Real Exchange Rate and Services Export Diversification

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Abstract
The relationship between real exchange rate and services export diversification is at the heart of this study. The analysis is performed using a sample of 125 countries over the period 1985-2014, and the two-step system Generalized Methods of Moments (GMM) approach. It shows that for both high income countries and developing countries, real exchange rate depreciations promote services export diversification and increase the total number of services export lines. These findings highlight the strong importance of real exchange policies in promoting services export diversification in high-income countries and developing countries alike.

Keywords: Real Effective Exchange Rate; Services Export Diversification.
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1. Introduction

The literature has now established that exchange rate policies play a critical role on countries’ export performance, including their manufacturing export performance (e.g., Elbadawi, 2002; Grobar, 1993; Fung and Liu, 2009; Hunegnaw, 2017; Mao et al., 2019; Nouira et al., 2011; Sekkat and Varoudakis, 2000) and export product diversification (e.g., Agosin et al., 2012; Kwasi, 2018; Tran et al., 2017; Sekkat, 2016). Having been neglected for several decades and considered as a residual sector of the economy, the services sector has recently gained a strong attention of policymakers, researchers and scholars, in part due to the globalization and the rapid development of tools of information and communication technologies. Specifically, recent years have witnessed a growing interest on the factors underpinning the development of trade in services, and particularly services exports. Some of the studies on the determinants of services exports have looked at the relationship between the real exchange rate and services exports, and reported that an appreciation of the exchange rate influences negatively services exports, and even more than goods exports, including manufacturing exports (e.g., Abeyesinghe and Yeok, 1998; Baggs et al., 2010; Eichengreen and Gupta, 2013; Fung, 2008; Smith, 2004). At the same time, some few studies (e.g., Agosin et al., 2012; Kwasi, 2018; Tran et al., 2017; Sekkat, 2016) concerning the effect of exchange rate policies on export product diversification and provided empirical evidence that exchange rate appreciations prevent countries, including developing ones from diversifying their export product baskets. However, to the best of our knowledge, little attention has been paid to the relationship between the exchange rate and services export diversification. In fact, we are no aware of any empirical analyses on this topic, let alone any study on the determinants of services export diversification. The current paper aims to fill this gap in the literature by investigating empirically the effect of the real exchange rate on services export diversification.

The growing importance of the services sector for countries’ participation in international trade and more generally for their economic growth and development has been underlined by many recent studies (e.g., Adlung, 2007; Anand et al. 2012; Fiorini, and Hoekman, 2018; François and Hoekman, 2010; Hoekman, 2017; Hoekman and Mattoo, 2008; Hoekman and Shepherd, 2017; Lanz and Maurer, 2015). The increasing importance that international organizations have been attaching to the services sector is epitomized by the fact that the World Trade Organization (WTO) has devoted its 2019 trade report (WTO, 2019) to the issue of trade in services. The report entitled "The future of services trade" aims to contribute to deepening the understanding on trade in services. It uses new trade in services data to present the current landscape on trade in services as well as how it will evolve in the near future, particularly in light of the rapid development of technologies that facilitate the tradability of services. In the same spirit, the current article also aims to help better understand the underlying factors of services exports, in particular services export diversification, including by focusing on how real exchange rate influences services export diversification. The empirical analysis covers 125 countries over the period 1985-2014, and reveals that real effective exchange rate depreciations strongly promote services export diversification both in high income countries as well as in developing countries.

The rest of the article is organized as follows. Section 2 discusses the avenues through which real exchange rate could influence services export diversification. Section 3 presents the model specification and the econometric methodology for the empirical analysis. Section 4 discusses empirical results, and Section 5 concludes.
2. Theoretical motivation - discussion on the effect of the real exchange rate on services export diversification

At the outset, we would like to note that the effect of real exchange rate on services export diversification would take place through its effects on services export volumes. If movements of real exchange rate induce a rise in export of existing services 'products' (i.e., a rise in services exports at the intensive margins), then they would be associated with services export concentration. In contrast, if these real exchange movements promote the development of new services export 'products' (i.e., a rise in services exports at the extensive margins), then they would induce services export diversification.

