992) have reached the same conclusion by relying in their model on the assumption that the income effect does not dominate the substitution effect.

Meanwhile, Edwards (1989a) has shown that the initial conditions of the tariff level also matters for the effect of trade liberalization (or tariffs reduction) on the real exchange rate. In fact, when the initial level of tariff is low, the reduction in tariffs would result in a depreciation of the real exchange rate (i.e., the price of non-tradables will fall relatively to the price of tradables), given that the substitution effect would dominate the income effect. However, trade liberalization in the context of high initial level of tariffs can result in an improvement in welfare (i.e., it would generate an income effect). In turn, the latter can induce a higher demand for non-tradables relatively to tradables, and consequently lead to an appreciation of the real exchange rate.

Greater trade openness (or trade liberalization) can also affect the real exchange rate through its effect on productivity. For example, if higher trade openness results in higher productivity gains (e.g., Camarero et al. 2015; Frankel and Romer, 1999; Melitz, 2003), it would induce an expansion of the tradables sector, and ultimately lead to a depreciation of the real exchange rate. Li (2004) has shown that opening-up economies to international trade leads to a depreciation of the real exchange rate. However, countries with multiple trade liberalization episodes, experience an appreciation of the real exchange rate during earlier episodes. The author has concluded that partial or noncredible trade liberalizations are associated with an appreciation of the real exchange rate. More recently, Sposi (2015) has documented empirically the existence of an apparent similarity in prices of tradables across countries, while at the same time, prices of services in rich countries are systemically higher than those in poor countries. However, removing trade barriers results in the elimination of over half of the disparity in the relative price of services between rich and poor countries, while the disparity in the price of tradables between rich and poor countries remains unchanged. This signifies that greater trade liberalization (or trade openness) would result in a depreciation of the real exchange rate. Gantman and Dabós (2018) have used a set of 101 countries (both developed and developing ones) over the period 1960-2011, and provided empirical evidence that greater trade openness leads to a depreciation of the real exchange rate.

Against this background, we argue that the direction of the effect of poverty on the real exchange rate is a priori unknown, and is an empirical matter. First, it would depend on the extent to which the poverty-induced decline in consumption affects the demand for non-tradables relatively to tradables. Second, in the event the poverty-induced lower consumption results in a lesser demand for tradables relatively to non-tradables, the direction of the effect of poverty on the real exchange rate could depend on the degree of trade openness (including trade policy liberalization), and ultimately on how the latter also affects the real exchange rate.

Besides, poverty can also affect the real exchange rate through its effect on productivity: higher poverty levels can result in a less productive workforce (e.g., Breunig and Majeed, 2020; Hill and Sandfort, 1995) due, *inter alia*, to its adverse effect on investment on human capital. Lower productivity can induce a shrinking of the tradeable sector (notably the sector of exportable goods and services) relatively to non-tradables, in particular if a significant portion of poor people work in the tradables sector compared to the non-tradables sector. It could ensue an increase in the relative price of non-tradables to

tradables, and hence an appreciation of the real exchange rate. However, if the decline in productivity induced by the rise in poverty hurts much more the non-tradable sector compared to the tradable one (because many poor people work in the non-tradables compared to the tradables), then the productivity decline that arises from the rise in poverty rates would generate a depreciation of the real exchange rate. This because the price of non-tradables would decline compared to the price of tradables. Overall, the direction of the effect of poverty on the real exchange rate through the factor productivity channel is a priori unknown, and is therefore, an empirical matter.

In the remaining analysis, we test the effect of poverty on the real exchange rate through the channels of trade openness and workers' productivity.

[1] It is worth noting here that the concept of 'trade liberalization' is different from that of 'trade openness'. In fact, the level of trade liberalization in a given country reflects the extent of reduction in tariffs and non-tariffs barriers on goods imported and exported. The level of trade openness in a country arises from both the degree of trade liberalization and other factors, including for example other economic policies, geographical factors, and domestic and international politics that affect trade patterns, and flows.

## Model Specification

To analyse empirically the effect of poverty on the real exchange rate, we take cue from the voluminous empirical literature on the determinants of real exchange rate dynamics in developing countries (e.g., Addison and Balamoune-Lutz 2017; Ouattara and Strobl 2008). In particular, in addition to the variable of interest, i.e., the poverty indicator, denoted "POV", we use as controls variables that are deemed to be fundamental determinants of the real exchange rate. These control variables include the real per capita income (denoted "GDPC"), which also acts as a proxy for the economic development level; the general government final consumption expenditure, in percentage of GDP (denoted "GCONS"); the gross fixed capital formation in percentage of GDP (denoted "GFCF"), which is a proxy for public investment; development aid flows (whose transformation is denoted "ODA" - see details below); and finally, an indicator of terms of trade (denoted "TERMS"). The variables trade openness and factor productivity have not been included in the baseline model because they represent the channels through which poverty can affect the real exchange rate. These two variables would be included later in the analysis.

We postulate the following baseline model:

$$\text{Log}(REER)_{it} = \alpha_1 \text{Log}(REER)_{it-1} + \alpha_2 \text{POV}_{it} + \alpha_3 \text{Log}(GDPC)_{it} + \alpha_4 \text{ODA}_{it} + \alpha_5 \text{GFCF}_{it} + \alpha_6 \text{GCONS}_{it} + \alpha_7 \text{TERMS}_{it} + \mu_i + \gamma_t + \omega_{it} \quad (1)$$

Model (1) has been estimated over an unbalanced panel dataset of 106 countries, over the period 1980-2017, using data on 5-year non-overlapping sub-periods (1980-1984; 1985-1989; 1990-1994; 1995-1999; 2000-2004; 2005-2009; 2010-2014, and 2015-2017) to dampen the effect of business cycles on variables.  $i$  and  $t$  represent respectively a country, and the time-period.  $\alpha$  are coefficients to be estimated.  $\mu_i$  are countries' time-invariant specific effects;  $\gamma_t$  are time dummies and represent global shocks that influence simultaneously all countries' real exchange rates movements.  $\omega_{it}$  is a well-behaving error term.

The dependent variable, i.e., the real effective exchange rate index ("REER") is extracted from the Bruegel datasets (see Darvas 2012a, 2012b). It has been computed for a given country, as the nominal exchange rate multiplied by the consumer price index of the concerned country in period  $t$ , and divided by the geometrically weighted average of the consumer price indexes of its trading partners over the same period. The nominal effective exchange rate is based on 66 trading partners, and computed as a geometrically weighted average of the bilateral exchange rates between a given country and its trading partners. An increase in REER reflects an appreciation of the real effective exchange rate, i.e., an appreciation of the home

currency against the basket of currencies of trading partners, while a decrease in REER indicates a depreciation of the real effective rate. The natural logarithm has been applied to this variable so as to reduce its skewness.

The regressor of key interest "POV" is the measure of poverty rate. Two indicators of poverty, that are widely used in the empirical literature, have been utilized here. These include the poverty headcount ratio at \$1.90 a day, denoted "POVHC", and the poverty gap at \$1.90 a day, denoted "POVGAP", with the former being our main indicator of poverty, and the latter being used for robustness check analysis. The poverty headcount at \$1.90 a day represents the percentage of the population living with less than \$1.90 a day, at 2011 international prices. The poverty gap at \$1.90 a day (at 2011 international prices) reflects the depth and incidence of poverty. It represents the mean shortfall in income or consumption from the poverty line \$1.90 a day (counting the nonpoor as having zero shortfall), expressed as a percentage of the poverty line.

The variable "ODA" is the transformed measure of the net official development assistance, expressed in constant 2017 US dollars prices. As it contains negative values and is additionally highly skewed, we have transformed it. If we assume that "ODA1" represents the (non-transformed) net official development assistance (expressed in constant 2017 US\$ prices), the transformation procedure goes as follows (see Dabla-Norris et al., 2015; Yeyati et al. 2007):  $ODA$ , where refers to the absolute value of the variable "ODA1".

We have also applied the natural logarithm to the real per capita income variable in order to reduce its skewness. All other variables included in the baseline model (1) have been described in Appendix 1. Appendices 2 and 3 display respectively the standard descriptive statistics on these variables as well as the list of the 106 countries of the sample.

