On the Nexus Between Global Value Chains Participation, Exchange Rate Dynamics, Digitalization and Quality of Institutions

Mariz Abdou[1] Ibrahim Elbadawi[2] Patrick Plane[3] Chahir Zaki[4]

Abstract The macroeconomic literature widely supports the existence of a robust association between economic growth, trade performance and real exchange rate misalignment in terms of undervaluation, especially for developing economies. Yet, in a world characterized with global value chains (GVCs), the previous strands of literature become debatable as they assume that countries export only final goods that do not require any imported intermediate inputs. Thus, using a cointegration analysis for 143 countries over the period 1995-2018, this paper assesses the impact of real exchange rate (RER) misalignment on the two main components of GVC participation: first, the domestic value added of a country which is embodied in the exports of other countries (Forward GVC Participation); second, the foreign value added embodied in a country's exports (Backward GVC Participation). Moreover, it investigates how this impact is contingent to additional factors such as the quality of institutions, the degree of digitalization and the country's position within the value chain: upstream or downstream country. The main findings show that RER misalignment exerts a positive impact on both the forward and backward components of GVC participation. Moreover, misalignment is found to be a counter-productive policy instrument for promoting GVC participation in countries with good quality of institutions. However, it proves to be more beneficial for countries with a higher level of digitalization. Considering the country's position within the value chain, the results show that downstream countries are better cushioned from exchange rate changes. The robustness of the results is confirmed after controlling for the endogeneity of RER misalignment using an instrumental variable approach, investigating whether the impact of RER misalignment is primarily driven by positive values (undervaluation) or negative values (overvaluation), running the regressions using Driscoll-Kraay robust standard errors, and utilizing alternative indicators for the quality of institutions, and for the degree of digitalization.

Jel Classifications F14, F31, F40, O24

Keywords global value chains, exchange rate, misalignment, quality of institutions, digitalization, cointegration

[1] CERDI, CNRS, IRD, Université Clermont Auvergne and Cairo University.
[2] Economic Research Forum (ERF).
[3] CERDI, CNRS, IRD, Université Clermont Auvergne and FERDI.
[4] Laboratoire d'Economie d'Orléans, University of Orléans, ERF and EMANES.

1. Introduction

The macroeconomic literature on growth widely supports the existence of a robust association between economic growth and real exchange rate (RER) misalignment in terms of undervaluation, particularly for developing economies. This literature also provides huge evidence that not only avoiding overvaluation is vital for growth, but a mild undervaluation may promote growth (Rodrik, 2008; Aghion et al., 2009; Elbadawi et al., 2012).

Regarding the nexus between RER misalignment and trade performance, there is a lack of consensus among the researchers. While RER misalignment in terms of undervaluation is expected to increase the competitivity of exports since domestic products become relatively cheaper than foreign products, this relationship does not hold true in all circumstances. A possible explanation is that the impact of RER misalignment is not the same across countries as it can be influenced by other characteristics related to the income level (Rodrik, 2008), and the quality of institutions and market failures (Rodrik, 2008; Aghion et al., 2009; Elbadawi et al., 2012; Sekkat, 2016; Elbadawi and Zaki, 2021).

Yet, in a world characterized by global value chains (GVCs), reduced barriers to foreign trade, and cross-border fragmentation of production, the previous strands of literature become debatable as they make some simplifying assumptions that do not reflect the complex reality of trade relations. For instance, they assume that countries export only final goods that do not require any imported intermediate inputs. However, in a GVC, products become multi-country products as intermediate inputs are imported, transformed, and then re-exported. Hence, many countries contribute to the value added of the product by participating in the different stages of the production process. Thus, GVC-related trade is expected to respond differently to changes in exchange rate compared to traditional trade in single-country goods.

Therefore, this paper aims at studying the impact of RER misalignment on GVCs integration. An indicator of a country's integration into GVCs is the extent to which its exports rely on imported intermediate inputs in foreign value added (backward participation) and the extent to which its exports serve as inputs in value added in the exports of other countries (forward participation). For this purpose, we follow a cointegration analysis using the UNCTAD-EORA database that provides the key GVC indicators: foreign value added (FVA), and domestic value added (DVX) generated from EORA Multi-Region Input-Output tables (MRIOs) for 143 countries over the period 1995-2018.

The contribution of this paper is threefold. First, unlike most of papers examining the impact of RER misalignment on traditional trade, this paper uses the UNCTAD-EORA Global Supply Chain database to examine the impact on the two main components of GVC participation: the domestic value added of a country which is embodied in the exports of other countries (Forward GVC Participation), and the foreign value added embodied in a country's exports (Backward GVC Participation). Second, it examines how country's position within the GVC matters: whether it is an upstream or downstream country. Third, it investigates how this impact is

contingent upon additional factors, including the quality of institutions and the level of digitalization.

The main findings show that RER misalignment exerts a positive impact on both the forward and backward components of GVC participation. Moreover, misalignment is found to be a counter-productive policy instrument for promoting GVC participation in countries with good quality of institutions. However, it proves to be more beneficial for countries with a higher level of digitalization. Considering the country's position within the value chain, the results show that downstream countries are better cushioned from exchange rate changes. The robustness of the results is confirmed through several approaches: controlling for the endogeneity of RER misalignment using an instrumental variable approach, investigating whether the impact of RER misalignment is primarily influenced by positive values (undervaluation) or negative values (overvaluation), running the regressions using Driscoll-Kraay robust SE, and utilizing alternative indicators for the quality of institutions and for the degree of digitalization.

The remainder of the paper is organized as follows. Section 2 provides the theoretical framework as well as the main empirical predictions underpinning the relationship between exchange rate misalignment, international trade and GVC participation. Section 3 presents the data we use. Section 4 is dedicated to the methodology and econometric specification carried out in the study. Section 5 presents the empirical results. Section 6 presents some robustness checks. Section 7 concludes and provides some policy implications.

2. Literature Review

The received literature exploring the relationship between RER misalignment and trade performance is quite extensive. Additionally, it reveals that the impact of RER misalignment can be shaped by various factors, including income level, institutional quality, and market failures. Thus, this paper aligns with three main strands of literature. The first strand investigates the nexus between RER misalignment, traditional trade and GVC participation. The second strand focuses on the quality of a country's institutions and the presence market failures. The last strand elucidates the relationship between trade performance, GVC participation and Digitalization.

2.1 RER misalignment, traditional trade performance and GVC participation

In the literature, the nexus between exchange rate and trade performance is widely discussed and empirically tested. Since the RER is calculated as the relative prices of tradable goods to non-tradable ones, it serves as a measure of the level of competitivity. Therefore, it plays a pivotal role in the allocation of resources between the tradable and non-tradable sectors. Using the price channel to explain the impact of RER misalignment on trade performance, the main findings show that, other things remaining the same, the RER misalignment in terms of undervaluation makes the exports more attractive in the international market as it makes the exports cheaper which, in turn, increases the incentives of domestic producer to compete with

foreign countries (Bayoumi et al., 1994; Odedokun, 1997; Edwards and Golub, 2004; Frieden et al., 2006; Freund and Pierola, 2012). Hence, a RER undervaluation increases not only the value of exports of the same product to the same destination (intensive margin) but also the probability of exports of new products to new markets (extensive margin). The impact of RER misalignment on exports performance is expected to be more pronounced in the short run where prices are sticky. Therefore, a nominal depreciation of the exchange rate leads to real depreciation of the exchange rate. Consequently, foreign products become more expensive than those domestically produced which, in turn, will bring about more exports and less imports (Krugman et al., 2012).

The nexus between RER misalignment and trade performance was the center of interest of several studies in the literature at both the macro and firm-levels and the empirical findings are conflicting. At the macro-level, Mamun et al. (2021) use data for 21 emerging economies over the period 1980 to 2016 and conclude that currency undervaluation promotes exports while an overvaluation reduces them. In the same vein, Leigh et al. (2015) conducts a study using annual data for 60 countries from 1980 to 2014. The results of the study show that RER misalignment has a significant impact on the exports volume. Additionally, according to this study, a real effective depreciation of a currency by 10% leads in average to a 1.5% rise in the real net exports as percent of GDP. These results are in line with the findings of several studies that use different econometric techniques and conclude that RER misalignment in terms of undervaluation enhance the exports performance (Genc and Artar, 2014; Bahmani-Oskooee and Ardalani, 2006), especially on the short and medium run (Haddad and Pancaro, 2010).

At the firm-level, Zaki et al. (2019) find that RER depreciation has a positive impact on the intensive margin (value of exports of the same product to the same destination) without affecting the quantity of exports. This shows that the price effect is stronger than the quantity one. Therefore, the depreciation of the RER lowers the price of exports for the foreign currency without increasing the quantity of exports. Moreover, they find that RER depreciation has a positive and significant effect on the extensive margin measured through the number of products and destinations.

Conversely, these results have been rejected by many researchers. For instance, Rasbin et al. (2021) use data for 22 manufacturing industries in Indonesia over the period 1990-2015 and argue that the manipulation of exchange rate does not significantly contribute to the improvement of the Indonesian manufacturing exports. In the same vein, Eaton et al. (2007), Glüzmann et al. (2012), and Rowbotham et al. (2014) argue that currency undervaluation has no significant impact neither on exports nor on imports.

Despite the solid foundation of the previous strands of literature, they become debatable as they do not distinguish between trade in final goods and trade in value added and intermediate inputs. Hence, assuming that countries export only final goods that do not require any imported intermediate inputs may mislead their interpretation for the impact of exchange rate changes and misalignments on trade flows for two main reasons. First, deeper integration into GVCs and higher share of FVA in producing exports is expected to dampen the impacts of exchange rate changes on exports performance. A RER depreciation leads to an increase of the cost of

imported inputs which, in turn, reduces the competitive gains from currency depreciation compared to the traditional case without GVCs (Ahmed et al., 2016). Along the same lines, Sato and Zhang (2017) argue that the impact of GVCs integration may be ambiguous. On the one hand, GVC integration may dampen the effects of exchange rate changes on exports. This is because, within GVCs, the countervailing effects of exchange rate volatility on the costs of foreign imported inputs and prices of exports mean that the profit of exporting firms is expected to rise less in the GVC context compared to the conventional case of traditional trade. On the other hand, trade costs related to uncertainty are more relevant in GVCs (Hayakawa and Kimura, 2009). Hence, GVCs integration may amplify the adverse impacts of exchange rate changes on exports performance. The final impact of GVCs depends on which effect dominates.