The conventional literature (e.g. Guzman et al., 2018; Freund and Pierola, 2012; Nouira et al., 2011; Rodrik, 2008, 2009) has usually argued that a competitive and a stable real exchange rate should be part of the portfolio of instruments aiming at diversification production and exports, and promoting macroeconomic stability and development. Further to an appreciation of the home currency, the increased competition faced by domestic firms in both domestic and foreign markets could lead some firms (notably those with a relatively high productivity) to reduce their mark-up so as to maintain their competitiveness. This aligns with the argument of many economists that in general, exports depend in varying degrees on imported raw materials and imported intermediate inputs (e.g., Abeyasinghe and Yeek, 1998; Athukorala, 1991; Athukorala and Menon, 1994), so that when exporters face an appreciation of the currency, they reduce their profit mark-up so as to maintain in varying degrees their competitiveness in world markets. The prices decline associated with the increased competition could induce lower profits for less productive firms that could exit the international markets (e.g., Baggs et al., 2010; Fung, 2008; Melitz and Ottaviano, 2008). Baldwin and Krugman (1989) have underscored that there are significant implications of exchange rate movements for firms' entry and exit. Melitz (2003) has suggested that a depreciation of the home currency should increase the rate of new exporters' entry into the market only when the fixed entry costs are low, because if expected gains in the international market are lower than fixed entry costs, firms would opt for staying out of the international markets. Furthermore, authors such as Baggs et al. (2010) and Fung (2008) have shown that an appreciation of the home currency could have two opposing effects on the domestic firms' sales in both the domestic and international markets. On the one hand, some firms could exit the market because of a substantial decline of their profits, and hence provide surviving firms in the market with a higher market share. As a result, the effect of the home currency appreciation on the survival of domestic firms depends on the direction and the relative magnitude of the changes in exports (and domestic sales): the lower the firms' exit rate (or the smaller the number of exiting firms compared to the incumbent firms), the higher is the magnitude of the expected adverse effect of the home currency appreciation on surviving firms' sales. On the other hand, the appreciation of the domestic currency could be associated with higher sales of surviving firms in the context of high exit rates or large number of exiting firms, and where market share gains of surviving firms (due to the death of some firms) exceed the fall in sales induced by the enhanced competition associated with the appreciation of the domestic currency (see Baggs et al., 2010). The lines of arguments developed above show that real exchange rate appreciation could positively or negatively influence services export volumes and hence be positively associated either with services export concentration or services export diversification.
On the other hand, Guzman et al. (2018) have stressed that a competitive real exchange rate is desirable only under specific conditions. Specifically, the authors have demonstrated theoretically two conditions under which a competitive real exchange rate is a constrained optimal policy. The first condition refers to the situation where there are no constraints on subsidies to the tradable sector. In such a case, optimal intervention entails the appreciations of the real exchange rate. This involves for the government to identify the learning spillovers related to each type of activity and to use subsidies (financed by lump-sum taxes) and transfers to promote the production and exports of the tradable products that features learning spillovers. This first best policy response would require an appreciation of the real exchange rate (see also Irskhoki and Moll, 2014). The second condition refers to the situation where the use of subsidies is constrained by international agreements (as it is the case for goods in the Agreement on Subsidies and Countervailing Measures of the World Trade Organization – WTO). Under this condition, the optimal policy entails a depreciation of the real exchange rate and the implementation of a set of taxes on tradable products that have a low or no learning benefits. Such an approach involves the creation of a system of multiple exchange rates. As subsidies in favour of export services are for the time being not disciplined in WTO Agreements (see for example, Grosso, 2008), countries, including developing ones could use them to stimulate the production and exports of services that feature learning spillovers (this particularly the case for modern services). According to Grosso (2008), export subsidies for services have been used by many developed and developing countries to support a wide range of services sectors. In this case, an appreciation of the real exchange rate would be the best policy option, as it could expand services exports through the development of new services export products (and hence lead to services export diversification) or through the expansion of production or exports of exciting services products (this would be associated with the rise in the degree of services exports concentration).

Another strand of the literature has also argued that the net effect of a domestic currency depreciation (or devaluation) on the tradable sector (and eventually on export diversification) would depend on the balance between contrasting effects (e.g., Ramzi, 2013; Wondemu and Potts, 2016). On the one hand, as noted above a domestic currency depreciation (or devaluation) could result in higher profitability of the tradable sector, investment, employment and export diversification that involves new tradable products (including services). On the other hand, a domestic currency depreciation could also lead to higher real wages (induced by the rise in employment in the tradable sector), which could counteract its expected expansionary effect on the tradable sector (including both goods and services). At the same time, the expected expansionary effect could dominate the negative real wages effects if the profits in the tradable sector induced by the depreciation of the domestic currency translates into higher accumulation of capital and learning and hence technological progress. Furthermore, the inflationary effects of a depreciation of the home currency could reduce the resources available for domestic investment, which lowers (increases) the possibilities for firms as well as for the government to invest in the strengthening of productive capacities and the supply capacity of the economy. Guzman et al. (2018) have noted the existence of some trade-offs in the implementation of competitive real exchange rate policies. This is because while a more depreciated exchange rate induces higher costs of imported inputs and capital goods (although Baumol, 2017 has indicated that import share could rise after a devaluation), the rise in the domestic content of the production of tradable goods would help improve the profitability of the tradable sector in the context of a real exchange rate depreciation. Furthermore, as the development of sectors may require a long time for firms to
learn so as to become competitive internationally, the costs of learning will increase with a more depreciated real exchange rate if learning entails imported inputs (Guzman et al. 2018: p55). To some extent, similar views have been shared by Abeysinghe and Yeok (1998) who have noted that under certain circumstances (or a combination of circumstances), exports volumes could increase in the context of currency appreciation. This is the case if (i) the import content of exports is relatively large, which significantly reduces the negative effect of the currency appreciation on exports. In fact, export and import prices become closer as the import content of exports rises (or when domestic value added of exports is low), which lowers the negative effect of currency appreciation on exports. This means that as services have a relatively lower content of imported inputs than goods, including manufacturing products, they could be more affected by a currency appreciation than goods would be; (ii) external demand has been on rise as it could mitigate and even more than compensate the negative effect on services exports volumes of the currency appreciation. (iii) productivity increases (a rise in productivity could counteract the adverse effects on services export volumes of a currency appreciation); and (iv) pricing-to-market policies counter the adverse effects of currency appreciation. Once again, these lines of arguments do not allow us to anticipate theoretically whether a real exchange rate appreciation (or depreciation) would lead to higher (or lower volumes) whether this would hence translate into higher level of services export concentration or greater services export diversification.