We present in Figures 1 to 3 the development of poverty and the real exchange rate indicators respectively over the full sample, and the sub-samples of least developed countries<sup>[1]</sup> (LDCs) and NonLDCs (that is, countries not classified as LDCs). We split the sample into LDCs and NonLDCs because according to the United Nations, the group of LDCs represents the poorest and most vulnerable countries in the world to economic and environmental shocks.

Figures 1 to 3 have been constructed using the panel dataset based on the non-overlapping sub-periods of 5-year. The three Figures show that both poverty indicators have exhibited a downward trend over the period, thereby reflecting a tendency for countries (on average) to experience a fall in the poverty rates over time. However, unsurprisingly, poverty levels remain higher in LDCs than in NonLDCs. For example, poverty headcount ratio has moved in LDCs from 69.6 in 1980-1984, to 37.1 in 2015-2017, while in NonLDCs, it was 4.5 in 2015-2017 against 22.4 in 1980-1984. Interestingly, the slope of the poverty rate decline in NonLDCs is higher than that of LDCs.

The real exchange rate has not shown similar developments in the three Figures, in particular between the sub-period 1980-1984 and 1990-1994. Specifically, apart from these two sub-periods, the developments of the real exchange rate appear to be similar across the two sub-samples and the full sample, although the levels of real exchange rate differ across the three groups. In the full sample, and sub-sample of NonLDCs, the real exchange rate has substantially appreciated from 1980-1984 to 1985-1989, and then suddenly depreciated from 1985-1989 to 1990-1994. In contrast, in LDCs, the real exchange rate has depreciated from 1985-1989 to 1990-1994. For the rest of the period (i.e., from 1990-1994 to 2015-2017), the real exchange rate has, in the first instance, depreciated from 1990-1994 to 2005-2009, and then exhibited an upward trend (i.e., an appreciation) from 2005-2009 to 2015-2017.

### ***Discussion on the theoretical effects of control variables***

We draw on the Balassa-Samuelson basic theory on the real exchange rate effect of productivity to explain the effect of the real per capita income on the real exchange rate. Balassa (1964) and Samuelson (1964) have explained why relative prices co-vary positively with the development level. According to the basic framework of their theory, larger cross-country productivity differences in tradables than in nontradables lead to larger cross-country differences in the price of nontradables than in the price of tradables. The intuition underlying this basic framework goes as follows. In the context of free trade, the

price of tradables is the same across countries[2]. As it is likely that productivity gap in the tradable sector would be higher in rich countries compared to poor countries, and assuming that differences in labor productivity are likely greater in the tradables goods sector than in the non-tradable goods one, wages would be relatively higher in rich countries than in poor countries. As a result, production costs would increase in rich countries than in poor countries. Specially, production costs in the non-tradables sector in rich countries would raise thanks to the mobility of homogeneous labor across sectors. Combined with the small cross-country productivity differences in nontradables, these would lead to a higher price of non-tradables in rich countries than in poor countries, and an over-appreciation of the real exchange rate relative to its purchasing power parity[3].

Some works have provided empirical support for the Balassa-Samuelson hypothesis (e.g., Bergin et al., 2006; Buera et al., 2011; Drine and Rault 2003; Gantman and Dabós, 2018; Herrendorf and Valentinyi, 2012). For example, Herrendorf and Valentinyi (2012) have found that the cross-country productivity differences are larger in tradables than in nontradables. Bergin et al. (2006) have explained the higher cross-country productivity gap in tradables than in non-tradables by the fact that more productive firms tend to produce tradable goods, and drive out less productive firms from the domestic market. According to Buera et al. (2011), financial frictions induce a misallocation of productive resources across sectors, and consequently larger differences in cross-country productivity in goods sectors compared to the services sectors. Gantman and Dabós (2018) have found that while the effect of productivity on the real exchange rate is positive, it is not always statistically significant across all regressions. Nonetheless, Choudhri and Schembri (2010) have shown that as the elasticity of substitution between domestic and foreign goods can vary, the effect of the improvements in traded-goods productivity on the real exchange rate can be positive or negative.

The effect of government consumption (expenditure) on the real exchange rate is an empirical matter, as it depends theoretically on whether such a consumption has been primarily spent on tradables or on non-tradables. A rise in government consumption of tradables would lead to a depreciation of the real exchange rate, while a higher government consumption of non-tradables would generate an appreciation of the real exchange rate. Some works such as Corsetti and Müller (2006) and Galstyan and Lane (2009) have shown that government consumption tends to be much more on non-tradables goods than on tradable goods. Therefore, it is more likely that higher government consumption results in an appreciation of the real exchange rate than in its depreciation. Miyamoto et al. (2019) have uncovered empirically that government purchases result in an appreciation of the real exchange rate in developing countries, but generates a depreciation of the exchange rate in advanced countries. However, a real exchange rate depreciation effect of government purchases has been reported by Monacelli and Perotti (2010) and Ravn et al. (2012).

On another note, higher public investment in tradables (non-tradables) would be associated with a depreciation (appreciation) of the real exchange rate (e.g., Galstyan and Lane, 2009; Ouattara and Strobl 2008).

As for the development aid, its effect on the real exchange rate depends on whether these capital inflows generate a Dutch disease effect in the recipient economy (this is a demand-side effect) or whether these resource inflows are used to expand the tradable sector (this is a supply-side effect). The Dutch disease theory provides that a capital inflow (here development aid inflow) can result in a rise in the aggregate demand, and hence an increase in the price of non-tradables relatively to tradables, that is, an appreciation of the real exchange rate. In this process, productive factors, including labour, move from the tradables sector to the non-tradables sector, and further shrink the tradable sector, including for example the manufacturing sector. An eventual appreciation of the nominal exchange rate associated with the capital inflow would enhance the degree of real exchange rate appreciation (e.g., Addison and Balamoune-Lutz 2017). On the other hand, development aid inflows can be used to address the supply-side constraints, and expand the productive capacity of the recipient country. The latter's production and exports would then increase, which signifies an expansion of the tradables sector relatively to the non-tradable sector (e.g., Adams, 2005; Addison and Balamoune-Lutz 2017). As a consequence, the real exchange rate would depreciate. Overall, the effect of development aid inflows on the real exchange rate is an empirical issue. In the empirical literature, some studies have found that development aid inflows have led to an appreciation of the real exchange rate (e.g., Addison and Balamoune-Lutz 2017; Adu and Denkyirah, 2018; Edwards and van Wijnbergen, 1989;

Ouattara and Strobl, 2008; Vos, 1998; Younger, 1992). Others have uncovered that development aid inflows may not be associated with a significant appreciation of the real exchange rate (e.g., Berg et al. 2005; Jarotschkin and Kraay, 2016). Along the same lines, Issa and Ouattara (2008) have found no significant effect of development aid inflows on the real exchange rate in the recipient countries. Finally, some other works have obtained evidence that development aid inflows have induced a depreciation of the real exchange rate (e.g. Arhenful, 2013; Li and Rowe, 2007; Nkusu, 2004; Nyoni, 1998; Sackey, 2001; Selaya and Thiele, 2010).

Finally, the terms of trade exert two opposite effects on the real exchange rate. These include an income effect of terms of trade and a substitution effect of terms of trade, both being reflected in a higher demand for non-tradables. The income effect arises from a rise in domestic income (due either to an increase in export prices, or a fall in import prices) that is spent on both tradables and non-tradables goods. As the price of tradable goods is assumed to be fixed (i.e., determined in the international market, and not influenced by domestic factors), it will not be affected. Instead, the price of non-tradables would rise, and generate an increase in the relative price of non-tradables to tradables, and hence an appreciation of the real exchange rate. The substitution effect stems from a decrease in the foreign demand for exports (due to the increase in export prices), which in turn, induces a fall in the production of these goods. As a result, production factors would move from the tradables sector to the non-tradables sector, thereby leading to a decline in the price of non-tradables (relatively to that of tradables), and ultimately to a depreciation of the real exchange rate. Summing-up, the net effect of the terms of trade on the real exchange rate depends on whether the income effect dominates the substitution effect. In the event the income effect dominates, then an improvement in terms of trade is associated with an appreciation of the real exchange rate. Conversely, when the substitution effect dominates, improvements in terms of trade are associated with a depreciation of the real exchange rate. According to Edwards (1988), it is likely that an improvement in the terms of trade would lead to an appreciation of the real exchange rate because the income effect would likely dominate the substitution effect. Clark and MacDonald (1999) and, De Gregorio and Wolf (1994) have reported that terms of trade improvements generate in an appreciation of the real exchange rate. Addison and Bali moune-Lutz (2017) have obtained for Tunisia that terms of trade improvements also induce an appreciation of the real exchange rate. Gantman and Dabós (2018) have uncovered that movements in terms of trade do not affect in a robust way the real exchange rate appreciation.