Second, sectors that are large exporters are at the same time large importers. Therefore, aggregating them with sectors that do not trade leads to an overestimation of the domestic value-added content in exports and consequently the impact of changes in foreign prices on the level of competitivity (Bems and Johnson, 2017). In the same vein, Svensson (2003) and Brach and Naudé (2012) argue that while currency undervaluation reduces the price of exports for foreign countries, it makes the imports more expensive for the domestic currency. Hence, country and firms trading in final goods that rely on imported intermediate inputs may not get benefit of a currency undervaluation.

A rich strand of literature focuses on exploring the nexus between GVC integration and exchange rate elasticity of exports. Using panel data for 46 countries over the period 1996-2012, Ahmed et al. (2016) explore how GVCs affect the exchange rate elasticity of exports and conclude that the more the country is integrated into GVCs, a currency depreciation leads to a partial improvement of the competitiveness of the value of final good exports. Moreover, they find that GVC participation reduces on average the RER elasticity of manufacturing exports by 22%. Likewise, Tan et al. (2019) use the OECD-WTO TiVA database and apply panel regression techniques over the period 1995-2011 to investigate whether a country's integration into GVCs affects the relation between the real effective exchange rate (REER) and gross exports. They find that a higher share of FVA embodied in exports completely offsets the negative impact of REER appreciation on real gross exports. Moreover, a higher share of FVA dampens the negative relationship between increased REER volatility and exports. Likewise, Greenaway et al. (2010) use panel data for UK manufacturing firms and conclude that the negative impact of RER appreciation on the probability of exports is lower in industries that rely on a higher share of imported inputs. In the same vein, many studies conclude that the exchange rate pass through to export prices is weaker when countries are deeply integrated into GVCs and exported goods rely more intensively on foreign imported inputs (Berman et al., 2012; Amiti et al., 2014; Ollivaud et al., 2015; and Fauceglia et al., 2018).

Using sectoral level panel data from the World Input-Output Tables (WIOD) over the period 1995-2009, De Soyres et al. (2021) test three main predictions: First, the higher the share of foreign value added in exports, the lower the response of export volumes to exchange rate fluctuations. Second, the higher the share of exports that returns as imports, the lower the response of exports volumes to exchange rate changes. Third, the higher the share of inputs

that are going to be re-exported, the higher the response of exports to the nominal effective exchange rate of its trading partner. Their findings provide support for these three predictions.

Looking at the impact of RER on GVC participation, Cheng et al. (2016) use the OECD-WTO TiVA database and find that a real appreciation reduces not only the exports of domestic value added (DVA), in line with the theory, but also the imports of FVA (contradictory to the traditional trade theory). This is in line with the idea of complementarity between GVC-related FVA and DVA in production, hence, producing and exporting less DVA implies the reduction of demand for imported FVA. The magnitude of response relies on the share of FVA in the exports. A share of FVA in exports that exceeds 60% leads to a shift in the sign of import and export elasticities from negative to positive, indicating that the country's DVA and FVA increase in response to a currency appreciation.

Indeed, country's position in the supply chain also matters. Exports and imports are better cushioned and protected from exchange rate changes in countries that are more downstream in the supply chain, which means, sell inputs that will be used in further production processes or operates in a stage of production that is closer to the end consumer (Riad et al., 2012). The cushioning effect occurs mainly due to the price flexibility advantage that downstream countries have over upstream countries. To cope with currency fluctuations, countries that downstream can pass on a part of the cost increase or decrease on their customers or suppliers. Hence, price flexibility allows to mitigate the impact of exchange rate changes on trade and reduce countries' vulnerability to currency fluctuations.

2.2 RER Misalignment, Quality of Institutions, and Market Failures

Considering the quality of institutions, the literature shows strong evidence that the positive impact of RER misalignment on trade flows is accentuated when a country has weak institutions and suffers from market failures (Rodrik, 2008; Aghion et al., 2009; Elbadawi and Kaltani, 2016; Rajan and Subramanian, 2011; Freund and Pierola, 2012; Combes et al., 2019). This can be attributed to two plausible explanations. First, according to Méon and Sekkat (2008), sophisticated goods are more relationship and contracts intensive than primary ones. Weak institutions in a country impose more taxes on relationship and contracts intensive exports compared to primary product. Therefore, a currency undervaluation will help to compensate for taxes which, in turn, promotes the manufactured and sophisticated exports. Second, Rodrik (2008) argues that poor economic institutions create a wedge between private and social returns which is more severe in traded economic activities, especially in developing countries. This wedge leads to a huge misallocation of resources in favor of non-traded sectors and to huge dynamic distortions in the traded ones. Since traded sectors are more dynamic, a rise in the relative prices of traded to non-traded goods should lead to an enhancement of static efficiency and growth in a second-best fashion. Hence, by offering an economy-wide subsidy to tradable sectors, RER undervaluation is expected to partially ameliorate at least the negative effect of weak economic institutions. Nevertheless, these arguments have been rejected by Svensson (2003) and Brach and Naudé (2012). They argue that a currency undervaluation would lead to an increase in the costs of imported inputs required to produce sophisticated

goods such as the machinery. In this case, an overvaluation of the national currency would reduce the costs of the imported inputs which, in turn, encourages the diversification of exports. In the same vein, they argue that the more the international entrepreneurs export, the more they pay bribes. Therefore, the expected surge of diversified exports after a currency undervaluation may be cancelled by the weakness of institutions which contradicts Rodrik's conclusion.

Considering the level of financial development and the quality of institutions, ElBadawi and Zaki (2021) use firm-level fata for four Arab countries (Egypt, Jordan, Kuwait, and Yemen) and conclude that RER undervaluation promotes the firm's intensive margin regardless the level of financial development. However, RER undervaluation is found to be a counter-productive policy instrument for stimulating exports at the product-extensive margin, especially for financially developed countries.

2.3 Digitalization and GVC Participation

Access to telecommunication technology acts as a key determinant of GVCs participation. In addition to the benefits of access to knowledge, it also enables the coordination of complex and geographically dispersed production processes (Kowalski et al., 2015). Moreover, telecommunications have played a crucial role in enabling firms to outsource intricate production activities across borders.

Using different datasets on the macro and firm-levels, the main findings show evidence that access to internet and digital adoption in form of email usage and website ownership promote export performance (Freund and Weinhold, 2002; Clarke, 2008; Fernandes et al., 2019; Cusolito et al., 2020), especially for developing countries (Clarke and Wallsten, 2006).

In the context of GVCs, Gopalan et al. (2022) conduct a study using firm-level data for 24,839 firms across 52 countries spanning from 2006 to 2018 and examine how digitalization affects firms' integration into GVCs. They utilize two indicators to measure digitalization: the ownership of a firm website and the availability of a high-speed internet connection. Their findings reveal that firms adopting digitalization are 6 - 10 percent more likely to engage in GVCs.

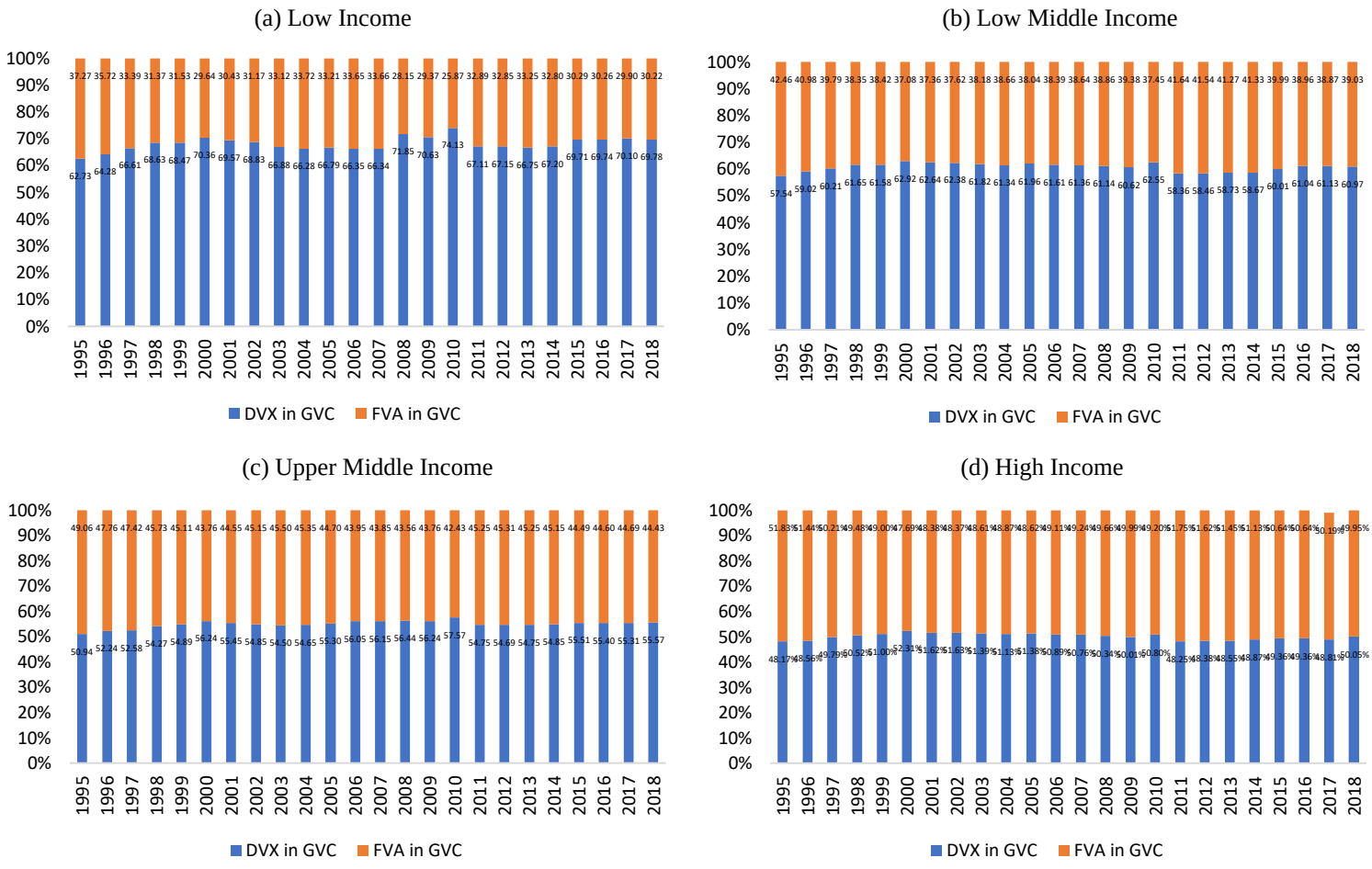
Against this background, this paper contributes to the previous literature in three aspects. First, unlike most of papers examining the impact of RER misalignment on traditional trade, this paper uses the UNCTAD-EORA Global Supply Chain database to examine the impact on the two main components of GVC participation: the domestic value added of a country which is embodied in the exports of other countries (Forward GVC Participation), and the foreign value added embodied in a country's exports (Backward GVC Participation). Second, it examines how country's position within the value chain matters: whether it is situated upstream or downstream. Third, it investigates how this impact is contingent upon additional factors, including the quality of institutions and the level of digitalization.

