After the Shock
Reform, Resilience, and Economic Transformation in MENA

ERF 32nd Annual Conference
June 14-16 | Cairo, Egypt

2026

Shaping Egypt's Sectoral Positioning in Global Value Chains: The Role of Bilateral Real Exchange Rate

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ECONOMIC RESEARCH FORUM
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Shaping Egypt's Sectoral Positioning in Global Value Chains: The Role of Bilateral Real Exchange Rate[†]

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Abstract Global value chains (GVCs) have become a key mechanism for structural transformation in developing economies, yet benefiting from them depends not only on participation but also on upgrading into higher value-added activities. A central but underexplored question is whether exchange rate policy can support both deeper GVC integration and movement up the value chain. Egypt offers a particularly relevant case: over the past decades, the real exchange rate (RER) has been actively used as a policy instrument, while the country has simultaneously sought to expand its GVC participation and diversify its export base. However, empirical evidence on whether RER has fostered integration or upgrading remains limited. Using sector-level multi-regional input-output data from EORA over the period 1995-2022, this paper examines the effect of bilateral RER depreciation on Egypt's sectoral GVC integration through forward and backward linkages and assesses the potential for sectoral upgrading. The findings show that RER depreciation increases GVC participation through both forward and backward linkages. Forward gains are strongest in primary sectors, while backward gains are concentrated in high-tech sectors. Yet, RER alone does not generate upgrading. Once foreign knowledge embedded in imported inputs is accounted for via a constructed knowledge spillover index, RER depreciation is associated with significant upgrading, particularly in high-tech sectors. Heterogeneity analysis shows stronger effects in South–North value-added trade flows. All results remain robust to alternative specifications. Policy implications point to the need for a balanced approach: while exchange-rate flexibility can enhance GVC participation, sustained upgrading requires complementary structural reforms that expand access to knowledge-intensive imports, strengthen innovation and skills, and redirect policy support toward high-productivity, export-oriented sectors.

J.E.L. Classifications: F14, F31, F40, O24

Keywords: global value chains, upgrading, real exchange rate, depreciation, sectoral level

[†] I am grateful to Silvia Nenci, Enrico Marvasi, Luca Salvatici, Chahir Zaki, Patrick Plane, Adam Jakubik, Rabah Arezki, as well as participants at Roma Tre internal seminar, ETSG 26th Annual Conference, and ED SEJPG doctoral day for insightful discussions and valuable comments.

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1. Introduction

In the pursuit of economic development, many developing countries have adopted a Global Value Chain (GVC)-led growth strategy as a pathway to industrialization. GVC integration enables firms, particularly in developing economies, to participate in international production networks by specializing in specific stages of production and niche activities, rather than striving to build full-fledged domestic production systems (Baldwin, 2012). While the initial phase of this strategy focuses on integration into global production networks, the more intricate and consequential challenge, especially for developing economies, lies in upgrading within these chains. Advancing from low value-added activities to higher value-added segments is crucial to avoid the so-called "low value-added trap". Yet, upgrading is inherently non-linear, uncertain, and multifaceted often requiring the development of industrial clusters, institutional support, and technological capabilities (Stojčić and Matić, 2024).

Unlike GVC participation, which is relatively well documented, there is a lack of unified consensus on how to measure GVC upgrading. Baldwin (2012) visualizes GVC upgrading through a "smiling curve", which illustrates how value-added is distributed along the chain. Activities in the middle of the curve, tend to be of low-value added, are characterized by low barriers to entry, and are subject to intense price-based competition (Pietrobelli and Rabellotti, 2011). In contrast, high value-added activities are typically concentrated in either upstream or downstream activities of the chain. Therefore, firms operating in the middle of the curve are encouraged to move toward upstream or downstream segments, where entry barriers are higher and competition is less fierce (Mudambi, 2008).

Further conceptual framework (Fernandez-Stark et al., 2012; and Taglioni and Winkler, 2016) distinguish three types of upgrading. First, product upgrading which refers to the production of more sophisticated products within the same value chain. Second, functional upgrading which involves moving into more sophisticated tasks, thereby increasing the value-added share in the final product. Third, inter-sectoral upgrading that entails shifting to new supply chains with higher value-added shares. Despite their relevance, these forms of upgrading are seldom empirically tested in developing economies, primarily due to the scarcity of firm-level and task-specific data. In this paper, we adopt a sector-level GVC position index as a proxy for potential upgrading trajectories[2].