The few existing studies on the services exports effects of the real effective exchange rate tends to report a negative effect of real exchange rate on services exports. For example, Smith (2004) has obtained that different export sectors respond differently to the same exchange rate movements. In particular, they have uncovered that the volumes of services exports (which include tourism) are more sensitive to exchange rate movements than export volumes from the agricultural sector. Sahoo and Dash (2014) have found a long-run negative effect of real exchange rate appreciations on modern services exports in India. Baggs et al. (2010) have examined the effect of the appreciation of the Canadian dollar on the probability of survival, sales, and profitability of Canadian firms. They have found evidence that real appreciations (depreciations) of the Canadian dollar reduce (increase) firms' probability of survival, sales, and profitability. Furthermore, their study has shown that while the magnitude of exchange on firms' sales is the same for both services and manufacturing firms, the magnitude of the profits effects of the exchange rate is higher for manufacturing firms. The effect of the exchange rate appreciation on the probability of firms to survive is larger among services firms. Eichengreen and Gupta (2013) have found empirical evidence that real exchange rate appreciations influence negatively and significantly both services and merchandise exports, but the negative effect is more pronounced for services exports, notably modern services exports than for merchandise exports. These effects apply to developing countries and developed countries alike in their full sample of 66 countries. The authors have proposed several explanations for the differences in services exports and merchandise exports responses to the real exchange rate appreciations. These include the eventual fewer imported inputs content of services exports, the possible lower fixed costs of entry into the services sectors and the possible high elasticity price of the demand for services exports. The empirical findings of Abeysinghe and Yeok (1998) are in line with those of Eichengreen and Gupta (2013). These authors have obtained for Singapore that because of their very low import content, services exports have suffered from currency appreciation, including more than merchandise exports. Based on these arguments, one could argue that real exchange rate depreciations would be associated with higher services exports, which could
translate into a higher services export concentration or greater services export diversification. However, even though real exchange rate appreciations induce higher negative effects on services exports (notably modern services exports) than on merchandise exports, it is still possible that firms (including the less productive ones) that face lower entry costs into the services (modern services) sectors compared to the merchandise sectors, they may decide to shift their resources to the services sector, and invest either in new services activities (which would lead to services export diversification) or on existing services activities in which the country enjoys a comparative advantage in the international market (this would generate greater services export concentration).

In addition, in the context of real exchange appreciations, new firms that aim to invest in the tradable sector might opt for entering into the services sector (given the relatively lower entry costs in this sector) and invest on existing activities or on new services export activities. The rationale for this reasoning lies on the findings by Baggs et al. (2010) that firms’ probability of surviving after real appreciations of the domestic currency is higher among services firms than among firms operating in the merchandise sectors. Even surviving firms in the services sectors that reduce their mark-up so as to maintain their competitiveness in the context of real exchange rate appreciations (Abeyasinghe and Yeok, 1998; Athukorala, 1991; Athukorala and Menon, 1994; Baggs et al. 2010) might decide to explore new services export items so as to regain a higher level of competitiveness in the international trade markets. In this case, real exchange rate appreciations would be associated with greater services export diversification. The argument for a positive effect of real exchange rate appreciations on services export diversification also holds if as noted by Abeyasinghe and Yeok (1998), in the context of such exchange rate appreciations, the import inputs content of services export increases; the external demand increases; productivity improves, and firms adopt pricing-to-market policies counter the adverse effects of currency appreciation.

In light of the review documented above, it is difficult to anticipate from a theoretically perspective the direction in which the real exchange rate appreciation (or depreciation) would influence services export diversification.

3. Model specification and econometric strategy

3.1 Model specification

The literature has not yet provided a unified theoretical framework on the determinants of services export diversification. However, a number of studies (e.g., Kimura and Lee, 2006; Nyahoho, 2010; van der Marel, 2012) have shown that the international trade theory that applies to trade in goods could also apply to trade in services. This has led the studies on the determinants of services exports to draw on the literature on the determinants of goods exports. In light of this, the current study relies on existing empirical studies on the determinants of export product diversification (e.g., Adityaa and Acharyya, 2015; Agosin et al., 2012; Amighini and Sanfilipo, 2014; Zhu and Fu, 2013; Gnangnon, 2019a, 2019b; Gnangnon and Roberts, 2017; Hausmann et al., 2007; Kim, 2019; Osakwe et al., 2018; Parteka and Tamberi, 2013; and Zhu and Fu, 2013) and to some extent on Anand et al. (2012) to investigate how development influences services export diversification and to what extent the real exchange rate matters for this relationship. Thus, we postulate the following model specification:
\[ SEC_{it} = \beta_0 + \beta_1 SEC_{it-1} + \beta_2 \log(REER)_{it} + \beta_3 \log(GDPC)_{it} + \beta_4 TRPOL_{it} + \beta_5 EDU_{it} + \beta_6 \log(FIND\_EDV)_{it} + \beta_7 POLITY2_{it} + \beta_8 \log(POP)_{it} + \mu_i + \lambda_t + \omega_{it} \quad (1) \]