3. Data

To assess the impact of RER misalignment on GVCs participation, we make use of the UNCTAD-EORA Global Supply Chain database (Casella et al., 2019) on backward and forward linkages. This dataset provides the key GVC indicators: foreign value added (FVA), domestic value added (DVA) and indirect value added (DVX) generated from EORA Multi-Region Input-Output tables (MRIOs) for 189 countries over the period 1995-2018.

To allow the comparability between countries with different income levels, we classify the countries covered by our sample (see Appendix 1) into four income groups following the World Bank classification. Figure 1 illustrates the share of domestic and foreign value-added components in GVC for the four income groups. Two remarks can be mentioned: first, the higher the income level, the lower the domestic value-added content in the final GVC product. Second, low-income countries rely more on their domestic value added to produce a final GVC product. By contrast, high income countries rely more on foreign intermediate inputs in their production. This confirms the findings of Bems and Johnson (2017) who argue that sectors that are large exporters are at the same time large importers.

Figure 1. The Share of Domestic and Foreign Value-Added Components in GVC



Source: Constructed by the authors using UNCTAD-EORA dataset.

Accounting for the quality of institutions, we incorporate two variables into our analysis. Firstly, we utilize the government effectiveness index from the World Governance Indicators (WGI), which reflects the quality of public and civil services as well as their independence from political pressures. Secondly, we include the financial institutions efficiency index from the Financial Development Index database provided by the International Monetary Fund (IMF). This index encompasses various metrics such as banking sector net interest margin, lending-deposits spread, non-interest income to total income, overhead costs to total assets, return on assets, and return on equity. To gauge the extent of digitalization, we employ the proportion of individuals within the total population using the internet from the World Development Indicators (WDI)[5].

4. Methodology

Our analysis is conducted in three main steps. First, we estimate RER misalignment. Second, we assess the stationarity of the series and examine the presence of a long-term relationship between the variables. Third, we delve into the relationship between RER misalignment and GVC participation.

4.1 Derivation of RER Misalignment

The first step of our analysis is to estimate RER misalignment over the years. Following Rodrik (2008), the index of misalignment is measured as a real exchange rate adjusted for the Balassa-Samuelson effect. The main advantage of this index is its comparability between countries and over years since it adjusts the relative price of tradables to nontradables. The index is estimated following three steps. First, data on exchange rates (XR) and purchasing power parity conversion factors (PPP) expressed as national currency units per U.S. dollar and controls for price level differences with respect to the US economy is used to calculate a RER as follows:

$$Ln\,(RER_{it}) = Ln\left({}^{XR_{it}}/_{PPP_{it}}\right) \qquad (1)$$

Where i and t denote country and year, respectively. A value of RER greater than one indicates that the currency is more depreciated than indicated by PPP. Nevertheless, through the Balassa-Samuelson effect, the relative prices of nontradables tend to increase as countries become richer due to a higher productivity in tradables. However, nontradables are cheaper in poorer countries. Hence, in a second step, we account for this effect by regressing Ln (RER) on real gross domestic product per capita (RGDPPCPPP) as follows:

$$Ln\,(RER_{it}) = \beta_0 + \beta_1\, Ln\,(RGDPPCPPP_{it}) + f_t + \varepsilon_{it} \qquad (2)$$

[5] A comprehensive overview of the definitions of these variables is presented in Appendix 2.

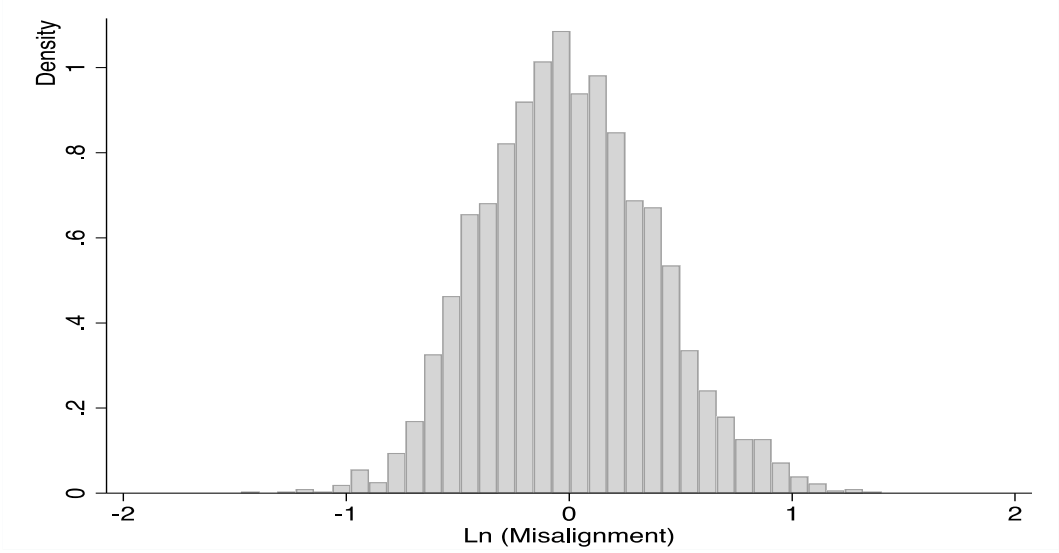
Where f_t denotes year fixed effects and ε_{it} is the disturbance term. The regression yields an estimate beta ($\hat{B}_1 = -0.25$ with a high t-statistic of around 48.31) close to the beta ($\hat{\beta} = -0.24$) estimated by Rodrik (2008). This result suggests a strong estimated Balassa-Samuelson effect as it shows that an increase of income by 10% leads to a decrease of RER by 2.5% (Table A1). As final step, RER misalignment is estimated as the difference between the actual RER and the predicted one as follows:

$$Ln\,(Misalignment_{it}) = Ln\,(RER_{it}) - Ln\,(\widehat{RER_{it}}) \qquad (3)$$

Where $Ln\,(\widehat{RER_{it}})$ is the predicted RER from equation (2). A positive value corresponds to RER undervaluation and a negative one corresponds to overvaluation. Figure 2 depicts the distribution of the misalignment measure which is centered at zero and has a standard deviation of 0.38.

Comparing between countries' income groups, Table 1 shows that almost 49% and 75% of low/ low middle income and upper middle-income countries, respectively, have an undervalued RER. However, this is the case for only 30% of high-income countries. Overall, almost 48% of the countries covered by the sample have an undervalued RER. Steinberg (2016) argues that state owned institutions influence exchange rate policy in developing countries with large manufacturing sectors. A developing country can get benefit of RER undervaluation in three main ways: First, RER undervaluation helps developing economies to overcome the challenges related to the limited export competitiveness they may face by making their exports relatively cheaper, and thus more competitive. Second, developing countries often face high levels of external debt. Hence, undervaluing their currency can help reduce the burden of servicing foreign debt by making it cheaper to repay loans denominated in foreign currencies. Third, RER undervaluation may attract foreign investment by making the country's assets and investments more attractive to foreign investors.

Figure 2. Distribution of the Misalignment Measure



Source: Authors' own calculations.

Note: Positive values correspond to RER undervaluation and negative values correspond to overvaluation.

Table 1. Descriptive Statistics of RER Misalignment (log units) 1995-2018

	Obs	Mean	Std. Dev.	Min	Max	Positive Value	Negative Values
Low/Low Mid. Income	1458	0.018	0.394	-1.47	1.28	708	750
Upper Middle Income	931	0.169	0.241	-0.44	1.40	694	237
High Income	1346	-0.137	0.397	-1.04	1.25	408	938
All	3735	6.44e-10	0.381	-1.47	1.40	1810	1925

Source: Authors' own calculations.

Note: Positive values correspond to RER undervaluation and negative values correspond to overvaluation.

4.2 Unit-root Tests and Cointegration Analysis

To test for the stationarity of the series[6], we rely on three main unit-root tests. First, Im-Pesaran-Shin test (Im et al., 2003) that tests the null hypothesis "all panels contain unit roots" against the alternative hypothesis "some panels are stationary". Second, Harris-Tzavalis test (Harris and Tzavalis, 1999) that tests a more flexible null-hypothesis "panels contain unit roots" against the same alternative hypothesis of the latter. Third, Fisher test (Choi, 2001) that tests the same null-hypothesis of Im-Pesaran-Shin test but a broader alternative hypothesis "at least one panel is stationary".

Table A2 (Appendix 3) reports the results of unit-root tests. The results of the three tests are in line. They confirm that the components of GVC, exchange rate misalignment and RGDPPC are I(1) - integrated of order one - and tariffs, financial development, and digitalization indicators are stationary. Hence, panel cointegration tests are performed to verify the existence of long-run relationship between the variables. Relying on two cointegration tests (Kao, 1999; Pedroni 1999, 2004). Table A3 (Appendix 3) reports the results of tests. Based on the results of the tests, we can confirm the existence of long-run relationship between the variables. Hence, cointegration methods that fit for non-stationary but cointegrated series are used to estimate the impact of RER misalignment on GVC participation.

4.3 RER Misalignment and GVC Participation

To reduce the bias of standard ordinary least squares (OLS) in regressions with non-stationary variables, a Dynamic OLS (DOLS) model is estimated. DOLS is a cointegration method that fits for non-stationary but cointegrated series (Nouira et al., 2011; Fišera and Horvath, 2022). It is a parametric approach that relies on the inclusion of lags and leads in the regression. Hence, it accounts for potential endogeneities among the variables. Moreover, by introducing leads and lags of explanatory variables, it deals with the problem of different orders of integration (Kao and Chiang, 2001; Mark and Sul, 2003).

Estimating a DOLS model, the nexus between RER misalignment and GVC participation is estimated as follows:

$$Ln\,(GVC_{it}) = \alpha_0 + \alpha_1\, Ln\,(Misalignment_{it}) + \alpha_2\,\eta_{it} + \alpha_3\,\gamma_{it} + \delta_i + \mu_t + \tau_{it} \quad (4)$$

[6] Table A4 in Appendix 3 includes the summary statistics of all the variables used in the study.