A second strand of literature highlights the central role of the real exchange rate (RER) in shaping export performance, industrialization, and long-term growth, a relationship that is especially salient in the context of developing economies[3]. A competitive RER enhances a country's export potential by making its products relatively cheaper and attractive to foreign countries, thereby stimulating foreign demand. Conversely, it may also dampen imports as their prices become relatively more expensive. Historical evidence, especially from East Asian economies, demonstrates the effectiveness of the exchange rate policy as a policy tool in

[2] Further details regarding the construction of the index and the intuition behind is provided in the methodology section.

[3] See Bahmani-Oskooee and Ardalani (2006); Rodrik (2008); Krugman et al. (2012); and Genc and Artar (2014) as a very few examples from this wide strand of the literature.

driving export-led growth and industrial diversification. A depreciated RER has been widely recognized as a catalyst for the economic boom experienced in the Asian region, serving as a central driver behind the 'miracle' of the Asian countries and the structural transformation from agriculture-based economies toward the industrialization and service-led growth (Ghura and Grennes, 1993; Collier and Gunning, 1999). For instance, China's strategic undervaluation of its currency, alongside trade and industrial policy reforms, is often credited for its transition from an agricultural to an industrial economy (Dutta, 2005). Similar dynamics are observed in South Korea, Japan, and Taiwan (e.g. Johnson 1982; Amsden, 1989; Wade 1990).

In a GVC context, the literature on how countries integrate into GVCs and use their potential to upgrade remains largely fragmented. The dynamics seem to be shaped by several factors and policy frameworks, including though not limited to, domestic institutional quality (Gereffi and Sturgeon, 2013; Pipkin and Fuentes, 2017; Montalbano and Nenci, 2022; and Stojčić and Matić, 2024), workforce development and investment in human capital (Barrientos et al., 2011; Fernandez-Stark et al., 2011), as well as adherence to labor, social and environmental standards (Kummritz et al., 2017). Nevertheless, the literature on how exchange rate policy influence GVC integration is scarce, and most existing studies examine the impact of country's participation into GVCs on the exchange rate elasticity of exports (e.g. Greenway et al., 2010; Berman et al., 2012; and De Soyres et al., 2021). Few studies investigate the direct impact of RER misalignment on GVC integration (Cheng et al., 2016; and Abdou et al., 2024), and even those that do generally overlook sectoral heterogeneity or the prospects for upgrading along the value chain.

In the Egyptian context, the exchange rate has been actively used as a policy tool over the last decades[4]. Yet the literature focuses almost exclusively on export performance, either at the macro level (Nouira et al., 2011; and Brixiova et al., 2014) or the firm level (Zaki et al., 2019). To date, no study examines the effectiveness of the RER as policy tool for Egypt's integration into GVCs at the sectoral level or its prospects for upgrading and strategic positioning along the value chain.

Against this background, this paper aims to investigate the impact of RER depreciation on Egypt's integration into GVCs at the sectoral level and the potential for sectoral upgrading along the value chain. To examine this question, we use the UNCTAD-EORA Multi-Region Input-Output (MRIOs) tables, which provide key bilateral GVC indicators, including foreign value added (FVA), direct domestic value added (DVA), and indirect domestic value added (DVX) for 26 sectors over the period 1995-2022.

Therefore, this paper makes four main contributions to the previous literature. First, it represents the first attempt, to our knowledge, to study the impact of RER depreciation on Egypt's integration into GVCs at the sectoral level. Second, it explores the potential for sectoral upgrading and the prospects for moving up along the value chain. Third, it constructs a knowledge spillover index to evaluate how foreign knowledge embedded in imported inputs support upgrading. Fourth, it provides new empirical evidence linking exchange rate policy,

[4] A detailed overview of the Egyptian context is provided in Section 3.

GVC upgrading, and knowledge spillover, with policy implications for enhancing GVC participation in the context of a developing economy.

Our main findings reveal that RER depreciation increases GVC integration through both forward and backward linkages, considered complements in production. Disaggregating sectors by technological intensity, forward linkage gains are strongest in primary sectors, whereas backward linkage responsiveness is more pronounced in high-tech sectors. Although RER depreciation alone does not significantly induce GVC upgrading, the effect becomes positive and significant once foreign knowledge embedded in imported inputs is accounted for, especially in high-tech sectors. Additional heterogeneity analysis reveals that South-North value-added trade flows are more responsive to RER depreciation than South-South flows. Moreover, the effect of RER varies across subperiods, with stronger impact observed during the periods 2001-2007 and 2008-2015. All results hold under a range of robustness checks.

The remainder of the paper is organized as follows. Section 2 reviews the literature, highlighting the salient theoretical framework and empirical predictions underpinning the relation between RER depreciation and GVC participation. Section 3 details the data and gives an overview of the Egyptian context. Section 4 outlines the empirical strategy. Section 5 presents the main findings. Section 6 explores some heterogeneity across trade direction and subperiods. Section 7 reports robustness checks. Finally, Section 8 concludes and discusses the main policy implications.