[1] The group of LDCs has been defined by the United Nations as the poorest and most vulnerable countries in the world to economic and environmental shocks. The criteria used to include countries in this category, and graduate them from this group could be found online at: <https://www.un.org/ohrrls/content/least-developed-countries>

[2] Sposi (2015) has confirmed the apparent similarity in prices of tradables across countries, while at the same time, prices of services in rich countries are systemically higher than those in poor countries.

[3] This is the case because in each country, the relative price of non-tradables represents the inverse of its relative productivity.

## Estimation Approach

At the outset, it is important to emphasize that all regressions performed in this analysis use the two indicators of poverty, with the poverty headcount ratio being the main indicator of poverty, while the poverty gap indicator is used for robustness check. Thus, any reference in the text to "poverty variable" means both poverty headcount ratio indicator, and poverty gap indicator.

In terms of the econometric strategy used to perform the empirical analysis, we proceed as follows. In the first instance, we use the within fixed effects estimator ("FE") to estimate a static specification of model (1), that is, model (1) without the one-period lag of the dependent variable. The outcomes arising from this estimation are reported in columns [1] and [2] of Table 1. The main limitations of this estimation is that it does not address the endogeneity concerns, in particular the bi-

directional causality between regressors and the dependent variable. For example, while in the current study, poverty is expected to influence the real exchange rate, some previous studies have found that the real exchange rate depreciation can contribute to poverty reduction (e.g., Apergis, 2015; Apergis and Arusha, 2018; Diallo, 2007; Elbadawi, 2015). We try to address the endogeneity of the poverty variable in the next regression (although the other potential endogenous variables such as government consumption, public investment, and development aid have not been addressed at this stage of the analysis). Note that the terms of trade variable is considered as exogenous.

We report in columns [2] and [4] of Table 1 the outcomes of the estimation of the same static specification of model (1) by means of the within fixed effects-based instrumental variable approach. Here, only the poverty variable (which is our variable of main interest) is instrumented. Drawing from the literature on the determinants of poverty, we have used two instruments of poverty. These include the population density (denoted "POPDENS" - and to which we have applied the natural logarithm to reduce its skewness) and the total public revenue share of GDP. While high population density can exert negative effects on economies (and induce higher poverty levels), including through increased pressures on scarce resources such as farmland (e.g., Liu and Yamauchi, 2014), it can also increase the intensity of economic activities through agglomeration economies (e.g., Fujita et al., 1999; Krugman, 1996). This can contribute to poverty reduction. Liu and Yamauchi (2014) have found for Indonesia that the effect of the population density on per capita household consumption expenditure is positive if the average educational attainment is high (that is, above junior high school), and negative otherwise. Klasen, and Woltermann (2005) have noted that there is a potential for population density to contribute to poverty reduction. On the other hand, the importance of tax policies (and hence public revenue) for poverty reduction has been emphasized by authors such as Gemmell and Morrissey (2005) and Kanbur et al. (2018). A simple regression (by means of the within fixed effects estimator) of each of the poverty indicators over the variables representing the population density (in Logs) and the share of total public revenue in GDP suggests negative and significant (at the 1% level) coefficients of these two regressors[1].

Next, we utilize the two-step system Generalized Methods of Moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) to estimate the dynamic model (1), as well as all its variants described below. This estimator, which has also been employed in the literature by authors such as Ouattara and Strobl (2008), is well suited for the present analysis. This is not only because it is appropriate for dynamic panel datasets with persistent time series (as it is the case in the current study), but also because it helps handle various types of endogeneity, including the endogeneity problem arising from the bi-directional causality between regressors and the dependent variable. Additionally, the two-step system GMM estimator helps overcome the endogeneity problem that could arise from the correlation between the one-period lag of the dependent variable and the error term if the dynamic model (1) were to be estimated by the FE estimator. The use of this estimator involves estimating a system of equations that combines an equation in levels and an equation in differences (first differences). Lagged values are used as instruments for the first-differenced regressors, and first-differences are utilized as instruments for the equation levels. The two-step system GMM estimator is more efficient than the difference GMM estimator proposed by Arellano and Bond (1991), in particular when variables exhibit a high persistence over time (in which case, the difference GMM estimator can generate weak instruments). Furthermore, it has been shown that the difference GMM estimator magnifies gaps when panel dataset is unbalanced (e.g., Roodman, 2009).

To make sure that the two-step system GMM estimator is a consistent estimator, we perform a set of diagnostic tests. These include the Arellano-Bond test of first-order serial correlation in the error term (denoted AR(1)), the Arellano-Bond test of no second-order autocorrelation in the error term (denoted AR(2)), and the Sargan-Hansen test of over-identifying restrictions (OID), which tests the validity of the instruments used in the regressions. In addition, the absence of the autocorrelation in the error term at the third-order (AR(3)) may indicate that the model does not suffer from an omitted variable bias. The consistency of the two-step system GMM is ensured when the null hypotheses of these tests are not rejected. Following the literature (e.g., Roodman, 2009), we have also made sure that there is no proliferation of instruments in the different estimations of model (1) (described below), as otherwise, the diagnostic tests described above may become powerless. We have used a maximum of 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments so as to meet these requirements of the two-step system GMM estimator in the different regressions.

It is worth pointing out that as our dataset spans the period 1980-2017 (i.e., 38 years), which is a relatively long time-period, we would have used other estimators such as the Common Correlated Effects (CCE) mean group estimator developed by Pesaran (2006), the fully modified ordinary least squares (FMOLS) estimator proposed by Pedroni (1997) and Phillips and Moon (1999), or even the panel dynamic ordinary least squares (PDOLS) approach proposed by Mark et Sul (2003), which is the panel version of the dynamic ordinary least squares estimator that was developed originally for time series datasets developed by Saikkonen (1991) and Stock and Watson (1993). However, these estimators have not been employed in the present analysis because, as noted above, the panel dataset is highly unbalanced, and few countries have data covering a relatively long-time-period (i.e., consecutively several years). Therefore, to fully exploit the available panel dataset, we have employed an alternative estimator, which is the two-step system GMM estimator.

The two-step system GMM estimator has been used to perform the following regressions (based on the dynamic model (1)). First, we estimate the baseline model (1) as it stands. Results of this estimation are presented in columns [1] and [2] of Table 2. Second, we examine how poverty affects the real exchange rate in LDCs versus NonLDCs. To that end, we estimate a specification of model (1) in which we include a dummy, denoted "LDC", which captures the group of LDCs (this dummy takes the value 1 for LDCs, and 0 for NonLDCs), and its interaction with the poverty variable. The outcomes of the estimation of this specification of model (1) with each poverty indicators are reported in columns [3] and [4] of Table 2. Third, in addition to analysing the effect of poverty on the real exchange rate in LDCs versus NonLDCs, we also adopt a more general approach that consists of examining the effect of poverty on the real exchange rate for varying levels of real per capita income. This involves the estimation of another variant of model (1) in which we include the interaction variable between the poverty variable and the real per capita income. The outcomes of this estimation are presented in columns [5] and [6] of Table 2.