Where $Ln\ (GVC_{it})$ is the GVC participation index of country i at year t measured through two main components. First, the domestic value added of country i which is embodied in the exports of other countries (DVX). This corresponds to the Forward GVC participation component of the participation index. Second, the foreign value added of other countries which is embodied in the exports of country i (FVA). This corresponds to the Backward GVC participation component of the GVC participation index. $Ln\,(Misalignment_{it})$ represents RER misalignment estimated in equation (3). η_{it} is a vector of control variables[7]: Ln of Real GDP Per Capita, Ln of Tariffs, and Ln of total rents of natural resources. γ_{it} is a vector that compiles variables related to the quality of institutions: government effectiveness index and financial institutions efficiency index, and access to internet. δ_i and μ_t denote country and year fixed effects respectively. τ_{it} is the disturbance term.

To ensure the robustness of our findings, we employ four distinct robustness checks. Firstly, we utilize an instrumental variable (IV) approach to tackle the potential endogeneity of RER misalignment. Secondly, we investigate whether the impact of RER misalignment is primarily driven by positive values (undervaluation) or negative values (overvaluation). Furthermore, we assess the magnitude of misalignment, regardless of whether it is undervalued or overvalued. Thirdly, we employ panel fixed-effects regressions with Driscoll-Kraay robust standard errors (Driscoll and Kraay, 1998). These standard errors are designed to account for heteroskedasticity, as well as spatial and temporal cross-sectional dependencies. Lastly, we consider alternative indicators to evaluate the quality of institutions and the level of digitalization.

5. Empirical Findings

Our empirical analysis focuses on the impact of RER misalignment on GVC participation measured by two variables: the domestic value added of the country which is embodied in the exports of other countries (Forward GVC participation) and the foreign value added which is embodied in the country's exports (Backward GVC participation). Moreover, it analyses how this impact is contingent on other factors such as the quality of institutions, the degree of digitalization and the country's position within the value chain: being an upstream or downstream country.

5.1 Baseline Regressions

Looking at the nexus between RER misalignment and GVC participation, Table 2 reports the results for the forward linkage (columns a and b) and the backward linkage (columns c and d).

First, the higher the income level, the higher the domestic and foreign value-added components. More developed countries tend to engage in both purchasing and selling a higher proportion of their gross exports as intermediate goods. Regarding natural resources endowments measured by the total value of rents, countries that are abundant in natural resources are less likely to

[7] The selection of control variables is guided by a pairwise correlation matrix (Table A5 in Appendix 3).

engage in forward as well as backward linkages. This negative impact can be explained by the natural resources curse and the idea that countries that are abundant in natural resources cannot get advantage of this abundancy and may experience stagnant economic growth and suffer from weak institutions. When considering the impact of tariffs, backward participation is expected to be more sensitive to the country's own tariff policy as it encompasses imports into the country levying the tariff. Conversely, forward participation involves producers who face tariffs imposed on their exports. Thus, a distinction is made between the tariffs faced by a country on its exports (forward linkage) and the tariffs imposed by a country on its imports (backward participation). The findings provide evidence that tariffs significantly decrease both forward and backward participation in GVCs, which is consistent with the findings of Kowalski et al. (2015). Tariffs, particularly those imposed on intermediate inputs, hinder a country's ability to access foreign inputs, increase costs, and ultimately impede the growth and development of downstream industries.

As per our variable of interest RER misalignment, the coefficient is positive and highly significant for both the forward and backward linkages. The results of the backward linkage may appear contradictory when compared to traditional trade theory that argue that RER misalignment in terms of undervaluation lowers imports as their prices become more expensive. However, the latter result is consistent with the notion that GVC-related domestic and foreign value added are complements in production. Hence, producing and exporting more DVX increases the derived demand for imported FVA, especially for countries that export final goods that rely more on imported intermediate inputs. For the interaction between the income level and RER misalignment, we find a negative and highly significant coefficients that go in line with the findings of Rodrik (2008) that prove that the impact of RER misalignment relies on the initial level of income. Hence, RER misalignment works better for countries with lower initial level of income.

Considering the quality of institutions, the coefficients of the interaction between RER misalignment and the government effectiveness index and the interaction of misalignment with the financial development index are negative and highly significant. These findings are in line with the previous results in the literature proving that RER misalignment is not likely to be effective nor necessary for export promotion in economies with developed institutions. However, it becomes a counter-productive policy instrument for GVC promotion as first best solutions already exist.

Finally, to capture aspects related to connectivity and the use of technology, we control for the number of individuals using the internet (% of population). The widespread utilization of the internet in business operations is expected to promote GVC participation through different channels. First, it offers producers the ability to communicate with their customers, suppliers, distributors, and workers regardless of their geographic location (Clarke, 2008; Hagsten and Kotnik, 2017). Second, the internet facilitates access to faster and more accurate information about various economic agents and market conditions, enabling firms to expand internationally (Mostafa et al., 2005). Third, access to internet reduces the cost linked to finding an expensive intermediary who plays a crucial role in establishing trade relations (Fernandes et al., 2019).

Lastly, access to internet enables swift cross-border interactions among firms and provides a cost-effective means of participating in global markets (Kim, 2020).

The findings show that the coefficient of internet usage is positive and highly significant for both the forward and backward linkages, proving the role of access to internet in the promotion of GVC participation. These results are consistent with the findings of Gopalan et al. (2022) showing that access to internet acts as a key determinant of GVCs participation and plays a crucial role in deepening firms' integration into GVCs.

Table 2. GVC Participation & RER Misalignment – Baseline Regressions

	Forward Linkage		Backward Linkage	
	(a)	(b)	(c)	(d)
[1] Ln (RGDPPC)	0.638***	0.540***	0.632***	0.518***
	(0.00791)	(0.00856)	(0.00830)	(0.00677)
[2] Ln (Misalignment)	0.180***	0.449***	0.372***	0.578***
	(0.0462)	(0.0606)	(0.0499)	(0.0491)
[1] * [2]	-0.0687***	-0.114***	-0.0583***	-0.121***
	(0.00515)	(0.00704)	(0.00555)	(0.00567)
Ln (Tariffs)	-0.0338***	-0.0166***	-0.0462***	-0.0236***
	(0.00292)	(0.00252)	(0.00382)	(0.00254)
Ln (Rents)	-0.00625***	-0.00509***	-0.00390***	-0.00234***
	(0.00133)	(0.00112)	(0.00140)	(0.000897)
[2] * Government Effectiveness		-0.0913***		-0.0233***
		(0.0108)		(0.00849)
[2] * Ln (Internet Usage)		0.140***		0.132***
		(0.00309)		(0.00244)
[2] * Financial Development		-0.271***		-0.00787
		(0.0386)		(0.0305)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Each variable of the interactions	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Mean of dependent variable	13.953	13.953	13.663	13.663
Observations	2,649	2,649	2,649	2,649

Rescaled standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5.2 GVC Position & RER Misalignment

As the position within the value chain matters, we investigate the impact of RER misalignment on GVC participation considering the country's position within the value chain. To do so, we split the sample into two sub-samples. Following the literature, a country is specializing in an upstream (downstream) activity in the production process if the domestic value added is higher (lower) than the foreign value added (Ahmed et al., 2016). Then, for each sub-sample, we run the regressions for the forward and backward linkages.

The results (Table 3) show that RER misalignment exerts a consistently positive and highly significant impact on the forward linkage, irrespective of a country's position within the value chain. Regarding the impact on the backward linkage, we find a strong and negative impact for

upstream countries, while the impact remains positive and highly significant for downstream countries. One possible explanation for this pattern is that exports and imports are better cushioned and protected from exchange rate changes in countries that are more downstream in the supply chain, which means, sell inputs that will be used in further production processes or operates in a stage of production that is closer to the end consumer. This protection stems from their greater price flexibility advantage over upstream countries. To cope with currency fluctuations, countries that downstream can pass on a part of the cost increase or decrease on their customers or suppliers, thereby mitigating the impact on trade and reducing their vulnerability to currency volatility.

Table 3. GVC Position & RER Misalignment

	Forward Linkage: DVX		Backward Linkage: FVA	
	(a) Upstream	(b) Downstream	(c) Upstream	(d) Downstream
[1] Ln (RGDPPC)	0.443***	0.459***	0.337***	0.585***
	(0.0137)	(0.0153)	(0.0156)	(0.0240)
[2] Ln (Misalignment)	0.157*	0.695***	-0.814***	2.861***
	(0.0861)	(0.149)	(0.0979)	(0.239)
[1] * [2]	-0.0734***	-0.127***	0.0666***	-0.430***
	(0.00986)	(0.0170)	(0.0112)	(0.0272)
[2] * Government Effectiveness	-0.211***	-0.129***	-0.236***	0.247***
	(0.0171)	(0.0196)	(0.0192)	(0.0312)
[2] * Ln (Internet Usage)	0.118***	0.207***	0.120***	0.214***
	(0.00478)	(0.00751)	(0.00540)	(0.0120)
[2] * Financial Development	-0.293***	-0.599***	-0.291***	0.461***
	(0.0529)	(0.0698)	(0.0600)	(0.112)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Each variable of the interactions	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Mean of dependent variable	13.953	13.953	13.663	13.663
Observations	1,431	1,215	1,431	1,215

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6. Robustness Checks

As mentioned in the methodology section, we ensure the reliability of our findings by employing four different checks. Firstly, we utilize an instrumental variable (IV) approach to address the potential endogeneity of RER misalignment. Secondly, we examine whether the impact of RER misalignment is primarily driven by positive values (undervaluation) or negative values (overvaluation). Additionally, we assess the extent of misalignment, irrespective of whether it is undervalued or overvalued. Thirdly, we employ panel fixed-effects regressions with Driscoll-Kraay robust standard errors (Driscoll and Kraay, 1998). These standard errors are deigned to account for heteroskedasticity, as well as spatial and temporal cross-sectional dependencies. Lastly, we consider alternative indicators to evaluate the quality of institutions and the level of digitalization.

6.1 Instrumental Variable Approach

In an attempt to control for the endogeneity of RER misalignment, we use a set of instruments, and we test for their validity. The instrument must satisfies two main criteria. First, it must be highly correlated with the endogenous variable (RER misalignment in our case). Second, it should not be correlated with the error term and does not affect GVC participation directly.

For the forward linkage, we use different combinations of three different instruments. First, the RER misalignment of the country's main trade partner. Cheng et al. (2016) argue that when a country has a limited DVA contribution to the final GVC product, any change in its RER will have a minor impact on the overall competitiveness of the entire supply chain. Therefore, the response in terms of DVA and FVA to its own RER misalignment will be muted. Conversely, countries with substantial DVA contribution experience significant competitiveness effects on the entire supply chain when their RER changes, leading to spillover effects on other participants. Consequently, a country with a small DVA contribution can benefit when a supply-chain partner with a large DVA contribution undergoes depreciation, even if the small DVA-contributing country's own RER is appreciating.