where the subscript \( i \) represents a country recipient of given country, and \( t \) indicates the time-period. The unbalanced panel dataset covers 125 countries and the period 1985-2014, based on data availability. The analysis has used two sub-samples, namely High-Income Countries\(^2\) (HICs) and other countries in the full sample (denoted "NonHICs"), which we could also refer to as "Developing countries”. The sample contains 36 countries classified as HICs and 89 developing countries. The effect of business cycles on variables has been smoothed out by using non-overlapping sub-periods of 5-year average data, i.e., the sub-periods 1985-1989; 1990-1994; 1995-1999; 2000-2004; 2005-2009; and 2010-2014. \( \beta_0 \) to \( \beta_8 \) are parameters to be estimated. \( \mu_i \) represent countries' fixed effects (unobservable time invariant characteristics that could influence services export diversification path); \( \omega_{it} \) is a well-behaving error-term. \( \lambda_t \) are time dummies that represent global shocks affecting together all countries’ services export diversification path. The description and source of variables included in model (1) are provided in Appendix 1. Appendix 2 shows descriptive statistics on these variables and Appendix 3 presents the list of countries used in the analysis.

The dependent variable "SEC" is the measure of the level of services export concentration. The latter is measured using three indicators drawn from the empirical work on the determinants of export product diversification (e.g., Agosin et al., 2012; Cadot et al., 2011). The first indicator is the Herfindahl index (also referred sometimes to the Hirschman-Herfindahl index), which is the most commonly used indicator for measuring concentration. The computed Hirschman-Herfindahl index of services export concentration is denoted "HHI". The second index of services export concentration is the Theil index, which is denoted "THEIL". The third indicator used in the analysis is the total number of services export lines (denoted "LINES").

The HHI indicator has been computed as the sum of the squared shares of each export line \( k \) (with amount exported) in total services exports, using the formula: \[ HHI = \sum_{k=1}^{n} s_k^2 \cdot \frac{1}{n} \] where \( s_k = \frac{x_k}{\sum_{k=1}^{n} x_k} \) represents the share of export line \( k \) (with amount exported \( x_k \)) in total services exports: \( x_k \) stands for the amount of services exports associated with the service line "k"; \( n \) represents the total number of the services export lines (\( k \)) and \( n = \sum_{k=1}^{n} k \). The computed indicator has been normalized so that its values range between 0 and 100. Higher values of this index indicate greater services export concentration, while lower values show higher level of services export diversification. The indicator "THEIL" has been computed as follows: \[ THEIL = \frac{1}{n} \sum_{k=1}^{n} \frac{x_k}{\mu} \ln \left( \frac{x_k}{\mu} \right), \] where \( \mu = \frac{1}{n} \sum_{k=1}^{n} x_k \); and \( n \) and \( x_k \) are as defined above. The indicator LINES is such that \( LINES = n = \sum_{k=1}^{n} k \). The computed indicators HHI and THEIL have been normalized so that their values range between 0 and 100. Higher values of each of these two indices reflect greater services export concentration, while lower values show higher level of services export diversification. The database developed by the International Monetary Fund (IMF) (see Loungani et al., 2017) has been used to compute these indices. This database covers 11 major sectors of services (categories of services). Specifically, we have used disaggregated data on services exports at the 2-digit level to compute these three indicators. Note that the analysis has considered

\( ^2 \) The list of these countries is derived from the World Bank classification of countries.
only commercial services exports (this, therefore, excludes government goods and services exports). The lag of the dependent variable has been introduced as a regressor in model (1) for several reasons. First, it helps capture the existence of a state-dependence in recipient-countries' services export diversification path. Second, this approach follows from the empirical literature on the determinants of export product diversification, where the latter has been shown to exhibit a strong persistence over time, and we believe that this also applies to services export diversification. Third, the use of the lag of the dependent variable also allows to control for omitted variables in the model specification.

The variable "REER" represents the second variable of key interest in the analysis, and stands for the measure of the real effective exchange rate. It has been extracted from the Bruegel database (see details in Appendix 1). It has been computed using a nominal effective exchange rate based on 65 trading partners. An increase in the index indicates an appreciation of the real effective exchange rate, i.e., an appreciation of the home currency against the basket of currencies of trading partners. We have applied the natural logarithm to this variable so as to reduce its high skewness.