2. Literature Review

This study examines the impact of RER depreciation on Egypt's integration into GVCs, its sectoral positioning, and the potential for moving up along the value chain. While the literature on currency depreciation and traditional trade is extensive, research on its effects within the GVC context remains limited. This section first summarizes key findings on the relationship between RER depreciation and traditional trade and then explores the emerging literature on the relation between RER dynamics and GVC integration.

2.1 RER Depreciation and Traditional Trade Performance

The literature examining the impact of RER depreciation on traditional trade is abundant but inconclusive. A competitive RER is often associated with improved export performance, as it makes domestic goods cheaper for foreign countries, stimulating external demand. Simultaneously, depreciation increases the cost of imported inputs, potentially reducing imports (e.g., Bahmani-Oskooee and Ardalani, 2006; Krugman et al., 2012; Genc and Artar, 2014). However, this relationship does not hold true in all circumstances and is contingent on country-specific structural features. For instance, Loto (2011) finds that RER depreciation benefits only countries that are export-oriented prior to the depreciation. Using trade data for Nigeria, where 90 percent of production inputs and raw materials are imported, he shows that RER depreciation undermines export performance. Moreover, using bilateral trade data for 172 countries over the period 1962-2012, Caglyan and Demir (2019) show that the impact of RER depreciation varies by product composition and trade direction. They find that high-skill and primary goods are less sensitive to RER depreciation, while resource intensive, low- and medium-skill manufactures are more responsive. Furthermore, exports from the Global South are more sensitive to RER changes than those from the Global North in all categories, except primary goods.

In the MENA region, most studies focus on the impact of RER misalignment (Nabli and Véganzonès-Varoudakis, 2004; Nouira et al., 2011; Brixiova et al., 2014) or exchange rate risk (Bahmani-Oskooee et al., 2015a; 2015b) on exports performance. Despite Egypt's relevance as a case study for examining the effects of exchange rate developments on export performance, studies specifically analyzing the impact of RER depreciation on Egypt's exports remains limited. Using firm- and sector-level monthly data for the period 2005-2016, Zaki et al. (2019) investigate the impact of RER devaluation on Egypt's intensive margin (the quantity and value of exports) and extensive margin (the ability to export new products and/or enter new markets). Their findings suggest that RER depreciation increases the value but not the quantity of exports, indicating that the price effect outweighs the quantity effect. In other words, while RER depreciation lowers the foreign price of Egyptian exports, it does not necessarily lead to higher export volumes. Moreover, they find a positive and significant effect on the extensive margin, reflected in an increase in both the number of exported products and export destinations. The study also reports some heterogeneity across sectors and destinations. At the sectoral level, RER depreciation appears most beneficial for products in which Egypt has a comparative advantage, such as fruits and vegetables, apparel and clothing, mineral fuels and oils, and certain chemical products. Destination-wise, European markets exhibit the strongest response to depreciation.

Yet, in a world characterized by the increasing role of GVCs, this strand of literature is becoming less intuitive. Traditional models often overlook the distinction between exports of final goods and trade in value added and intermediate inputs, where imported inputs play a crucial role in production. The following section reviews the literature at the intersection of exchange rate dynamics and GVC integration. Moreover, we outline potential channels through which a competitive RER can enhance a country's position or facilitate its upgrading along the value chain.

2.2 RER, GVC Integration and Moving Up the Value Chain

The literature on how exchange rate policy influence GVC integration is scarce, and most existing studies examine the impact of country's participation into GVCs on the exchange rate elasticity of exports. A substantial body of literature shows that GVC participation reduces the exchange rate elasticity of exports. Using panel data for 46 countries over the period 1996-2012, Ahmed et al. (2016) find that GVC integration reduces RER elasticity of manufacturing exports by 22 percent on average. Bang and Park (2018) reach similar conclusions in three East Asian countries (China, Japan, and South Korea), though the impact depends on a county's position within the value chain. In this vein, Tan et al. (2019) show that a higher share of foreign value added in a country's exports offsets the negative effect of RER appreciation on gross exports.

Similarly, several studies find that exchange rate pass-through to export prices is dampened when countries are deeply integrated into GVCs and rely more heavily on imported inputs

(Greenaway et al., 2010; Berman et al., 2012; Amiti et al., 2014; and Fauceglia et al., 2018; De Soyres et al., 2021).