The second instrument is a leave-one-out mean measure of misalignment to instrument the endogenous RER misalignment variable. This measure refers to the instrument for the ith country at year t constructed as the region-year average of RER misalignment while excluding the ith country's RER misalignment. By doing so, we draw information from regions that are homogenous to draw inference on RER misalignment and GVC participation of countries. This "leave-one-out mean" instrument has been widely used in the literature (Alby et al., 2013; Clarke et al. 2015; Dovis and Zaki, 2020; Ehab and Zaki, 2021; Cette et al., 2022; Gopalan et al., 2022).

The third instrument is a leave-one-out mean measure of misalignment calculated over a set of countries that share the country i's main characteristics at year t excluding the ith country's RER misalignment. The idea of replacing the value of country i by the value of countries that share similar characteristics is inspired from the work of Autor et al. (2013). To match each country with the countries that have the same characteristics, we follow two steps. First, we calculate propensity scores for each country i at year t based on a set of characteristics: the GDP per capita, tariffs imposed, tariffs faced, domestic value added, foreign value added, rents, quality of institutions, level of financial development and degree of digitalization. Second, we estimate an average for the RER misalignment over the blocks[8] constructed upon the estimated scores.

As per the backward linkage, we use the leave-one-out means over region-year and over countries sharing a country's main characteristics. However, we do not make use of the RER misalignment of the main trade partner as it directly impacts the foreign value added of the country. Hence, it violates the exclusion restriction.

[8] Table A6 in Appendix 3 provides a comprehensive presentation of the blocks.

Hence, the endogeneity problem is tackled following a Two-Stage Least Squares (2SLS) technique. The first stage predicts RER misalignment as follows:

$$Ln\ (Misalignment_{it}) = \chi_{it}\ \beta_1 + \eta_{it}\ \beta_2 + \gamma_{it}\ \beta_3 + \delta_i + \mu_t + \in_{it}\ (5)$$

Where $Ln\ (Misalignment_{it})$ is RER misalignment suspected to be endogenous. χ_{it} is a vector that compiles a set of instruments that varies according to the GVC participation indicator (forward and backward linkages). η_{it} and γ_{it} represent the vector of control variables and the vector that compiles variables related to the quality of institutions, the level of financial development and the degree of digitalization. $\in_{it}$ is the error term. The instruments appear to satisfy the relevance condition as shown by the positive and significant coefficient of the instruments in the first stage[9] regressions.

Tables 4 and 5 report the results for the forward and backward linkages, respectively. Two comments are worth to be mentioned. First, the coefficients of the IV approach are not comparable with the baseline coefficients (Table 2) since the baseline coefficients are estimated following a dynamic OLS estimation. However, we estimate a static 2SLS model to check the robustness of our results. Second, even though the OLS coefficients are deemed irrelevant, they are still reported in Column 1 (Tables 4 and 5) to allow the comparison of coefficients before and after addressing the issue of endogeneity.

The findings show that, using different sets of instruments, RER misalignment exerts a positive and highly significant impact on both the forward and backward linkages. It is pertinent to note that, when considering endogeneity, the economic impact of RER misalignment becomes even more significant, as evident from the larger coefficients compared to the baseline estimates. Failing to account for endogeneity may result in underestimated coefficients.

In terms of the interactions between RER misalignment and the government effectiveness index, financial institutions efficiency index, and internet usage variable, the coefficients of financial efficiency and internet usage align with the baseline results for the forward linkage. However, the negative interaction with government effectiveness is no longer present. For the backward linkage, the coefficients for internet usage and government effectiveness (Column 2) remain consistent with the baseline results. Nevertheless, the coefficient for the interaction with the financial institutions efficiency index is no longer statistically significant.

[9] The results of the first stage regressions as well as the endogeneity and validity tests are reported in Table A7 (for the forward linkage) and Table A8 (for the backward linkage) in Appendix 3.

Table 4. Forward Linkage & RER Misalignment – IV Approach

	OLS		2SLS	
Forward Linkage: Ln (DVX)	(1)	(2)	(3)	(4)
[1] Ln (RGDPPC)	0.600***	0.705***	0.648***	0.714***
	(0.0260)	(0.0284)	(0.0286)	(0.0285)
[2] Ln (Misalignment)	0.347*	4.286***	1.504**	4.322***
	(0.178)	(0.479)	(0.610)	(0.466)
[1] * [2]	-0.096***	-0.55***	-0.22***	-0.550***
	(0.0205)	(0.0558)	(0.0710)	(0.0546)
Ln (Tariffs)	-0.00324	-0.02***	-0.0124*	-0.022***
	(0.00637)	(0.00702)	(0.00742)	(0.00703)
Ln (Rents)	-0.00312	-0.01***	-0.008*	-0.014***
	(0.00367)	(0.00414)	(0.00439)	(0.00415)
[2] * Government Effectiveness	-0.0490	0.309***	0.292***	0.339***
	(0.0313)	(0.0739)	(0.102)	(0.0727)
[2] * Ln (Internet Usage)	0.120***	0.280***	0.392***	0.281***
	(0.00828)	(0.0237)	(0.0462)	(0.0239)
[2] * Financial Development	-0.290***	-0.506*	-2.10***	-0.485*
	(0.102)	(0.280)	(0.349)	(0.279)
Country & Year FE	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Each variable of the interactions	Yes	Yes	Yes	Yes
Mean of dependent variable	13.953	13.953	13.953	13.953
Inst 1: Avg over region & year	No	Yes	No	Yes
Inst 2: Avg over countries sharing the main charac.	No	Yes	Yes	No
Inst 3: Misalignment of main trade partner	No	No	Yes	No
Observations	2,652	2,652	2,629	2,652

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5. Backward Linkage & RER Misalignment – IV Approach

	OLS	2SLS	
Backward Linkage: Ln (FVA)	(1)	(2)	(3)
[1] Ln (RGDPPC)	0.459***	0.516***	0.518***
	(0.0343)	(0.0341)	(0.0342)
[2] Ln (Misalignment)	-0.0946	1.661***	1.626***
	(0.237)	(0.583)	(0.576)
[1] * [2]	-0.0269	-0.241***	-0.243***
	(0.0273)	(0.0678)	(0.0673)
Ln (Tariffs)	-0.0256**	-0.0112	-0.0130
	(0.0118)	(0.0121)	(0.0122)
Ln (Rents)	0.00402	0.00232	0.00255
	(0.00484)	(0.00503)	(0.00506)
[2] * Government Effectiveness	-0.109***	-0.165*	-0.122
	(0.0412)	(0.0915)	(0.0912)
[2] * Ln (Internet Usage)	0.0798***	0.167***	0.154***
	(0.0109)	(0.0286)	(0.0289)
[2] * Financial Development	0.177	0.359	0.497
	(0.135)	(0.344)	(0.348)
Country & Year FE	Yes	Yes	Yes
Intercept	Yes	Yes	Yes
Each variable of the interactions	Yes	Yes	Yes
Mean of dependent variable	13.663	13.663	13.663
Inst 1: Avg over region & year	No	Yes	Yes
Inst 2: Avg over countries sharing the main characteristics	No	Yes	No
Inst 3: Misalignment of main trade partner	No	No	No
Observations	2,652	2,652	2,652

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6.2 Undervaluation Vs. Overvaluation

In our baseline specification, where RER misalignment is represented with its sign, we show that the sign of the deviation from the equilibrium level matters. However, one might question whether the magnitude of the effects really depends on the sign of RER misalignment. In this vein, Rodrik (2008) finds that, for developing countries, the positive effect of an increase of undervaluation on economic growth is just as powerful as the negative growth effect of overvaluation.

Therefore, we examine whether the impact of RER misalignment is predominantly driven by positive values (undervaluation) or remains consistent regardless of whether the RER is undervalued or overvalued. We investigate this effect by employing two distinct variables, as indicated by equation (7):

$$Ln\,(GVC_{it}) = \gamma_1\,|Misalignment_{it}| + \gamma_2\,(Misalignment_{it} * Dummy_{it}) \qquad (7)$$

Where $|Misalignment\_it\ |$ is an absolute value of RER misalignment and ($Misalignment\_it{*}Dummy$) is the RER misalignment interacted with a dummy variable that takes the value 1 if RER misalignment > 0 (undervaluation) and 0 if RER misalignment < 0

(overvaluation). The equation incorporates all the control variables, quality of institutions and access to internet variables and fixed effects mentioned in equation 4.

Including the absolute value of RER misalignment allows us to capture the magnitude of RER misalignment irrespective of notions of undervaluation or overvaluation. Regarding the interaction between RER misalignment and the dummy variable, three scenarios are plausible for γ_2. Firstly, it can be statistically insignificant, suggesting no discernible difference between undervaluation and overvaluation. Secondly, it can be statistically significant and positive, indicating that the impact is predominantly influenced by RER undervaluation. Thirdly, it can be statistically significant and negative, suggesting that the impact is driven by RER overvaluation.

Table 6 presents the findings for the forward linkage (column 1) and the backward linkage (column 2). Our results indicate that regardless of whether the RER is overvalued or undervalued, RER misalignment has a significant effect on increasing domestic value added. However, we do not observe a significant coefficient for the foreign value added.

Regarding the interaction between RER misalignment and a dummy variable that indicates undervaluation (1) or overvaluation (0) of the RER, we find a highly significant and positive coefficient for both the forward and backward linkages. This implies that the positive impact of RER misalignment on the forward and backward linkages is primarily driven by undervalued values[10].

Table 6. GVC & RER Misalignment – Undervaluation Vs. Overvaluation

	(1) Ln (DVX)	(2) Ln (FVA)
AbsVal_Misalignment	0.252***	-0.00500
	(0.0117)	(0.0146)
[1] Ln (RGDPPC)	0.650***	0.654***
	(0.00886)	(0.0110)
[2] Undervaluation	0.444***	1.505***
	(0.0776)	(0.0993)
[1] * [2]	-0.144***	-0.210***
	(0.00888)	(0.0113)
[2] * Government Effectiveness	-0.313***	-0.0820***
	(0.0162)	(0.0202)
[2] * Ln (Internet Usage)	0.181***	0.149***
	(0.00394)	(0.00487)
[2] * Financial Development	-0.554***	-0.381***
	(0.0512)	(0.0640)
Country & Year FE	Yes	Yes
Intercept & Control Variables	Yes	Yes
Observations	2,649	2,649
Difference T-test: Undervaluation Vs Overvaluation	-0.612***	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[10] The T-test reported in the last row in Table 6 shows that the difference between RER undervaluation and RER overvaluation is highly significant.