Fourth, we test empirically whether the effect of poverty on the real exchange rate depends on countries' level of trade openness. We do this by estimating another variant of the dynamic model (1) in which we introduce both an indicator of trade openness, and the interaction between the latter and the poverty variable. Three different measures of trade openness have been used to that end. The first two measures of trade openness are 'de facto' indicators of trade openness, while the third measure of trade openness is a 'de jure' indicator of trade openness (i.e., a trade policy liberalization indicator). The difference between the 'de jure trade openness' and the 'de fact trade openness' is that the former reflects purely trade policies measures (i.e., tariffs and non-tariffs measures) implemented by policymakers either to liberalize or to restrict their trade regimes. The 'de facto trade openness' is the outcome of various factors of which the 'de jure trade openness' as well as other economic policies, along with geography, history and, domestic and international politics. The first 'de facto indicator' of trade openness is the standard measure of trade openness in the empirical literature, that is, the ratio of the sum of exports and imports in GDP (denoted "OPEN"). The second indicator of the de facto trade openness is the trade openness measure suggested by Squalli and Wilson, 2011) and denoted here "OPENSW". It is calculated as the share of the sum of exports and imports in percentage of GDP (i.e., the standard trade openness indicator), adjusted by the proportion of a country's trade level relative to the average world trade. It provides a better level of countries' level of participation in international trade, than the standard trade openness indicator. Note that in the different regressions that allow examining how poverty affects the real exchange rate through the trade openness channels, we have applied the natural logarithm to the variable "OPENSW" because of its high skewness. Finally, the third trade openness indicator is a de jure measure of trade openness, and indicates the degree of trade policy liberalization in a given country. It is measured by the de jure trade globalisation index, denoted "TRJURE", and computed as a composite index of trade regulations, trade taxes, tariffs, and trade agreements (see Dreher, 2006; Gygli et al. 2019). Results of the estimations of the different specifications of model (1) that allow testing whether the effect of poverty on the real exchange rate translates through the trade openness channel, are reported in Table 3.

Fifth, and finally, we display in Table 4 the estimations' outcomes that help investigate whether the effect of poverty on the real exchange rate passes through the factor productivity channel. These outcomes are obtained by estimating another variant of model (1) in which we introduce both an indicator of labor productivity, as well as its interaction with the poverty variable. We use the ratio of the annual real GDP to the number of workers as a proxy for workers' productivity (i.e., labor productivity). (see for example, Gantman and Dabós, 2018). As a result, the specification of model (1) used to address this question does not contain the real per capita income variable. However, it does contain a trade openness indicator, in

particular "OPEN". This is to ensure that trade openness does not influence the outcomes that we intend to capture here, that is, the effect of poverty on the real exchange rate through the labour productivity channel (given that as shown above, trade openness also influences factor productivity). The sources of variables used to compute the labor productivity indicator are described in Appendix 1.

[1] These estimates can be obtained upon request.

## Discussion Of Empirical Results

The outcomes reported in columns [1] and [2] of Table 1 (based on the FE estimator) suggest positive and significant (at the 1% level) coefficients of the two poverty indicators. This signifies that higher poverty rates (whether it is poverty headcount ratio or poverty gap rate) generate an appreciation of the real exchange rate. A 1-point increase in the index of poverty headcount ratio is associated with a 0.76 ( $= 0.0076 \times 100$ ) percent increase in the real exchange rate. Likewise, a 1-point increase in the index of poverty gap rate is associated with a 1.12 ( $= 0.0112 \times 100$ ) percent increase in the real exchange rate. Estimates of control variables reported in columns [1] and [2] suggest that government consumption, public investment, and terms of trade improvements induce an appreciation of the real exchange rate. However, the real per capita income does not influence significantly the real exchange rate. As also noted above, these estimates are likely biased. Therefore, we turn to estimates reported in columns [3] and [4] of Table 1 (that are based on the instrumental variable approach). We note from these two columns that at the 5% level, the two poverty indicators are associated with an appreciation of the real exchange rate. The p-values related to the Sargan-Hansen statistic in columns [3] and [4] are higher than 0.10 (i.e., than the 10% level), and hence, confirm the validity of the instrumental variables (i.e., the population density and the total public revenue share) used in the regressions. Specially, we obtain that a 1-point increase in the index of poverty headcount ratio is associated with a 2.21 ( $= 0.0221 \times 100$ ) percent increase in the real exchange rate. Similarly, a 1-point increase in the index of poverty headcount ratio is associated with a 2.5 ( $= 0.0252 \times 100$ ) percent increase in the real exchange rate. It is noteworthy that the magnitude of the positive effect of poverty headcount ratio and poverty gap rate on the real exchange rate are similar. Concerning control variables, results reported in columns [3] and [4] indicate that the real per capita income and terms of trade lead to an appreciation of the real exchange rate, but only at the 10% level.

We now turn to the regressions based on the two-step system GMM whose results are presented in Tables 2 to 4. The relevance of considering the dynamic specification of model (1) is shown by the positive and significant coefficient (at the 1% level) of the one-period lag of the dependent variable. This also underlines the state-dependence nature of the real exchange rate, i.e., its persistence over time. On another note, the p-values associated with the statistics of the AR(1) test are zero (i.e., lower than the 10% level of statistical significance); the p-values related to the statistics of the AR(2) and AR(3) tests are higher than 0.10 (i.e., higher than the 10% level of statistical significance). Overall, none of the null hypotheses is rejected. Additionally, the p-values of the statistic related to the OID test are all higher than 0.10. All these outcomes lead us to consider the two-step system GMM estimator as appropriate for conducting the empirical analysis.

We now consider the estimates in Tables 2 to 4. We note from results in columns [1] and [2] of Table 2 that the coefficients of the poverty indicators are positive and significant at the 1% level. While these confirm the findings in Table 1 (notably in terms of statistical significance and direction of the effect of poverty on the real exchange rate), the estimates in these first two columns of Table 2 remain different from those in Table 1, in particular those in columns [3] and [4] of Table 1. Here, a 1-point increase in the index of poverty headcount ratio is associated with a 0.41 ( $= 0.00412 \times 100$ ) percent appreciation of the real exchange rate. Additionally, a 1-point increase in the index of poverty gap rate generates a 0.825 ( $= 0.00825 \times 100$ ) percent appreciation of the real exchange rate. Estimates related to control variables suggest that at least at the 5% level, all regressors induce an appreciation of the real exchange rate. In other words, an appreciation of the real exchange rate is due to a rise in the real per capita income (which tends to confirm the Balassa-Samuelson theory), higher development aid

inflows, higher public investment, higher government consumption, and improvements in terms of trade. These outcomes of control variables confirm those in the other columns of Table 2.

Considering now results in columns [3] and [4] of Table 2, we find that the interaction variables ["POVHC\*LDC"] and ["POVGAP\*LDC"] hold positive and significant (at the 1% level) coefficients. These suggest that a rise in poverty levels exert a higher appreciation of the real exchange rate in LDCs than in NonLDCs. At the same time, the coefficients of each of the poverty indicators are negative and significant at the 1% level. Therefore, we conclude that for LDCs, the net effects of poverty headcount ratio and poverty gap on the real exchange rate are positive, and amount respectively to 0.007 (= 0.00947-0.00263) and 0.012 (= 0.0207-0.00896). At the same time, for NonLDCs, the net effects of poverty headcount ratio and poverty gap on the real exchange rate are negative, and amount respectively to -0.00263 and -0.00896. Hence, a 1-point increase in the index of poverty headcount ratio is associated with a 0.7 percent increase in the real exchange rate in LDCs, and a 0.26 percent decrease in the real exchange rate (i.e., a depreciation of the real exchange rate by 0.26 percent) in NonLDCs. Similarly, a 1-point increase in the index of poverty gap rate generates a 1.2 percent increase in the real exchange rate in LDCs, and a 0.9 percent decrease in the real exchange rate (i.e., a depreciation of the real exchange rate by 0.9 percent) in NonLDCs. Taking together, these outcomes in columns [3] and [4] of Table 2 reveal that poverty tends to be negatively associated with the real exchange rate (or at least the magnitude of its positive effect on the real exchange rate diminishes) as countries' real per capita income improves. This is exactly what the results presented in columns [5] and [6] of Table 2 show. We note from these two columns of Table 2 that the coefficients of "POVHC" and "POVGAP" are positive and significant at the 1% level, while the interaction term of the variables ["POVHC\*Log(GDPC)"] and ["POVGAP\*Log(GDPC)"] are negative and significant at the 1% level. These outcomes suggest that the total effect of poverty (poverty headcount or poverty gap) on the real exchange changes sign after a turning point of the real per capita income. Specially, a rise in poverty headcount ratio is associated with an appreciation of the real exchange rate in countries whose real per capita income is lower than US\$ 1339.4 [= exponential (0.0306/0.00425)], and a depreciation of the real exchange rate in countries whose real per capita income is higher than US\$ 1339.4. At the same time, an increase in the poverty gap induces an appreciation of the real exchange rate in countries whose real per capita income is lower than US\$ 1220.9 [= exponential (0.0629/0.00885)], and a depreciation of the real exchange rate in the other countries (i.e., those with a real per capita income higher than US\$ 1220.9). Additionally, in the group of countries that enjoy a real per capita income higher than US\$ 1339.4 (or than US\$ 1220.9), the magnitude of the negative effect of poverty headcount ratio (or poverty gap) on the real exchange rate becomes greater as the real per capita income improves.