Fewer studies directly address how RER affects GVC integration, but the evidence is suggestive. Cheng et al. (2016), using OECD-WTO Trade in Value Added (TiVA) data, show that real appreciation reduces both domestic and foreign value-added in exports, suggesting complementarity between the two. These findings contradict traditional trade theory predicting higher imports with RER appreciation but are consistent with the notion of complementarity between GVC related domestic and foreign value-added in production. Therefore, exporting less domestic value added implies reduced demand for imported FVA. Indeed, the magnitude of response relies on the share of foreign value-added in exports. They find that when FVA exceeds 60 percent of gross exports, RER appreciation raises both domestic and foreign VA. In the same vein, Abdou et al. (2024), using UNCTAD-EORA dataset for 143 countries over the period 1995-2018, find that RER increases GVC participation, through both forward and backward linkages, confirming the complementarity between domestic and foreign value added in the production.

To the best of our knowledge, no existing studies directly examine the impact of RER depreciation on GVC upgrading. However, several studies emphasize the role of competitive exchange rate in diversifying exports and enhancing their technological intensity. Using panel data for 111 countries over the period 1962-2008, Cimoli et al. (2013) adopt a North-South Ricardian framework to test two key hypotheses. First, a competitive RER promotes greater export diversification. Second, such diversification leads to technological upgrading in export composition. Their findings suggest that a competitive RER fosters export diversification and shifts production toward higher-technology and more innovative products, particularly when coupled with active industrial policies that encourage the emergence of new sectors and technological advancement within the production structure. Similarly, Álvarez and Lópoez (2009) find that RER depreciation can induce skill-biased technological change within firms, fostering quality upgrading and technological adoption that make exports more skill intensive.

Moreover, beyond the role of the RER, the literature on GVC upgrading and positioning identifies several determinants that play a role in the upgrading process. These include workforce development and investment in human capital (Barrientos et al., 2011; Fernandez-Stark et al., 2011), institutional quality (Pipkin and Fuentes, 2017; Montalbano and Nenci, 2022; Stojčić and Matić, 2024), labor, social and environmental standards (Kummritz et al., 2017), innovation (Kummritz et al., 2017), and technology diffusion and learning through backward GVC participation (Tian et al., 2022; Mehta, 2022; Stojčić and Matić, 2024).

In this study, we mainly focus on the impact of RER depreciation on GVC integration and upgrading, emphasizing the technology diffusion channel operating through GVC participation. This channel highlights the potential for learning via imported inputs that are intensive in technology and R&D. Using input-output tables derived from the WIOD, Tian et al. (2022) and Stojčić and Matić (2024) find that backward GVC integration provides significant opportunities for upgrading, especially for developing countries, by enabling them to import sophisticated inputs. Such imports foster learning through embodied knowledge, allowing domestic firms to build and expand their own technological capabilities. Similarly, Mehta (2022) confirms the upgrading hypothesis within GVCs by examining the electronics industries of South Korea, Taiwan, and Mexico.

Building on the above discussion, this paper makes four key contributions to the existing body of literature. First, it represents, to the best of our knowledge, the first attempt to examine the impact of RER depreciation on Egypt's GVC integration at the sectoral level. Second, it investigates the potential for sectoral upgrading and the prospects for moving up along the value chain. Third, it constructs a knowledge spillover index to assess how foreign knowledge embedded in imported inputs contributes to upgrading, thereby bridging two strands of literature: that on the role of RER depreciation and that on learning through backward GVC participation. Fourth, it provides empirical evidence linking exchange rate policy, GVC integration, and technological learning, offering policy-relevant insights for enhancing GVC participation in the context of developing economies.

3. Data and Overview of the Egyptian Context

This section introduces the data sources and key variables used in the analysis, including measures of Egypt's integration into GVCs and the construction of the bilateral RER variable. It also outlines the relevance of the Egyptian case within the broader context of GVC integration and exchange rate policy.

3.1 GVC Indicators: Backward and Forward Linkages

To assess the impact of RER depreciation on Egypt's integration into GVCs, this study employs data from the UNCTAD-EORA Global Supply Chain Database[5] (Casella et al., 2019), generated from Multi-Region Input-Output (MRIO) tables. The database is constructed using intermediate input, final demand, and value-added matrices, and the Leontien inverse is calculated accordingly. The dataset provides annual observations for Egypt across 26 sectors over the period 1995-2022 (see Table A1 in Appendix A).

The analysis focuses on two key GVC indicators. First, the domestic value added in exports (DVX), the value added generated in Egypt and embodied in the exports of its trading partners, which reflects Egypt's forward linkage. Second, the foreign value added (FVA) embodied in Egypt's gross exports, capturing the extent to which Egypt relies on imported inputs in its export production, thus reflecting its backward linkage. Both indicators are expressed as shares of gross exports[6] to account for the role of production fragmentation in value-added creation for exports.