6.3 Driscoll-Kraay Robust Standard Errors

Table 7 shows the results of panel fixed-effects regressions with Driscoll-Kraay robust standard errors. Correcting for spatial and serial cross-sectional dependence, the positive impact of RER misalignment is still confirmed for both the domestic and foreign value-added components.

Table 7. Misalignment and GVC Participation – Driscoll-Kraay Robust SE

	Forward Linkage	Backward Linkage
[1] Ln (Misalignment)	1.799***	1.106***
	(0.387)	(0.405)
[2] Ln (RGDPPC)	1.017***	0.879***
	(0.146)	(0.160)
[1] * [2]	-0.254***	-0.166***
	(0.0398)	(0.0363)
Ln (Tariffs)	-0.0470***	-0.0796***
	(0.00940)	(0.0216)
Ln (Rents)	0.0589***	0.0669***
	(0.0143)	(0.0151)
[1] * Government Effectiveness	0.497***	0.391***
	(0.0710)	(0.079)
[1] * Ln (Internet Usage)	0.0690**	0.051
	(0.0293)	(0.031)
[1] * Financial Development Index	0.00882	0.501*
	(0.315)	(0.275)
Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Each variable of the interactions	Yes	Yes
Mean of dependent variable	13.953	13.663
Observations	2,234	2,234

Driscoll-Kraay robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6.4 Alternative Measures of the Quality of Institutions and the Degree of Digitalization

To further ensure the robustness of our analysis, we conduct a fourth check by employing alternative measures to assess the quality of institutions and the level of digitalization. In assessing the quality of institutions, we utilize an indicator of socioeconomic pressures derived from the International Country Risk Guide (ICRG). Given that this variable reflects risk, we anticipate observing opposite signs compared to those reported in the baseline regressions. As a proxy for the degree of digitalization, we employ the natural logarithm of mobile cellular subscriptions per 100 people.

The findings, presented in Table 8, demonstrate the impact of RER misalignment on both forward and backward linkages. The results affirm a positive impact of RER misalignment on both types of linkages. Furthermore, the interaction effects between misalignment and variables controlling the quality of institutions and level of digitalization align with the findings observed in the baseline regressions for the forward linkage. However, concerning the

backward linkage, the results are consistent with the baseline regressions only for the interactions involving the mobile cellular subscriptions and the financial development index.

Table 8. Misalignment and GVC Participation – Alternative Indicators

	Forward Linkage	Backward Linkage
[1] Ln (RGDPPC)	0.536***	0.610***
	(0.00857)	(0.0142)
[2] Ln (Misalignment)	0.639***	0.217***
	(0.0447)	(0.0751)
[1] * [2]	-0.158***	-0.0349***
	(0.00595)	(0.00987)
[2] * Socio-Economic Risk	0.0189***	-0.0275***
	(0.00263)	(0.00433)
[2] * Ln (Mobile Cellular Sub.)	0.122***	0.109***
	(0.00266)	(0.00441)
[2] * Financial Development Index	-0.401***	-0.482***
	(0.0364)	(0.0601)
Country & Year FE	Yes	Yes
Intercept	Yes	Yes
Control Variables	Yes	Yes
Each variable of the interactions	Yes	Yes
Mean of dependent variable	13.953	13.663
Observations	2,234	2,234

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

7. Conclusion and Policy Implications

The surge in intermediate goods trade and trade in value added resulting from the increasing fragmentation of production processes shed light on the importance of considering these new patterns of production when we try to understand how trade in value added and intermediate inputs respond to exchange rate misalignments.

Therefore, this paper aims at studying how RER misalignment impacts the domestic and foreign value added components of GVC. Moreover, we explore how this impact can be moderated by other factors namely the initial income level, the country's position within the value chain (downstream or upstream supplier), the quality of institutions and the degree of digitalization. For this purpose, we follow a cointegration approach using the UNCTAD-EORA Global Supply Chain database.

The main findings show that RER misalignment exerts a positive impact on both the forward and backward components of GVC participation. Moreover, misalignment is found to be a counter-productive policy instrument for promoting GVC participation in countries with good quality of institutions. However, it proves to be more beneficial for countries with better access to internet. Considering the country's position within the value chain, the results show that downstream countries are better cushioned from exchange rate changes. The robustness of the results is confirmed after controlling for the endogeneity of RER misalignment using an instrumental variable approach, investigating whether the impact of RER misalignment is

primarily influenced by positive values (undervaluation) or negative values (overvaluation), running the regressions using Driscoll-Kraay robust standard errors, and utilizing alternative indicators for the quality of institutions, and for the degree of digitalization.

In terms of policy implications, RER misalignment in terms of undervaluation acts, in second-best fashion, to mitigate the economic cost of poor institutions and market failures. A first-best policy would consist of identifying specific market failures and implementing tailored solutions. However, undervaluation can be perceived as a substitute for a comprehensive industrial policy. Moreover, the study emphasizes the idea that the impact of RER misalignment on trade flows is not the same across countries. Many aspects should be taken into account while studying such impact such as the level of financial development, the quality of institutions and the degree of digitalization. Hence, to maintain the positive effect of RER misalignment, exchange rate policy should be coupled with other policies such as the fiscal policy, income policy, and financial policy.

References

[1] Aghion, P., Bacchetta, P., Ranciere, R., & Rogoff, K. (2009). Exchange rate volatility and productivity growth: The role of financial development. *Journal of monetary economics*, *56*(4), 494-513.

[2] Ahmed, S., Appendino, M., & Ruta, M. (2016). Global value chains and the exchange rate elasticity of exports. *The BE Journal of Macroeconomics*, *17*(1), 20150130.

[3] Alby, P., Dethier, J. J., & Straub, S. (2013). Firms operating under electricity constraints in developing countries. *The World Bank Economic Review*, *27*(1), 109-132.

[4] Amiti, M., Itskhoki, O., & Konings, J. (2014). Importers, exporters, and exchange rate disconnect. *American Economic Review*, *104*(7), 1942-1978.

[5] Autor, D. H., Dorn, D., & Hanson, G. H. (2013). The China syndrome: Local labor market effects of import competition in the United States. *American economic review*, *103*(6), 2121-2168.

[6] Bahmani-Oskooee, M., & Ardalani, Z. (2006). Exchange rate sensitivity of US trade flows: evidence from industry data. *Southern Economic Journal*, *72*(3), 542-559.

[7] Bayoumi, M. T., Clark, M. P. B., Symansky, M. S. A., & Bartolini, M. L. (1994). *Exchange rates and economic fundamentals: A framework for analysis*. International Monetary Fund.

[8] Bems, R., & Johnson, R. C. (2017). Demand for value added and value-added exchange rates. *American Economic Journal: Macroeconomics*, *9*(4), 45-90.

[9] Beck, T. (2002). Financial development and international trade: Is there a link?. *Journal of international Economics*, *57*(1), 107-131.

[10] Beck, T. (2003). Financial Dependence and International Trade. *Review of International Economics*, 11 (2), 296–316.

[11] Berman, N., Martin, P., & Mayer, T. (2012). How do different exporters react to exchange rate changes?. *The Quarterly Journal of Economics*, *127*(1), 437-492.

[12] Berthou, A. (2007, June). Credit constraints and zero trade flows: The role of financial development. In *Empirical Investigations in International Economics, 4th Annual Conference*.

[13] Brach, J., & Naudé, W. (2012). International entrepreneurship and technological capabilities in the Middle East and North Africa. Maastricht: UNU-MERIT, Maastricht Economic and Social Research and Training Centre on Innovation and Technology.
[14] Casella, B., Bolwijn, R., Moran, D., & Kanemoto, K. (2019). Improving the analysis of global value chains: the UNCTAD-Eora Database. *Transnational Corporations*, *26*(3), 115-142.
[15] Cette, G., Nevoux, S., & Py, L. (2022). The impact of ICTs and digitalization on productivity and labor share: evidence from French firms. *Economics of innovation and new technology*, *31*(8), 669-692.
[16] Cheng, K. C., Hong, G. H., Seneviratne, D., & van Elkan, R. (2016). Rethinking the exchange rate impact on trade in a world with global value chains. *International Economic Journal*, *30*(2), 204-216.
[17] Choi, I. (2001). Unit root tests for panel data. *Journal of international money and Finance*, *20*(2), 249-272.
[18] Clarke, G. R. (2008). Has the internet increased exports for firms from low and middle-income countries?. *Information Economics and Policy*, *20*(1), 16-37.
[19] Clarke, G. R., & Wallsten, S. J. (2006). Has the internet increased trade? Developed and developing country evidence. *Economic Inquiry*, *44*(3), 465-484.
[20] Clarke, G. R., Qiang, C. Z., & Xu, L. C. (2015). The Internet as a general-purpose technology: Firm-level evidence from around the world. *Economics Letters*, *135*, 24-27.
[21] Combes, J. L., Kinda, T., Ouedraogo, R., & Plane, P. (2019). Financial flows and economic growth in developing countries. *Economic Modelling*, *83*, 195-209.
[22] Cusolito, A. P., Lederman, D., & Peña, J. (2020). The effects of digital-technology adoption on productivity and factor demand: Firm-level evidence from developing countries. *World Bank Group*, Middle East and North Africa Region, Office of the Chief Economist.
[23] De Soyres, F., Frohm, E., Gunnella, V., & Pavlova, E. (2021). Bought, sold and bought again: The impact of complex value chains on export elasticities. *European Economic Review*, *140*, 103896.
[24] Dovis, M., & Zaki, C. (2020). Global value chains and local business environments: Which factors really matter in developing countries?. *Review of Industrial Organization*, *57*, 481-513.
[25] Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of economics and statistics*, *80*(4), 549-560.
[26] Eaton, J., Eslava, M., Kugler, M., & Tybout, J. R. (2007). Export dynamics in Colombia: Firm-level evidence. *National Bureau of Economic Research Working Paper 13531*.
[27] Edwards, L., & Golub, S. S. (2004). South Africa's international cost competitiveness and exports in manufacturing. *World Development*, *32*(8), 1323-1339.
[28] Ehab, M., & Zaki, C. R. (2021). Global value chains and service liberalization: do they matter for skill-upgrading?. *Applied Economics*, *53*(12), 1342-1360.
[29] Elbadawi, I. A., Kaltani, L., & Soto, R. (2012). Aid, real exchange rate misalignment, and economic growth in Sub-Saharan Africa. *World Development*, *40*(4), 681-700.