Control variables include the real per capita income (denoted "GDPC"), the population size (denoted "POP"), the level of trade policy liberalization (denoted "TRPOL"), the level of human capital accumulation (denoted "EDU"), the depth of financial development (denoted "FINDEV") and a proxy for the institutional quality (denoted "POLITY2"). The real per capita income variable is a proxy for countries' development level, and also captures the existence of economies of scale (e.g., Marvasti, 1994; Li et al., 2005; Nyahooho, 2010; Sapir and Lutz, 1981; Schulze, 1999). The trade theory (that incorporates monopolistic competition) developed by Krugman (1981) has shown that economies of scale is one of the main determinants of trade in goods and services. The existence of economies of scale could lead to higher demand for new services and hence induce services production and export diversification. The population size variable complements the real per capita income in capturing countries' size. Bigger states likely enjoy a larger share of services in GDP (e.g., Goswami et al., 2012) because a large number of services cater directly to the final consumer. As a result, a rise in the population size induces higher demand for services, and the expansion of the services sector, which could result either in services production and export concentration or services production and export diversification. Trade policy liberalization could promote services export diversification via the positive spillovers related to the knowledge and technology embodied in the imported goods and services, the encouragement of research, and development activities and the provision of greater access to investment and intermediate goods (e.g., Agosin et al., 2012; Grossman and Helpman, 1991; Coe and Helpman 1995; Costas et al., 2008; Yanikkaya, 2003) as well as the possibility for market extension (e.g., Dennis and Shepherd, 2011). Meanwhile, greater trade policy liberalization could be associated with greater services export concentration if it leads firms to further develop the goods and services activities in which they have a comparative advantage. Similarly, a better educated workforce could be associated with services export diversification if this workforce is employed to develop new exportable services items (see Agosin et al. 2012 for the case of export product diversification). In contrast, the educated workforce is employed to expand the production and export of existing services activities, then higher education would result in a higher degree of services export concentration. Greater financial development could lead to services export concentration if firms concentrate their financial resources on existing goods and services activities where the economy already enjoys a competitive advantage. In contrast, if financing-dependent firms use the financial resources to
develop more differentiated products and services, financial development would be positively associated with services export diversification (see also Agosin et al., 2012 for the case of the effect of financial development on export product diversification). Institutional quality could also play an important role in services export diversification, including through the promotion of trade in goods, notably manufacturing exports and export product diversification (e.g., Amighini and Sanfilipo, 2014; Faruq, 2011; Hausmann et al., 2007; Zhu and Fu, 2013). In light of this, we could expect better institutional and governance quality to result in services export diversification if they permit trading firms to develop new goods and services activities. Conversely, improvement in the quality of institutions and governance could generate services export concentration if such an improvement results in the expansion of existing goods and services activities.

A simple correlation pattern between real exchange rate and each of the three indicators of services export concentration is provided in Figure 1 for the full sample and in Figure 2 for the two sub-samples, HICs and developing countries. The graphs in Figure 1 show a positive correlation between real effective exchange rate and services export concentration. Similar correlation patterns are observed in Figure 2 for developing countries. However, for HICs, the real exchange rate is negatively correlated with HHI, but its correlation pattern with THEIL and LINES indicators remain unclear.

3.2. Estimation strategy
The empirical analysis draws from the empirical studies on the determinants of export product diversification (e.g., Agosin et al., 2012; Amighini and Sanfilipo, 2014; Zhu and Fu, 2013; Gnangnon, 2019a, 2019b; Gnangnon and Roberts, 2017; Kim, 2019; Osakwe et al., 2018) and uses the two-step system Generalized Methods of Moments 3 (GMM) estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). In the current analysis, we consider the variables "REER", "EDU", "TRPOL", "GDPC", "FINDEV", "POLITY2" as endogenous given the existence of a possible reverse causality from each of these variables to the dependent variable (the so-called simultaneity bias). Three diagnostic tests are used to evaluate the appropriateness of the two-step system GMM estimator. 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 test of over-identifying restrictions, which determines the joint validity of the instruments used in the estimations. Finally, we report the number of instruments used in the regressions as the rule of thumb provides that a higher number of instruments than the number of countries may reduce the power of the aforementioned tests (e.g., Roodman, 2009).

For the empirical analysis, all regressions have been performed by consistently using the three indicators of services export concentration described above. Table 1 shows the results of the estimation of model (1). In Table 2, we present the results of the specifications of model (1) that purport to explore the effect of real exchange rate on services export diversification in HICs versus "NonHICs". Hence, these results would allow obtaining the effect of real exchange rate on services

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3 Further details on this estimator could be found for example in the above-mentioned studies on the determinants of export product diversification.
export concentration in both HICs and developing countries. To that effect, the model (1) specifications that are estimated - with each of the indicators of services export concentration – include a dummy variable (denoted "HIC") that takes the value 1 for HICs and 0, otherwise, along with the interaction variable that captures the interaction between this dummy and the real exchange rate variable.

4. Analysis of empirical results

To start with, we first examine the results of the diagnostic tests that help to assess the appropriateness of the two-step system GMM estimator (see the bottom of Tables 1 and 2). It is important to underline that to meet the requirements of these tests, we have included two lags of the dependent variable in the regressions, as with only one lag of this dependent variable as a regressor, these requirements were not met. Across the two Tables, we obtain that the coefficients of the lags of the dependent variable are statistically significant at the 1% level. This underscores the persistence nature of the indices of services export concentration over time, and confirms the need for considering a dynamic specification in the analysis. We also obtain that: the p-values related to the AR(1) test are always lower than 0.01 (the 1% level of statistical significance); the p-values associated with the AR (2) test are all higher than 0.10; the p-values related to the OID test are also consistently higher than 0.10; and the number of countries is always higher than the number of instruments across all columns. Overall, the results of these diagnostic tests are full satisfactory, and show that the two-step system GMM estimator could be used to perform the empirical analysis.