We now examine the results in Table 3. To recall, these results help assess whether the effect of poverty on the real exchange rate depends on the level of trade openness. We note from columns [1] and [2] of this Table that the coefficients of "POVHC" and "POVGAP" are positive and significant at the 1% level, while the variables ["POVHC\*OPEN"] and ["POVGAP\*OPEN"] hold negative and significant coefficients at the 1% level. Therefore, we conclude that for lower levels of trade openness, poverty variables tend to be associated with an appreciation of the real exchange rate, while for higher degrees of trade openness, poverty induces a depreciation of the real exchange rate. In particular, there is a threshold of the variable "OPEN" below which poverty induces an appreciation of the real exchange rate. This threshold is 1.165 (= 0.00444/0.00381) for results in column [1] (i.e., based on the poverty headcount ratio) and 1.233 (= 0.0127/0.0103) for results in column [2] (i.e., based on the poverty gap rate). These thresholds of "OPEN" fall within the range of the values of the latter (i.e., from 0.133 to 2.296 - see Appendix 2). Overall, in countries whose level of trade openness ("OPEN") is lower than 1.17, a rise in the poverty headcount ratio is associated with an appreciation of the real exchange rate. Conversely, countries whose level of trade openness is higher than 1.17, experience a negative effect of the poverty headcount ratio on the real exchange rate (i.e., a depreciation of the real exchange rate). For this set of countries, the poverty headcount ratio exerts a higher depreciating effect on the real exchange rate as the degree of trade openness rises. The same reasoning applies to results based on the poverty gap, with the difference being here that the threshold of "OPEN" above which poverty gap exerts a real exchange rate depreciation effect is 1.233 (or 123.3%).

Results in columns [3] and [4] of Table 3 are quite interesting, and more than confirm the findings in columns [1] and [2] of Table 3. They suggest poverty (i.e., poverty headcount ratio or poverty gap) always induce a depreciation of the real

exchange rate, irrespective of the degree of trade openness ("OPENSW"). Additionally, the magnitude of this real exchange rate depreciation effect of poverty consistently rises as the degree of trade openness improves. These are because across columns [3] and [4] of Table 3, the coefficients of "POVHC" and "POVGAP", as well as the interaction terms related to the variables ["POVHC\*OPENSW"] and ["POVGAP\*OPENSW"] are all negative and significant at the 1% level.

Finally, results in columns [5] and [6] of Table 3 (based on the 'de jure' indicator of trade openness) display patterns that are similar to those in columns [1] and [2] of the same Table. The difference between these results lies in the magnitude of the estimates, given that the level of statistical significance of the estimates are quite similar. Thus, the interpretation of the results provided above for results in columns [1] and [2] of Table 3 applies here as well. The main differences here are that the turning points of the variable "TRJURE" above which poverty headcount ratio and poverty gap are associated with a depreciation of the real exchange rate are given by 0.47 (= 0.00683/0.0146) for results based on the poverty headcount ratio, and 0.51 (= 0.0142/0.0276) for results based on the poverty gap. Note that values of the indicator "TRJURE" range between 0.027 and 0.896. The outcomes of control variables in Table 3 line up with those in Table 2.

The take-home message of Table 3 is that poverty generates a depreciation of the real exchange rate in countries that further liberalize their trade regimes (in particular when the trade policy liberalization degree exceeds a minimum threshold), while in countries that restrict trade policies, it tends to be associated with an appreciation of the real exchange rate. Similarly, countries that enjoy a greater trade openness tend to experience a real exchange rate depreciation effect of poverty (be it poverty headcount ratio or poverty gap), and the magnitude of this depreciation of the real exchange rate increases as the level of trade openness rises. In contrast, countries with a low level of trade openness can experience a positive effect of poverty on the real exchange rate.

Finally, the outcomes presented in Table 4 show positive and significant (at the 1% level) coefficients of "POVHC" and "POVGAP". At the same time, the variables ["POVHC\*PROD"] and ["POVGAP\*PROD"] hold negative and significant coefficients at the 1% level. Against this background, we deduce that poverty variables are associated with a depreciation of the real exchange rate as countries experience a higher labour productivity, and particularly if the latter exceeds a threshold. This threshold of the labour productivity above which poverty becomes negatively associated with the real exchange rate amounts to 17825.05 [= exponential (0.0185/0.00189)] (for results based on the poverty headcount ratio – see column [1]) and 16446.45 [= exponential (0.0432/0.00445)] (for results based on the poverty gap rate - see column [2]). Values of the variable "PROD" range between 1432.176 and 79732.63, and this interval contains the threshold values obtained above. Therefore, poverty induces a depreciation of the real exchange rate only in countries that exhibits a high level of workers' productivity (i.e., higher than 17825.05 for results based on the poverty headcount ratio and higher than 16446.45 for results based on the poverty gap rate).

In a nutshell, Table 4 conveys the message that a rise in poverty levels induces an appreciation of the real exchange rate in countries with low labour productivity, and a depreciation of the real exchange rate in countries with a high labour productivity.

On another note, we find that trade openness is associated with a depreciation of the real exchange rate at the 1% level. The other estimates of control variables are consistent with those in Table 2.

## Further Analysis

Thus far, the analysis has focused on trade openness and factor productivity as the channels through which poverty can influence the real exchange rate. This section examines an additional channel, namely the 'export product diversification', through which poverty can affect the real exchange rate.

In fact, on the one hand, Gnanngnon (2019b) has shown empirically that poverty induces greater export product concentration due in particular to the adverse effect of poverty on human capital and financial resources in the economy. On the other hand, Tran et al. (2015) have examined the direction of the causality between export product diversification and real exchange rate

in the middle-income countries of Asia and Latin America over the period 1995-2013. They have shown empirically that export product diversification can affect the real exchange rate, including through its effect on the productivity gains<sup>[1]</sup> arising from changes in the relative prices of tradables and non-tradables goods, as well as the expansion of the tradable sector. As for the effect through the productivity gains, higher productivity gains in the tradables sector (that arise from greater export product diversification) can lead to higher wages in this sector. The resulting growth of wages in the tradable sector can spread to the rest of the economy, and generate higher inflation. In turn, the latter can result in an appreciation of the real exchange rate. Likewise, the expansion of the tradables sector relatively to the non-tradables one (due to greater export product diversification) would be associated with a lower unit production costs in the tradables sector (e.g., Helpman and Krugman 1986) compared to the non-tradables sector, and induce a depreciation of the real exchange rate. Summing-up, the direction of the effect of export product diversification on the real exchange rate is a priori unknown, as this effect can be positive or negative. Therefore, while we can postulate that the effect of poverty on the real exchange rate can pass through the export product diversification channel, it would be difficult to anticipate theoretically the direction of this effect. Specifically, it is hard at this stage of the analysis to anticipate theoretically how poverty would affect the real exchange rate for varying levels of export product concentration (or export product diversification). The issue is therefore purely empirical.

To assess empirically whether the effect of poverty on the real exchange rate translates through the export product concentration (or export product diversification) channel, we estimate several variants of model (1) (including with each indicator of poverty) that contain the trade openness<sup>[2]</sup> variable "OPEN" as well as an indicator of export product concentration, along with the interaction between the latter and each poverty indicators. We use the overall export product concentration index (based on the Theil index) developed by the International Monetary Fund (IMF) that has used the definitions and methods of Cadot et al. (2011) (see Appendix 1 for details on the computation of this index). We denote "ECI" the overall export product concentration. It has two main components that are also used in the empirical analysis. They are the export product concentration at the intensive margins (denoted "ECIINT") and export product concentration at the extensive margins (denoted "ECIEXT"). In fact, export product diversification can occur at the intensive margins, as well as the extensive margins. Export product diversification at the intensive margins refers to the growth in the exports of already existing products, while export product diversification at the extensive margins refers to the growth in the number of active export lines, via new products and new markets.