[30] Elbadawi, I., & Kaltani, L. (2016). Real exchange rates and export performance in oil-dependent Arab economies. *Understanding and Avoiding the Oil Curse in Resource-rich Arab Economies*, 44.
[31] Elbadawi, I., & Zaki, C. (2021). Exchange rate undervaluation, economic institutions and exports performance: evidence from firm-level data. *International Journal of Trade and Global Markets*, *14*(1), 62-93.
[32] Fauceglia, D., Lassmann, A., Shingal, A., & Wermelinger, M. (2018). Backward participation in global value chains and exchange rate driven adjustments of Swiss exports. *Review of world economics*, *154*, 537-584.
[33] Fernandes, A. M., Mattoo, A., Nguyen, H., & Schiffbauer, M. (2019). The internet and Chinese exports in the pre-ali baba era. *Journal of Development Economics*, *138*, 57-76.
[34] Fišera, B., & Horvath, R. (2022). Are exchange rates less important for trade in a more globalized world? Evidence for the new EU members. *Economic Systems*, *46*(1), 100868.
[35] Freund, C., & Pierola, M. D. (2012). Export surges. *Journal of Development Economics*, *97*(2), 387-395.
[36] Freund, C., & Weinhold, D. (2002). The Internet and international trade in services. *American Economic Review*, *92*(2), 236-240.
[37] Frieden, J., Broz, J. L., Weingast, B., & Wittman, D. (2006). The political economy of exchange rates. *Oxford Handbooks Online*.
[38] Genc, E. G., & Artar, O. K. (2014). The effect of exchange rates on exports and imports of emerging countries. *European Scientific Journal*, *10*(13), 128-141.
[39] Gopalan, S., Reddy, K., & Sasidharan, S. (2022). Does digitalization spur global value chain participation? Firm-level evidence from emerging markets. *Information Economics and Policy*, *59*, 100972.
[40] Greenaway, D., Kneller, R., & Zhang, X. (2010). The effect of exchange rates on firm exports: The role of imported intermediate inputs. *The World Economy*, *33*(8), 961-986.
[41] Glüzmann, P. A., Levy-Yeyati, E., & Sturzenegger, F. (2012). Exchange rate undervaluation and economic growth: Díaz Alejandro (1965) revisited. *Economics Letters*, *117*(3), 666-672.
[42] Haddad, M., & Pancaro, C. (2010). Can real exchange rate undervaluation boost exports and growth in developing countries? Yes, but not for long. *Economic Premise*, No. 20, Washington, DC: World Bank.
[43] Hagsten, E., & Kotnik, P. (2017). ICT as facilitator of internationalisation in small-and medium-sized firms. *Small Business Economics*, *48*, 431-446.
[44] Harris, R. D., & Tzavalis, E. (1999). Inference for unit roots in dynamic panels where the time dimension is fixed. *Journal of econometrics*, *91*(2), 201-226.
[45] Hayakawa, K., & Kimura, F. (2009). The effect of exchange rate volatility on international trade in East Asia. *Journal of the Japanese and International Economies*, *23*(4), 395-406.
[46] Hur, J., Raj, M., & Riyanto, Y. E. (2006). Finance and trade: A cross-country empirical analysis on the impact of financial development and asset tangibility on international trade. *World Development*, *34*(10), 1728-1741.
[47] Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of econometrics*, *115*(1), 53-74.

[48] Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of econometrics*, *90*(1), 1-44.
[49] Kao, C., & Chiang, M. H. (2001). On the estimation and inference of a cointegrated regression in panel data. In *Nonstationary panels, panel cointegration, and dynamic panels* (Vol. 15, pp. 179-222). Emerald Group Publishing Limited.
[50] Kim, D. (2020). Internet and SMEs' internationalization: The role of platform and website. *Journal of International Management*, *26*(1), 100690.
[51] Kowalski, P., Gonzalez, J., Ragoussis, A. and Ugarte, C. (2015). Participation of developing countries in global value chains: implications for trade and trade-related policies. *OECD Trade Policy Papers*, No. 179. Paris: OECD Publishing.
[52] Krugman, P. R., Obstfeld, M., & Melitz, M. J. (2012). International economics, Theory & policy, NY, Addison-Wesley.
[53] Leigh, D., Lian, W., Poplawski-Ribeiro, M., & Tsyrennikov, V. (2015). Exchange Rates and Trade Flows: Disconnected?, October 2015 World Economic Outlook. *International Monetary Fund*.
[54] Mamun, A., Akça, E. E., & Bal, H. (2021). The Impact of Currency Misalignment on Trade Balance of Emerging Market Economies. *Organizations and Markets in Emerging Economies*, *12*(2), 285-304.
[55] Manova, K. B. (2007). *The role of credit constraints in international trade and growth*. Harvard University.
[56] Manova, K. (2008). Credit constraints, equity market liberalizations and international trade. *Journal of International Economics*, *76*(1), 33-47.
[57] Mark, N. C., & Sul, D. (2003). Cointegration vector estimation by panel DOLS and long-run money demand. *Oxford Bulletin of Economics and statistics*, *65*(5), 655-680.
[58] Méon, P. G., & Sekkat, K. (2008). Institutional quality and trade: which institutions? Which trade?. *Economic Inquiry*, *46*(2), 227-240.
[59] Mostafa, R. H., Wheeler, C., & Jones, M. V. (2005). Entrepreneurial orientation, commitment to the Internet and export performance in small and medium sized exporting firms. *Journal of international Entrepreneurship*, *3*, 291-302.
[60] Nouira, R., Plane, P., & Sekkat, K. (2011). Exchange rate undervaluation and manufactured exports: A deliberate strategy?. *Journal of Comparative Economics*, *39*(4), 584-601.
[61] Odedokun, M. O. (1997). An empirical analysis on the determinants of the real exchange rate in African countries. *Journal of International Trade & Economic Development*, *6*(1), 63-82.
[62] Ollivaud, P., Rusticelli, E., & Schwellnus, C. (2015). The changing role of the exchange rate for macroeconomic adjustment. OECD Economics Department Working Papers, No. 1190.
[63] Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and statistics*, *61*(S1), 653-670.
[64] Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric theory*, *20*(3), 597-625.

[65] Rajan, R. G., & Subramanian, A. (2011). Aid, Dutch disease, and manufacturing growth. *Journal of development Economics*, *94*(1), 106-118.
[66] Rasbin, M., Ikhsan, M., Y. Gitaharies, B., & Affandi, Y. (2021). Real exchange rate undervaluation and Indonesia's manufacturing exports. *Cogent Economics & Finance*, *9*(1), 1930880.
[67] Riad, N., Errico, M. L., Henn, C., Saborowski, C., Saito, M., & Turunen, M. J. (2012). *Changing patterns of global trade*. International Monetary Fund.
[68] Rowbotham, N., Saville, A., & Mbululu, D. (2014). Exchange rate policy and export performance in efficiency-driven economies. *Available at SSRN 2443280*.
[69] Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings papers on economic activity*, *2008*(2), 365-412.
[70] Sato, K., & Zhang, S. (2017). Exchange Rate Volatility, Exports and Global Value Chains. *Retrived from: https://www. econ. ynu. ac. jp/cessa/english/publication/others. html*.
[71] Sekkat, K. (2016). Exchange rate misalignment and export diversification in developing countries. *The Quarterly Review of Economics and Finance*, *59*, 1-14.
[72] Svensson, J. (2003). Who must pay bribes and how much? Evidence from a cross section of firms. *The Quarterly Journal of Economics*, *118*(1), 207-230.
[73] Steinberg, D. A. (2016). Developmental states and undervalued exchange rates in the developing world. *Review of International Political Economy*, *23*(3), 418-449.
[74] Tan, K. G., Trieu Duong, L. N., & Chuah, H. Y. (2019). Impact of exchange rates on ASEAN's trade in the era of global value chains: An empirical assessment. *The Journal of International Trade & Economic Development*, *28*(7), 873-901.
[75] Zaki, C., Abdallah, A., & Sami, M. (2019). How Do Trade Margins Respond to Exchange Rate? The Case of Egypt. *Journal of African Trade*, *6*(1-2), 60-80.

Appendix 1: Countries in The Sample

Low Income	Low Middle Income	Upper Middle Income	High Income
Burundi	Algeria	Argentina	Antigua
Central African Republic	Angola	Armenia	Aruba
Gambia	Bangladesh	Azerbaijan	Australia
Madagascar	Bhutan	Bosnia and Herzegovina	Austria
Malawi	Bolivia	Botswana	Bahamas
Mali	Cambodia	Brazil	Bahrain
Mozambique	Cameroon	Bulgaria	Barbados
Niger	Cape Verde	China	Belgium
Rwanda	Côte d'ivoire	Colombia	Bermuda
Sierra Leone	Egypt	CostaRica	Brunei Darussalam
Uganda	El Salvador	Dominican Republic	Canada
	Gaza Strip	Ecuador	Chile
	Ghana	Fiji	Croatia
	Haiti	Gabon	Cyprus
	Honduras	Georgia	Czech Republic
	India	Guatemala	Denmark
	Indonesia	Jamaica	Estonia
	Iran	Jordan	Finland
	Kenya	Kazakhstan	France
	Kyrgyzstan	Lebanon	Germany
	Lao PDR	Malaysia	Greece
	Lesotho	Maldives	Hong Kong
	Mauritania	Mauritius	Hungary
	Mongolia	Mexico	Iceland
	Morocco	Montenegro	Ireland
	Myanmar	Namibia	Israel
	Nepal	Panama	Italy
	Nicaragua	Paraguay	Japan
	Nigeria	Peru	Kuwait
	Pakistan	Romania	Latvia
	Philippines	Russia	Lithuania
	Sao Tome and Principe	South Africa	Luxembourg
	Senegal	Suriname	Macao SAR
	Sri Lanka	TFYR Macedonia	Malta
	Swaziland	Thailand	Netherlands
	Tajikistan	Turkey	New Zealand
	Tanzania		Norway
	Togo		Oman
	Tunisia		Poland
	Ukraine		Portugal
	Uzbekistan		Qatar
	Vietnam		Seychelles
	Zambia		Singapore
			Slovak Republic
			Slovenia
			South Korea
			Spain
			Sweden
			Trinidad and Tobago
			United Arab Emirates
			United Kingdom
			United States of America
			Uruguay