[Insert Table 1, here]

Results in Table 1 indicate that real effective exchange rate is positively and significantly associated with HHI and THEIL indicators, but negatively and significantly associated with LINES indicator. These, therefore, suggest that appreciations of the real effective exchange rate induce higher services export concentration and a fall in the number of services export lines. In terms of magnitude of the effects, we note that an appreciation of the real effective exchange rate by 100 per cent induces a rise in indices HHI and THEIL respectively by 11 points and 9 points, and a fall in the total number of services export lines by 4.5 points. The magnitudes of these different impacts clearly show the relevance of exchange rate policies for services export diversification. For control variables, we obtain across columns [1] and [2] that a rise in the real per capita income is associated with a higher level of services export diversification. Trade policy liberalization tends to be positively associated with services export diversification (see results in column [2]). However, institutional quality and the population size appear to influence positively services export concentration. While financial development does not exert a significant effect on services export concentration, we note that the education level is negatively and significantly associated with HHI, but positively and significantly associated with THEIL. The differences between the sign of these estimates of the education level in columns [1] and [2] may be attributed to the differences in the way these indices have been computed (see for example, Palan, 2010 who has discussed the advantages and limitations of using varying indices of specialization, including HHI and THEIL indices). At best, the impact of human capital on services export diversification deserves another study, which goes beyond the purpose of the current analysis. The estimations' outcomes provided in column [3] of Table 1 show that among all control variables only the real...
per capita income and the education level variables appear to be statistically significant at the conventional levels. In particular, we obtain a negative effect of the real per capita income on the total number of services export lines, which signifies that countries with lower real per capita income levels tend to experience a high number of total services export lines compared to relatively advanced countries. A rise in the education level induces a rise in the total number of services export lines.

[Insert Table 2, here]

Turning now to estimates displayed in Table 2, we find that the net effect of the real effective exchange rate appreciation in HICs amounts 50.56. For developing countries, we might be tempted to conclude that real effective exchange rate does not affect services export diversification measured by HHI, as the coefficient of the "REER" variable is not statistically significant. However, this statistically nil impact may hide differentiated effects across developing countries. The appreciation of the real effective exchange rate exerts a positive and significant effect on THEIL and reduces the total number of services export lines in HICs and developing countries alike, with the magnitude of these impacts amounting to 18.56 and -3.96 respectively for THEIL and LINES indicators. Results concerning control variables in columns [1] to [3] are in line with those obtained in Table 1.

5. Conclusion

This article has explored the services export diversification effect of the real effective exchange rate, using a sample of 125 countries over the period 1985-2014. Results have shown that an appreciation of the real effective exchange rate exerts a strong positive impact on services export concentration (i.e., it discourages the diversification of services exports) and reduces the total number of services export lines, and these effects concern both high income countries and developing countries. These findings, therefore, complement previous (although few) studies on the negative effects of exchange rate appreciations on the volume (and values) of services exports, and highlight the strong importance of real exchange policies in promoting services export diversification in high-income countries and developing countries alike.
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FIGURES

Figure 1: Correlation pattern between real effective exchange rate and indices of services export concentration over the entire sample

Figure 2: Correlation pattern between real effective exchange rate and indices of services export concentration over the sub-samples of HICs and NonHICs

Source: Author
# TABLES and APPENDICES

Table 1: Effect of real exchange rate on services export diversification

**Estimator:** Two-Step System GMM

| VARIABLES | HHI (1) | THEIL (2) | LINES (3) |
|-----------|---------|-----------|-----------|
| One-period Lag of the Dependent Variable | 0.539*** | 0.394*** | 0.780*** |
| | (0.0210) | (0.0219) | (0.0301) |
| Two-period Lag of the Dependent Variable | -0.0714*** | -0.196*** | -0.174*** |
| | (0.0161) | (0.0222) | (0.0310) |
| Log(REER) | 11.04*** | 9.044** | -4.512*** |
| | (3.641) | (4.580) | (0.571) |
| Log(GDPC) | -3.974** | -4.625*** | -0.650** |
| | (1.652) | (1.691) | (0.259) |
| TRPOL | -0.0232 | -0.200*** | 0.00414 |
| | (0.0649) | (0.0564) | (0.0117) |
| EDU | -0.159*** | 0.110** | 0.0260*** |
| | (0.0438) | (0.0472) | (0.00592) |
| FINDEV | 0.0443 | 0.0352 | -0.00171 |
| | (0.0341) | (0.0377) | (0.00502) |
| POLITY2 | 0.681*** | 1.512*** | -0.00440 |
| | (0.207) | (0.234) | (0.0340) |
| Log(POP) | 2.540** | 3.479*** | 0.182 |
| | (1.046) | (1.063) | (0.190) |
| Constant | -1.687 | -33.52 | 23.58*** |
| | (28.28) | (24.58) | (4.471) |
| Observations - Countries | 347 - 125 | 347 - 125 | 357 - 125 |
| Number of Instruments | 89 | 89 | 89 |
| AR1 (P-Value) | 0.0048 | 0.0023 | 0.0020 |
| AR2 (P-Value) | 0.5180 | 0.4367 | 0.4539 |
| Sargan (P-Value) | 0.1765 | 0.1694 | 0.3585 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parenthesis. In the two-step system GMM estimations, the variables "REER", "EDU", "TRPOL", "GDPC", "FINDEV" and "POLITY2" have been considered as endogenous. The variable "POP" has been considered as exogenous. Time dummies have been included in the regressions. The latter have used a maximum of 3 lags of the dependent variables as instruments and 3 lags of endogenous variables as instruments. It is also worth noting that the regressions have used 2 lags of the dependent variables as regressors because with only one-period lag of the dependent variable, the requirements of the two-step system GMM approach were not met. We have applied the natural logarithm to the variables "REER", "GDPC" and "POP" in order to reduce their high skewness.
Table 2: Effect of real exchange rate on services export diversification in HICs versus NonHICs  
Estimator: Two-Step System GMM