Table 5 reports the outcome of the estimation of these variants of model (1) by means of the two-step system GMM technique. At the outset, the estimator passes all diagnostic tests, as shown at the bottom of columns of Table 5. Moreover, the one-period lag of the real exchange rate variable always holds a positive and significant coefficient (at the 1% level) across all columns of Table 5. This confirms once again the importance of considering the dynamic model (1) in the empirical exercise carried out in this section. Taking up the estimates in this Table, we first note that like in Table 4, greater trade openness induces a depreciation of the real exchange rate at the 1% level. The other control variables, including development aid flows, public investment, government consumption, and terms of trade are associated with an appreciation of the real exchange rate. Our estimates of interest in Table 5 suggest that the coefficient of the variable ["POVHC\*ECI"] is positive and significant at the 1% level, and the coefficient of "POVHC" is also positive and significant at the 1% level. Taking together these two results, we conclude that poverty is associated with an appreciation of the real exchange rate, as countries experience a greater export product concentration. This is particularly the case when the level of export product concentration exceeds 2.6 (= 0.00715/0.00279) (values of "ECI" range between 1.7 and 6.4). Hence, countries whose level of export product concentration is higher than 2.6 (this is likely the case for LDCs whose level of export product concentration particularly on primary commodities is high, and even higher than that of NonLDCs) experience a real exchange rate appreciation of poverty headcount ratio. For these countries, the greater the level of export product concentration, the higher is the magnitude of the real exchange rate appreciation due to poverty headcount ratio. In contrast, for countries whose degree of export product concentration is lower than 2.6 (i.e., those that exhibit a high degree of export product diversification), poverty headcount ratio is associated with a depreciation of the real exchange rate. Among these countries, the lower the degree of export product concentration (i.e., the greater the level of export product diversification), the higher is the magnitude of the depreciation effect of the real exchange rate induced by poverty headcount ratio.

The estimations' outcomes in column [2] show a positive and significant (at the 1% level) interaction term of the interaction variable ["POVGAP\*ECI"], while concomitantly, the variable "POVGAP" shows a coefficient that is not significant at the conventional levels. We deduce that poverty gap consistently induces an appreciation of the real exchange rate, regardless of the degree of export product concentration. Moreover, the magnitude of the positive effect of the poverty gap on the real exchange rate appreciation increases as the degree of export product concentration becomes higher. Results in columns [3] and [4] of Table 5 show similar patterns to those in column [2], although the magnitudes of estimates are different (but their levels of statistical significance are similar). We conclude that poverty (poverty headcount ratio or poverty gap rate) consistently induces a greater appreciation of the real exchange rate as the degree of export product concentration at the intensive margins rises.

Finally, the outcomes in columns [5] and [6] show positive and significant coefficients of the variables "POVHC", "POVGAP" and ["POVHC\*ECIEXT"] at the 1% level, and yet a positive coefficient of ["POVGAP\*ECIEXT"] but significant only at the 10% level. These lead us to conclude that regardless of the degree of export product concentration at the extensive margins, poverty headcount ratio always generates an appreciation of the real exchange rate. Additionally, the magnitude of the real exchange rate appreciation (associated with poverty headcount ratio) increases with the degree of export product concentration at the extensive margins. These findings apply also to the outcomes related to poverty gap indicator, but only when we consider results at the 10% level.

Summing-up, the main message conveyed by Table 5 is that poverty induces an appreciation of the real exchange rate in countries that experience a rising level of export product concentration.

[1] The productivity gains from greater export product diversification can arise from learning by doing or technical efficiency through improvement in skills and technology (e.g., Hatemi-j and Irandous, 2001). Some studies (e.g., Rath and Akram, 2017; Xuefeng and Yaşar, 2017) have reported that export diversification can be associated with higher productivity (firms productivity and factor productivity).

[2] We have also introduced the trade openness variable in this model because the theoretical literature has predicted that it is a fundamental determinant of the dynamics of the real exchange rate. Additionally, the inclusion of this variable in this specification of model (1) helps ensure that the effect of poverty on the real exchange rate through the export product diversification channel is independent of the trade openness channel.

## Conclusion

This paper has investigated the effect of poverty on the real exchange rate using a set of 106 countries over the period 1980-2017. The findings indicate that over the full sample, an increase in the poverty level is associated with an appreciation of the real exchange rate. Furthermore, a rise in the poverty rate generates an appreciation of the real exchange rate in LDCs, but a depreciation of the real exchange rate in NonLDCs. More generally, poverty tends to be associated with a depreciation of the real exchange rate as countries' real per capita income improves, in particular when the real per capita exceeds a certain threshold. Interestingly, the estimations' outcomes suggest that the effect of poverty on the real exchange rate translates through the channels of trade openness, labour productivity, and export product concentration. In particular, poverty induces an appreciation of the real exchange rate in countries that experience a low degree of trade openness (or trade policy liberalization), a low level of workers' productivity, and a high degree of export product concentration.

These findings show that not only can the real exchange rate influence the level of poverty, but the latter can also affect the dynamics of the real exchange rate. The exchange rate policy is an important policy tool that policymakers could use to achieve many public policy objectives, for example, to enhance the benefits of international trade for domestic consumers, and strengthen firms' competitiveness in the international trade market. In the absence of financial resources to directly reduce poverty through taxes and transfers, strategies and policies in favour of greater trade openness, enhancing labour

productivity and promoting export product diversification would not only contribute to poverty reduction, but could also allow contribute to the depreciation of the real exchange rate, in particular in the context of rising poverty levels.

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## Tables

**Table 1:** Effect of poverty on the real exchange rate  
*Estimator:* Within Fixed Effects ("FE")

Variables	FE		Instrumental Variables-based FE estimator	
	Log(REER) (1)	Log(REER) (2)	Log(REER) (3)	Log(REER) (4)
POVHC	0.00764*** (0.000628)		0.0221** (0.00932)	
POVGAP		0.0112*** (0.00115)		0.0252** (0.0109)
Log(GDPC)	0.0588 (0.113)	0.0139 (0.115)	0.593*** (0.193)	0.441*** (0.146)
ODA	0.000984 (0.00253)	0.00147 (0.00251)	0.00477 (0.00338)	0.00448* (0.00249)
GFCF	0.242*** (0.0730)	0.204*** (0.0733)	0.0471 (0.519)	-0.101 (0.486)
GCONS	2.360*** (0.560)	2.345*** (0.568)	0.181 (0.574)	0.170 (0.547)
TERMS	0.00140** (0.000683)	0.00128* (0.000672)	0.000978* (0.000513)	0.000797 (0.000562)
Constant	3.501*** (0.880)	3.936*** (0.901)	-0.274 (1.764)	1.274 (1.227)
Observations - Countries	605 - 106	605 - 106	484 - 99	484 - 99
Joint F-statistic (P-value)	175.33 (0.0000)	244.05 (0.0000)	7.56 (0.0000)	9.35 (0.0000)
Within R-squared	0.1173	0.1225	0.1815	0.2530
Sargan-Hansen statistic: Chi-Square statistic (P-value)			1.714 (0.1905)	1.641 (0.2002)

Note: \*p-value < 0,1; \*\*p-value < 0,05; \*\*\*p-value < 0,01. Robust Standard errors are in parenthesis. Time dummies have been included in the regressions. Instruments of poverty indicators used in the regressions are the total public revenue (% GDP), and the population density (in Logs). The regressions of these two instruments on each of the poverty indicator indicate strong significant (at the 1% level) and negative coefficients at the 1% level (results can be obtained upon request).