Source: Constructed by the authors based on the World Bank's classification

Appendix 2: Variables Definition

Variable	Definition	Source	Coverage
XR	Exchange rate, national currency/USD	WDI	1995-2018
PPP	Purchasing power parity	WDI	1995-2018
Ln (DVX)	Ln of the domestic value added of this country which is embodied in the exports of other countries. This corresponds to the Forward GVC participation component of the participation index	UNCTAD-EORA	1995-2018
Ln (FVA)	Ln of the foreign value added which is embodied in this country's exports. This corresponds to the Backward GVC participation component of the GVC participation index	UNCTAD-EORA	1995-2018
Ln (RGDPCPPP)	Ln of the real GDP per capita, purchasing power parity, (constant 2017 international $)	WDI	1995-2018
Ln (RGDPPC)	Ln of the real GDP per capita, Constant 2015	WDI	1995-2018
Ln (Tariffs)	Ln of the weighted mean tariff rate (applied) +1 imposed on the exports of country i by its main trade partners for the case of DVX or the average tariff imposed by country i on the exports of other countries for the case of FVA	WDI	1995-2018
Ln (Rents)	Ln of total natural resources rents value which are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	WDI	1995-2018
Gvt. Eff.	Government Effectiveness reflects the quality of public and civil services and the degree of their independence from political pressures. The estimate ranges from -2.5 (weak) to 2.5 (strong) governance performance	WGI	1995-2018
Socio-Eco.	A measure of the socioeconomic pressures at work in society. Maximum score is 12 points. The lower the risk point, the higher the risk	ICRG	1995-2018
Ln (Internet Usage)	Ln of individuals using the internet (% of population)	WDI	1995-2018
Ln (Mob. Cell. Sub.)	Ln of mobile cellular subscriptions (per 100 people)	WDI	1995-2018
Fin. Inst. Efficiency	Includes data on banking sector net interest margin, lending-deposits spread, non-interest income to total income, overhead costs to total assets, return on assets, and return on equity	IMF	1995-2018

Note: - WDI: World Development Indicators.
- WGI: World Governance Indicators.
- ICRG: International Country Risk Guide.
- IMF: Financial Development Index Database, International Monetary Fund.

Appendix 3: Unit-root and Panel Cointegration Tests

Table A1. RER Adjusted for Balassa-Samuelson Effect

	Ln (RER)
Ln (RGDPPCPPP)	-0.249***
	(0.005)
Constant	3.038***
	(0.048)
Year FE	Yes
Observations	3,735
R-squared	0.434

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A2. Unit-root Tests

	Ln (DVX)		Ln (FVA)		Ln (Mis.)		Ln (RGDPPC)	
Test		1st diff.		1st diff.				1st diff.
Fisher Unit-root test								
H_0: All panels contain unit roots								
H_a: At least one panel is stationary								
Inverse chi-squared	1.000	0.000	1.000	0.000	0.000		0.551	0.000
Inverse normal	0.999	0.000	1.000	0.000	0.000		1.000	0.000
Inverse logit	0.991	0.000	1.000	0.000	0.000		1.000	0.000
Modified inv. Chi-squared	1.000	0.000	1.000	0.000	0.000		0.561	0.000
Im-Pesaran-Shin test								
H_0: All panels contain unit roots								
H_a: Some panels are stationary								
Z-t-tilde-bar	0.969	0.000	1.000	0.000	-		-	-
Harris-Tzavalis test								
H_0: Panels contain unit roots								
H_a: Some panels are stationary								
rho	1.000	0.000	1.000	0.000	-		-	-
	Ln (Tariffs)		Ln (Rents)		Ln (Int Usage)	Fin Dev	Gvt. Eff.	
				1st diff.				1st diff.
Fisher Unit-root test								
H_0: All panels contain unit roots								
H_a: At least one panel is stationary								
Inverse chi-squared	0.000		0.2629	0.000	0.000	0.000	0.4485	0.000
Inverse normal	0.000		0.0021	0.000	0.000	0.000	0.4517	0.000
Inverse logit	0.000		0.0031	0.000	0.000	0.000	0.4293	0.000
Modified inv. Chi-squared	0.000		0.2682	0.000	0.000	0.000	0.4586	0.000
Im-Pesaran-Shin test								
H_0: All panels contain unit roots								
H_a: Some panels are stationary								
Z-t-tilde-bar	-		-	-	-	0.000	0.3728	0.000
Harris-Tzavalis test								
H_0: Panels contain unit roots								
H_a: Some panels are stationary								
rho	-		-	-	-	0.000	0.0087	0.000

Note: The table reports the p-values for each test.
Some p-values cannot be estimated for Im-Pesaran-Shin and Harris-Tzavalis because they require strongly balanced data.

Table A3. Panel Cointegration Tests

	(a) Forward Linkage (Domestic Value Added)
Test	P-value
Kao test for cointegration	
H_0: No cointegration	
H_a: All panels are cointegrated	
Modified Dickey-Fuller t	0.0012
Augmented Dickey-Fuller t	0.0001
Pedroni test	
H_0: No cointegration	
H_a: All panels are cointegrated	
Modified Phillips-Perron t	0.0000
Phillips-Perron t	0.0000
Augmented Dickey-Fuller t	0.0000
	(b) Backward Linkage (Foreign Value Added)
Test	P-value
Kao test for cointegration	
H_0: No cointegration	
H_a: All panels are cointegrated	
Modified Dickey-Fuller t	0.0000
Augmented Dickey-Fuller t	0.0000
Pedroni test	
H_0: No cointegration	
H_a: All panels are cointegrated	
Modified Phillips-Perron t	0.0000
Phillips-Perron t	0.0008
Augmented Dickey-Fuller t	0.0175

Note: The table reports the p-values for each test.

Table A4. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln (DVX)	4152	13.953	2.79	-.274	20.342
Ln (FVA)	4152	13.663	2.816	7.933	20.59
Ln (Misalignment)	3735	0	.382	-1.473	1.401
Ln (RGDPPC)	3918	8.634	1.526	5.383	12.094
Ln (Tariff_FVA)	2821	1.71	.736	0	5.023
Ln (Tariff_DVX)	2821	.648	.785	0	3.827
Ln (Rents)	3871	19.102	5.444	0	27.178
Government Eff. Estimate	4008	.087	.995	-2.45	2.43
Financial Efficiency Index	3744	.551	.135	0	.865
Ln (Internet Usage)	3953	2.499	1.535	0	4.612

Source: Authors' own calculations.

Table A5. Pairwise Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Ln (DVX)	1.000									
(2) Ln (FVA)	0.928*	1.000								
(3) Ln (Misalignment)	0.007	-0.059*	1.000							
(4) Ln (RGDPPC)	0.479*	0.564*	-0.149*	1.000						
(5) Ln (Tariffs_FVA)	-0.431*	-0.506*	0.084*	-0.512*	1.000					
(6) Ln (Tariffs_DVX)	-0.336*	-0.381*	0.186*	-0.327*	0.399*	1.000				
(7) Ln (Rents)	0.510*	0.396*	0.234*	-0.235*	0.032	0.018	1.000			
(8) Government Eff.	0.462*	0.590*	-0.303*	0.857*	-0.534*	-0.321*	-0.200*	1.000		
(9) Financial Dev.	0.382*	0.370*	0.065*	0.408*	-0.206*	-0.097*	0.024	0.436*	1.000	
(10) Ln (Internet Usage)	0.473*	0.530*	-0.122*	0.672*	-0.484*	-0.246*	-0.103*	0.577*	0.339*	1.000

*** p<0.01, ** p<0.05, * p<0.1

Table A6. Tabulation of Propensity Score Blocks

# of block	Freq.	Percent
1	300	11.32
2	65	2.45
3	94	3.55
4	197	7.43
5	334	12.60
6	351	13.24
7	374	14.11
8	387	14.60
9	349	13.16
10	200	7.54
Total	2651	100.00

Table A7. Instrumental Variable Approach – First Stage (Forward Linkage)

	Ln (Misalignment)		
	(1)	(2)	(3)
Avg_Misalignment_Region&Year	0.837***	-	0.837***
	(0.0435)		(0.0438)
Ln (Misalignment_Partner)	-	0.0876***	-
		(0.0142)	
Avg_Misalignment_MainCharac.	2.779***	2.789***	-
	(0.492)	(0.523)	
Ln (Tariffs)	0.00607	0.00884	0.0154**
	(0.00623)	(0.00661)	(0.00605)
Ln (Rents)	0.0120***	0.00982***	0.0114***
	(0.00347)	(0.00368)	(0.00349)
Ln (RGDPPC)	0.00882	0.0181	0.0173
	(0.0235)	(0.0251)	(0.0236)
Government Effectiveness	0.00937	0.0182	-0.0247*
	(0.0157)	(0.0167)	(0.0146)
Financial Development	-0.241***	-0.190***	-0.178***
	(0.0415)	(0.0441)	(0.0402)
Ln (Internet Usage)	-0.0450***	-0.0690***	-0.0434***
	(0.00684)	(0.00712)	(0.00687)
Country & Year FE	Yes	Yes	Yes
Intercept	Yes	Yes	Yes
Observations	2,652	2,629	2,652
Endogeneity Test			
H0: Variables are exogenous			
Durbin (score) chi2 (1)		(0.0000)	
Wu-Hausman F (1,2620)		(0.0000)	
Weak identification test			
Cragg-Donald Wald F statistic	201	34.70	366.8
Overidentification test			
Sargan statistic	0.2794	0.5054	-

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Note: We have two different first stages for the backward and forward linkages as tariffs are not the same for both.

Note: For the endogeneity test, p-values are reported into parentheses.

Table A8. Instrumental Variable Approach – First Stage (Backward Linkage)

	Ln (Misalignment)	
	(1)	(2)
Avg_Misalignment_Region&Year	2.372***	0.857***
	(0.492)	(0.0436)
Avg_Misalignment_MainCharac.	0.851***	-
	(0.0435)	
Ln (Tariffs)	-0.0340***	-0.0456***
	(0.00869)	(0.00838)
Ln (Rents)	0.0107***	0.00971***
	(0.00348)	(0.00349)
Ln (RGDPPC)	0.0106	0.0170
	(0.0234)	(0.0235)
Government Effectiveness	-0.00180	-0.0327**
	(0.0159)	(0.0146)
Financial Development	-0.225***	-0.171***
	(0.0414)	(0.0400)
Ln (Internet Usage)	-0.0479***	-0.0475***
	(0.00685)	(0.00688)
Country & Year FE	Yes	Yes
Intercept	Yes	Yes
Observations	2,652	2,652
Endogeneity Test		
H0: Variables are exogenous		
Durbin (score) chi2 (1)	(0.0002)	
Wu-Hausman F (1,2620)	(0.0002)	
Weak identification test		
Cragg-Donald Wald F statistic	206.3	385.9
Overidentification test		
Sargan statistic	0.4790	-

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Note: We have two different first stages for the backward and forward linkages as tariffs are not the same for both.

Note: For the endogeneity test, p-values are reported into parentheses.