| Variables | HHI | THEIL | LINES |
|-----------|-----|-------|-------|
| (1) | (2) | (3) |
| One-period Lag of the Dependent Variable | 0.641*** | 0.345*** | 0.813*** |
| | (0.0276) | (0.0292) | (0.0271) |
| Two-period Lag of the Dependent Variable | -0.0518*** | -0.183*** | -0.145*** |
| | (0.0186) | (0.0223) | (0.0309) |
| Log(REER) | 6.985 | 18.56*** | -3.964*** |
| | (4.386) | (5.343) | (0.646) |
| HIC*Log(REER) | 50.56*** | -21.96 | -3.424 |
| | (8.262) | (14.46) | (2.262) |
| HIC | -231.2*** | 78.59 | 14.26 |
| | (38.17) | (66.72) | (10.44) |
| Log(GDPC) | -3.026 | 0.435 | -0.485** |
| | (2.067) | (1.673) | (0.228) |
| TRPOL | -0.114* | -0.267*** | 0.00982 |
| | (0.0614) | (0.0779) | (0.0109) |
| EDU | -0.120*** | 0.125*** | 0.0260*** |
| | (0.0483) | (0.0404) | (0.00605) |
| FINDEV | 0.0830*** | 0.0614** | -0.000541 |
| | (0.0305) | (0.0303) | (0.00518) |
| POLITY2 | 0.744*** | 1.314*** | -0.0373 |
| | (0.191) | (0.193) | (0.0364) |
| Log(POP) | 1.326 | 1.234 | -0.196 |
| | (1.117) | (0.859) | (0.230) |
| Constant | 16.64 | -74.04** | 25.15*** |
| | (29.14) | (29.89) | (5.510) |

Observations - Countries: 347 - 125  
Number of Instruments: 87  
AR1 (P-Value): 0.0031  
AR2 (P-Value): 0.2392  
Sargan (P-Value): 0.3131

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parenthesis. In the two-step system GMM estimations, the variables "REER", "EDU", "TRPOL", "GDPC", "FINDEV", "POLITY2" and the interaction variable have been considered as endogenous. The variable "POP" has been considered as exogenous. Time dummies have been included in the regressions. The latter have used a maximum of 3 lags of the dependent variables as instruments and 3 lags of endogenous variables as instruments. It is also worth noting that the regressions have used 2 lags of the dependent variables as regressors because with only one-period lag of the dependent variable, the requirements of the two-step system GMM approach were not met. We have applied the natural logarithm to the variables "REER", "GDPC" and "POP" in order to reduce their high skewness.
### Appendix 1: Definition and Source of variables