**Table 2:** Effect of poverty on the real exchange rate  
**Estimator:** Two-Step System GMM

Variables	Log(REER)	Log(REER)	Log(REER)	Log(REER)	Log(REER)	Log(REER)
	(1)	(2)	(3)	(4)	(5)	(6)
Log(REER) <sub>t-1</sub>	0.154*** (0.00928)	0.141*** (0.00784)	0.131*** (0.0108)	0.108*** (0.0104)	0.128*** (0.0115)	0.113*** (0.00901)
POVHC	0.00412*** (0.000551)		-0.00263*** (0.000966)		0.0306*** (0.00324)	
POVGAP		0.00825*** (0.000743)		-0.00896*** (0.00212)		0.0629*** (0.00640)
POVHC*LDC			0.00947*** (0.00122)			
POVGAP*LDC				0.0207*** (0.00240)		
POVHC*Log(GDPC)					-0.00425*** (0.000479)	
POVGAP*Log(GDPC)						-0.00885*** (0.00101)
LDC			-0.426*** (0.0759)	-0.362*** (0.0750)		
Log(GDPC)	0.0781*** (0.0129)	0.0713*** (0.00917)	-0.0148 (0.0217)	-0.0280 (0.0199)	0.112*** (0.0179)	0.106*** (0.0121)
ODA	0.00277** (0.00131)	0.00420*** (0.00133)	0.00252** (0.00120)	0.00342*** (0.00112)	0.00459*** (0.00137)	0.00486*** (0.00148)
GFCF	0.518*** (0.105)	0.517*** (0.107)	0.818*** (0.131)	0.843*** (0.126)	0.819*** (0.100)	0.735*** (0.121)
GCONS	2.165*** (0.232)	2.312*** (0.192)	2.237*** (0.216)	2.494*** (0.216)	2.634*** (0.195)	2.783*** (0.189)
TERMS	0.00128*** (0.000128)	0.00106*** (0.000116)	0.00134*** (0.000141)	0.00114*** (0.000147)	0.00120*** (0.000142)	0.00104*** (0.000135)
Observations - Countries	545 - 106	545 - 106	545 - 106	545 - 106	545 - 106	545 - 106
Number of Instruments	79	79	80	80	80	80
AR1 (P-Value)	0.0394	0.0374	0.0443	0.0579	0.0378	0.0485
AR2 (P-Value)	0.7458	0.7053	0.8571	0.9691	0.9184	0.9815
AR3 (P-Value)	0.7239	0.9310	0.8180	0.9807	0.9009	0.7030
OID (P-Value)	0.3483	0.2745	0.2703	0.3511	0.2555	0.2731

*Note: \*p-value < 0,1; \*\*p-value < 0,05; \*\*\*p-value < 0,01. Robust Standard errors are in parenthesis. The variables "POVHC", "POVGAP", "ODA", "GFCF" and "GCONS" have been considered as endogenous. Time dummies have been included in the regressions. The latter have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments.*

**Table 3:** Effect of poverty on the real exchange rate for varying levels of trade openness

**Estimator:** Two-Step System GMM

Variables	Log(REER)	Log(REER)	Log(REER)	Log(REER)	Log(REER)	Log(REER)
	(1)	(2)	(3)	(4)	(5)	(6)
Log(REER) <sub>t-1</sub>	0.150*** (0.00920)	0.132*** (0.00888)	0.139*** (0.00783)	0.124*** (0.00814)	0.156*** (0.00781)	0.156*** (0.00592)
POVHC	0.00444*** (0.000610)		-0.00979*** (0.00187)		0.00683*** (0.000706)	
POVGAP		0.0127*** (0.000960)		-0.0242*** (0.00453)		0.0142*** (0.00125)
POVHC*OPEN	-0.00381*** (0.000515)					
POVGAP*OPEN		-0.0103*** (0.00102)				
POVHC*Log(OPENSW)			-0.00141*** (0.000204)			
POVGAP*Log(OPENSW)				-0.00336*** (0.000496)		
POVHC*TRJURE					-0.0146*** (0.00136)	
POVGAP*TRJURE						-0.0276*** (0.00364)
OPEN	-0.134*** (0.0219)	-0.114*** (0.0211)				
Log(OPENSW)			0.0625*** (0.0104)	0.0590*** (0.0102)		
TRJURE					0.329*** (0.0458)	0.191*** (0.0440)
Log(GDPC)	0.0686*** (0.0104)	0.0819*** (0.00867)	0.0399*** (0.0143)	0.0442*** (0.0133)	0.0170 (0.0131)	0.0332*** (0.00999)
ODA	0.00257*** (0.000586)	0.00381*** (0.000576)	0.00351*** (0.000715)	0.00429*** (0.000769)	0.000796 (0.00108)	0.000749 (0.00111)
GFCF	0.790*** (0.107)	0.974*** (0.119)	0.562*** (0.0934)	0.635*** (0.0979)	0.510*** (0.0836)	0.385*** (0.0992)
GCONS	2.415*** (0.162)	2.596*** (0.187)	1.651*** (0.175)	1.613*** (0.185)	1.934*** (0.141)	2.099*** (0.112)
TERMS	0.00119*** (9.56e-05)	0.000932*** (9.65e-05)	0.00120*** (0.000131)	0.00106*** (0.000126)	0.00149*** (0.000116)	0.00137*** (0.000109)
Observations - Countries	545 - 106	545 - 106	545 - 106	545 - 106	536 - 104	536 - 104
Number of Instruments	88	88	88	88	88	88
AR1 (P-Value)	0.0267	0.0325	0.0347	0.0492	0.0378	0.0338
AR2 (P-Value)	0.3743	0.4852	0.8257	0.9368	0.9616	0.9246
AR3 (P-Value)	0.9021	0.7838	0.7508	0.8562	0.8603	0.9529
OID (P-Value)	0.1137	0.1395	0.2083	0.2656	0.3039	0.3184

Note: \*p-value < 0,1; \*\*p-value < 0,05; \*\*\*p-value < 0,01. Robust Standard errors are in parenthesis. The variables "POVHC", "POVGAP", "ODA", "GFCF", "GCONS" "OPEN", "OPENSW", "TRJURE" and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The latter have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments.

**Table 4:** Effect of poverty on the real exchange rate for varying levels of factor productivity  
**Estimator:** Two-Step System GMM

Variables	Log(REER) (1)	Log(REER) (2)
Log(REER) <sub>t-1</sub>	0.154*** (0.0103)	0.139*** (0.00869)
POVHC	0.0185*** (0.00271)	
POVGAP		0.0432*** (0.00397)
POVHC*Log(PROD)	-0.00189*** (0.000315)	
POVGAP*Log(PROD)		-0.00445*** (0.000493)
Log(PROD)	0.0924*** (0.0155)	0.105*** (0.0108)
OPEN	-0.176*** (0.0209)	-0.202*** (0.0176)
ODA	0.00398** (0.00155)	0.00475*** (0.00131)
GFCF	0.529*** (0.0969)	0.573*** (0.0969)
GCONS	2.829*** (0.204)	3.044*** (0.233)
TERMS	0.00115*** (0.000141)	0.000940*** (0.000146)
Observations - Countries	535 - 102	535 - 102
Number of Instruments	88	88
AR1 (P-Value)	0.0407	0.0499
AR2 (P-Value)	0.6269	0.7086
AR3 (P-Value)	0.9889	0.7299
OID (P-Value)	0.2303	0.2349

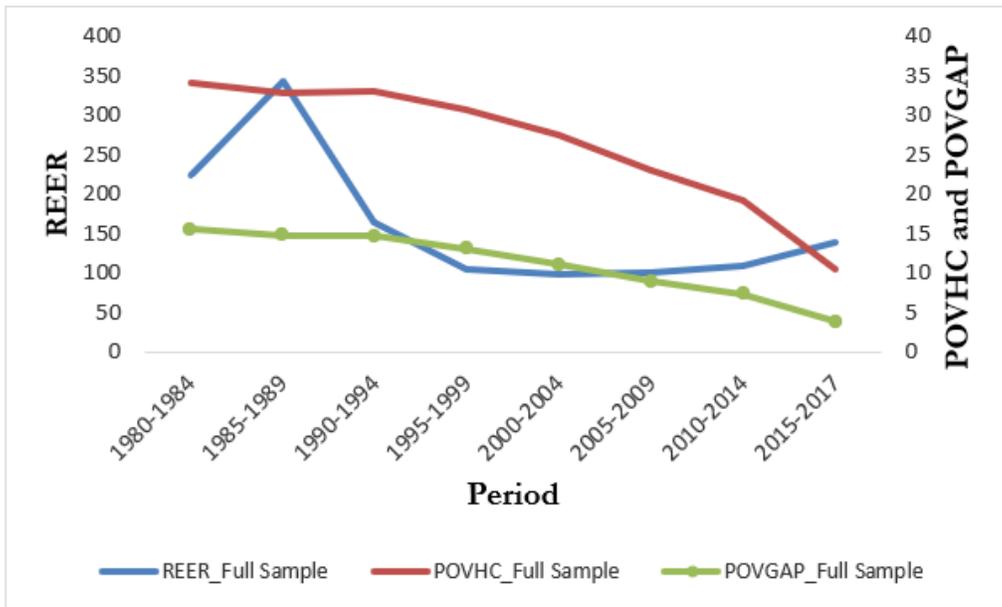
*Note: \*p-value < 0,1; \*\*p-value < 0,05; \*\*\*p-value < 0,01. Robust Standard errors are in parenthesis. The variables "POVHC", "POVGAP", "ODA", "GFCF", "GCONS" "OPEN", "PRODUCT", and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The latter have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments.*