| Variables | Definition | Sources |
|-----------|------------|---------|
| **HHI**   | This is the Herfindahl index, which is also referred to as the Hirschman-Herfindahl index. It has been computed as follows: \( HHI = \frac{\sum s_k^2 - 1/n}{1/n} \) where \( s_k = \frac{x_k}{\sum x_k} \) represents the share of export line \( k \) (with amount exported \( x_k \)) in total exports: \( x_k \) stands for the amount of services exports associated with the services line "\( k \)"; \( n \) represents the total number of the services export lines (\( k \)) and \( n = \sum n_k k \). The calculated indicator has been normalized so that its values range between 0 and 1. Higher values of this index indicate greater services export concentration, while lower values show greater services export diversification. | Author's calculation based on data extracted from the database developed by the International Monetary Fund (IMF) on the international trade in services (see online at: [https://data.imf.org/?sk=07109577-E65D-4CE1-BB21-0CB309F8FC504](https://data.imf.org/?sk=07109577-E65D-4CE1-BB21-0CB309F8FC504)) - See also Loungani et al. (2017). The data used to compute the HHI indicator are sectoral data on services exports at 2-digit level, which is the maximum digit-level of disaggregated data available on services. In particular, we have relied on 11 major sectors of services (categories of services) – at the 1-digit level - and used the disaggregated data on services exports for sub-sectors at the 2-digit level. See Loungani et al. (2017: page 20, Table 1) for the 11 major services sectors and the related sub-sectors covered in the analysis. |
| **THEIL** | This variable represents the Theil index of services export concentration. It has been calculated using the following formula (for example, see Agosin et al, 2012; Cadot et al., 2011): \( THEIL = \frac{1}{n} \sum_{k=1}^{n} \frac{v_k}{\mu} \ln \left( \frac{v_k}{\mu} \right) \), where \( \mu = \frac{1}{n} \sum k x_k \) \( n \) represents the total number of the (services) export lines (\( k \)) \( n = \sum n_k k \); \( x_k \) stands for the amount of services exports associated with the services line "\( k \)". | Author's calculation based on the same data (extracted from the IMF database on the international trade in services) used to compute the HHI indicator described above. |
| **LINES** | This is the total number of services export lines for a given country per year. \( LINES = n = \sum n_k k \). | Author's computation based on services exports data (at the 2-digit level) described above. |
| **REER** | This is the index measuring the Real Effective Exchange Rate. The REER is computed using a nominal effective exchange rate based on 65 trading partners. An increase in the index indicates an appreciation of the real effective | Bruegel Datasets (see Darvas (2012a, 2012b)). The dataset could be found online at: [http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/](http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/) |
| Variable | Description | Source |
|----------|-------------|--------|
| GDPC | Per capita Gross Domestic Product (constant 2010 US$) | World Development Indicators (WDI), 2019 |
| TRPOL | This is the main measure of trade openness. It is in fact the De Jure measure of trade openness, i.e., the De Jure Trade Globalisation index (see Dreher, 2006 and Gygli et al. 2019). It is a composite index of trade in goods, trade in services and trade partner diversity. | See the database and other information online at: [https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html](https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html) |
| EDU | This is the average of the gross primary school enrollment (%), gross secondary school enrollment (%), and gross tertiary school enrollment (%). | Author's calculation based on data collected from the WDI. |
| FINDEV | Domestic credit to private sector (% of GDP). Missing values have been replaced with data on the domestic credit to private sector by banks (% of GDP). | Author's calculation based on data extracted from the WDI. |
| POP | This is the measure of the total Population | WDI, 2019 |
| POLITY2 | This variable is an index extracted from Polity IV Database (Marshall et al., 2018). It represents the degree of democracy based on competitiveness of political participation, the openness and competitiveness of executive recruitment and constraints on the chief executive. Its values range between -10 and +10, with lower values reflecting autocratic regimes, and greater values indicating democratic regimes. Specifically, the value +10 for this index represents a strong democratic regime, while the value -10 stands for strong autocratic regime. | Polity IV Database (Marshall et al., 2018) |
Appendix 2: Descriptive statistics on variables used in the model

| Variable | Observations | Mean     | Standard Deviation | Minimum | Maximum   |
|----------|--------------|----------|--------------------|---------|-----------|
| HHI      | 695          | 51.015   | 28.906             | 0.000   | 100.000   |
| THEIL    | 695          | 53.646   | 27.459             | 0.000   | 98.801    |
| LINES    | 705          | 9.927    | 6.259              | 1       | 27        |
| GDPC     | 725          | 11165.440| 16977.380          | 153.903 | 105761.9  |
| POLITY2  | 732          | 3.724    | 6.245              | -10     | 10        |
| POP      | 750          | 4.22e+07 | 1.48e+08           | 321270.8| 1.35e+09  |
| REER     | 734          | 138.766  | 567.182            | 14.918  | 14144000  |
| EDU      | 635          | 194.829  | 61.329             | 30.858  | 332.421   |
| FINDEV   | 665          | 41.009   | 38.921             | 0.186   | 332.421   |
| TRPOL    | 733          | 50.213   | 24.777             | 7.401   | 97.122    |

Appendix 3: List of countries contained in the Entire Sample

| Entire sample | HIC          |
|---------------|--------------|
| Albania       | Australia    |
| Angola        | Austria      |
| Argentina     | Bahrain      |
| Armenia       | Belgium      |
| Australia     | Canada       |
| Austria       | Chile        |
| Bahrain       | Croatia      |
| Bangladesh    | Cyprus       |
| Belarus       | Czech Republic |
| Belgium       | Denmark      |
| Benin         | Estonia      |
| Botswana      | Finland      |
| Brazil        | France       |
| Bulgaria      | Germany      |
| Burkina Faso  | Greece       |
| Burundi       | Hungary      |
| Cabo Verde    | Ireland      |
| Cambodia      | Israel       |
| Cameroon      | Italy        |
| Canada        | Kuwait       |
| Chile         | Lithuania    |
| China         | Luxembourg   |
| Colombia      | Netherlands  |
| Congo, Democratic Republic of the | New Zealand |
| Congo, Republic of | Norway      |
| Costa Rica    | Oman         |
| Croatia       | Poland       |
| Cyprus        | Portugal     |
| Czech Republic | Slovak Republic |
| Côte d'Ivoire | Slovenia     |
| Denmark       | Sweden       |
| Dominican Republic | Switzerland |
| Ecuador       | Trinidad and Tobago |
| Egypt         | United Kingdom |
| El Salvador   | United States |
| Estonia       | Uruguay      |
| Ethiopia      | Switzerland  |