**Table 5:** Effect of poverty on the real exchange rate for varying levels of export product concentration  
**Estimator:** Two-Step System GMM

Variables	Log(REER)	Log(REER)	Log(REER)	Log(REER)	Log(REER)	Log(REER)
	(1)	(2)	(3)	(4)	(5)	(6)
Log(REER) <sub>t-1</sub>	0.129*** (0.00869)	0.116*** (0.0118)	0.134*** (0.0122)	0.121*** (0.0109)	0.126*** (0.0109)	0.108*** (0.0106)
POVHC	-0.00715*** (0.00185)		-0.00146 (0.00193)		0.00199*** (0.000716)	
POVGAP		0.00177 (0.00294)		0.000192 (0.00282)		0.00847*** (0.000933)
POVHC*ECI	0.00279*** (0.000386)					
POVGAP*ECI		0.00192*** (0.000584)				
POVHC*ECIINT			0.00238*** (0.000489)			
POVGAP*ECIINT				0.00328*** (0.000753)		
POVHC*ECIEXT					0.00233*** (0.000448)	
POVGAP*ECIEXT						0.00123* (0.000704)
ECI	-0.0617*** (0.0118)	-0.0133 (0.0109)				
ECIINT			-0.0615*** (0.0168)	-0.0280** (0.0135)		
ECIEXT					-0.0856*** (0.0304)	-0.0362 (0.0227)
Log(GDPC)	0.0776*** (0.0138)	0.0942*** (0.0110)	0.127*** (0.0156)	0.109*** (0.0101)	0.0828*** (0.0165)	0.0829*** (0.0114)
OPEN	-0.277*** (0.0286)	-0.292*** (0.0326)	-0.261*** (0.0345)	-0.258*** (0.0314)	-0.262*** (0.0238)	-0.260*** (0.0242)
ODA	-0.00427** (0.00204)	-0.00521*** (0.00186)	-0.00231 (0.00224)	-0.00149 (0.00176)	-0.00322* (0.00169)	-0.00343** (0.00163)
GFCF	1.074*** (0.102)	1.086*** (0.119)	1.284*** (0.127)	1.176*** (0.117)	0.792*** (0.0898)	0.799*** (0.0856)
GCONS	2.681*** (0.177)	3.049*** (0.200)	3.026*** (0.197)	3.061*** (0.202)	2.903*** (0.170)	3.058*** (0.198)
TERMS	0.00137*** (0.000109)	0.00106*** (0.000106)	0.00152*** (0.000139)	0.00124*** (0.000135)	0.00131*** (0.000102)	0.00108*** (0.000108)
Observations - Countries	480 - 106	480 - 106	480 - 106	480 - 106	480 - 106	480 - 106
Number of Instruments	89	84	84	84	84	84
AR1 (P-Value)	0.0388	0.0504	0.0298	0.0507	0.0427	0.0478
AR2 (P-Value)	0.7653	0.8656	0.5791	0.6948	0.8303	0.7052
AR3 (P-Value)	0.7434	0.5408	0.6215	0.4560	0.7238	0.5212
Sargan (P-Value)	0.1159	0.1448	0.1160	0.1584	0.100	0.1360

Note: \*p-value < 0,1; \*\*p-value < 0,05; \*\*\*p-value < 0,01. Robust Standard errors are in parenthesis. The variables "POVHC", "POVGAP", "ECI", "ODA", "GFCF", "GCONS" "OPEN", and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The latter have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments.

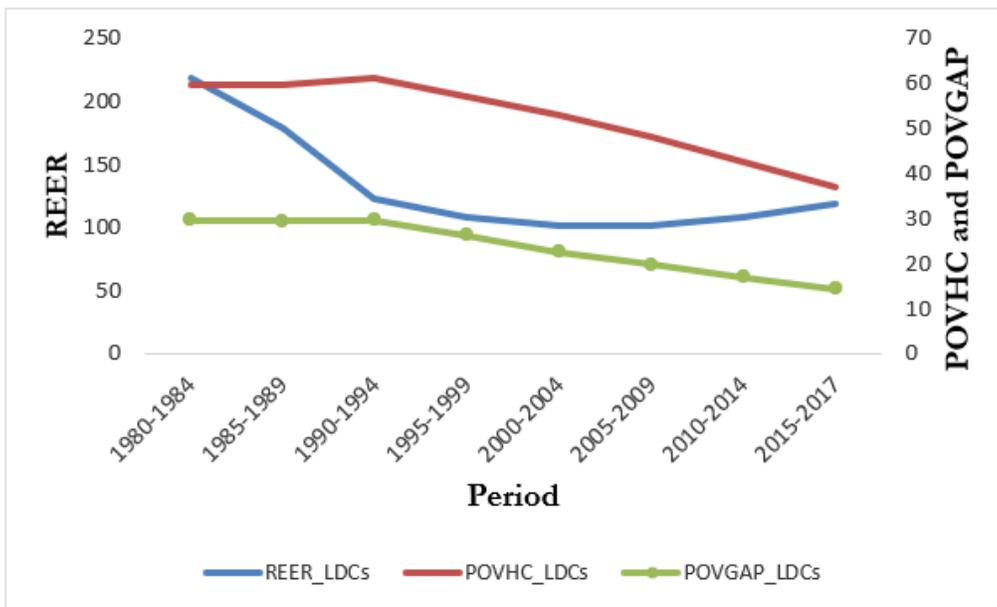
## Figures



Source: Author

Figure 1

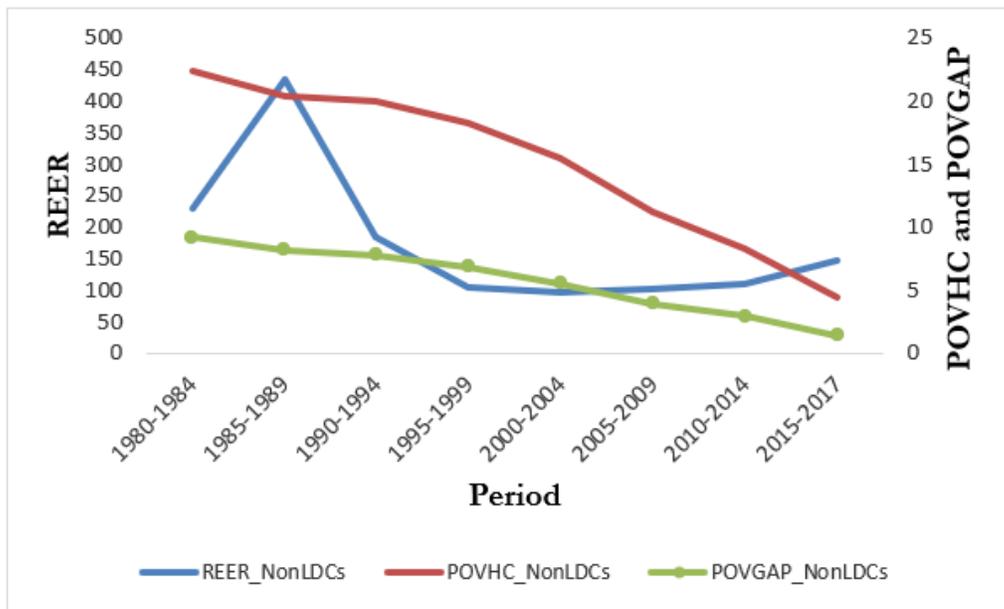
Poverty and Real Exchange Rate\_Over the full sample



Source: Author

Figure 2

Poverty and Real Exchange Rate\_Over the sub-sample of LDCs



Source: Author

**Figure 3**

Poverty and Real Exchange Rate\_Over the sub-sample of NonLDCs

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix1final.jpg](#)
- [Appendix2.png](#)
- [Appendix3final.jpg](#)