Additionally, a comprehensive GVC participation index is constructed, also expressed as share of gross exports, and defined as the sum of forward and backward linkages (DVX + FVA). This metric captures the overall depth of Egypt's integration into global production networks.

[5] UNCTAD-EORA is the only available database, to our knowledge, that have the coverage needed for our study.
[6] By definition, gross exports are the sum of direct domestic value added (DVA) and FVA in absolute terms.

3.2 Bilateral Real Exchange Rate

The key explanatory variable in our analysis is the logarithm of the bilateral RER, denoted as $\ln(RER_{ijt})$, where RER_{ijt} is constructed as follows:

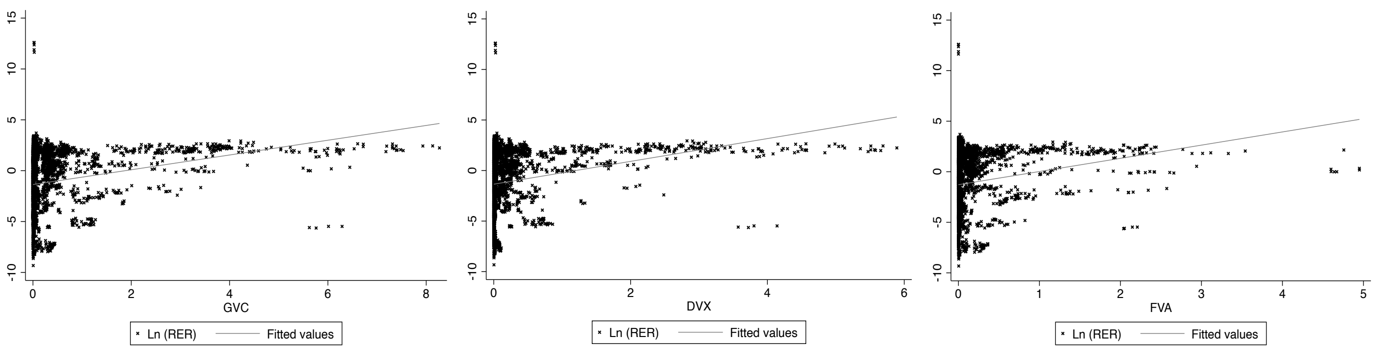
$$RER_{ijt} = E_{ijt} \times \frac{P_{jt}}{P_{it}} \quad (1)$$

Where *i, j,* and *t* refer to the domestic country (Egypt), the foreign partner country, and the year, respectively. E_{ijt} is the bilateral Nominal Exchange Rate (NER), sourced from the IMF's International Financial Statistics (IFS) and is defined as the number of units of the domestic currency (Egyptian pound) per unit of the partner country's currency[7]. P_{jt} and P_{it} denote the indexes of price level in the foreign and domestic country, respectively. They are measured by the Consumer Price Index (CPI), obtained from the World Development Indicators (WDI). Constructed in this way, an increase (decrease) in the RER corresponds to a real depreciation (appreciation) of the Egyptian pound relative to the partner country's currency.

Figure 1 illustrates the association between Egypt's bilateral RER and its GVC participation. Specially, Panel (a) plots the overall GVC participation index, panel (b) shows the forward linkage, and Panel (c) displays the backward linkage. In all three panels, a positive correlation emerges between RER depreciation and GVC integration, suggesting that a more competitive exchange rate may be associated with deeper involvement in GVCs, through both forward and backward linkages.

Figure 1. The Correlation between Bilateral RER and GVC Participation

(a) GVC Participation (DVX+FVA) (b) Forward Linkage (DVX) (c) Backward Linkage (FVA)



Source: Author's own construction based on data from the EORA, IMF's IFS, and WDI.
Note: An increase (decrease) of the RER corresponds to a real depreciation (appreciation) of the Egyptian Pound with respect to the foreign currency. GVC, DVX, and FVA are shares of gross exports.

[7] Using the NER of each trade partner with respect the USD, a bilateral NER is calculated between Egypt and each trade partner (E_{ijt}).

3.3 Egyptian Context

Egypt presents a compelling case for examining the relationship between RER dynamics and GVC integration, given the country's substantial shifts in both its de jure and de facto exchange rate regimes over the period 1995–2022.

Since the early 1990s, the Central Bank of Egypt (CBE) has adopted several exchange rate arrangements as part of broader macroeconomic and structural reforms. Between 1991 and 2001, Egypt operated under a de facto peg, maintaining the Egyptian pound (EGP) at approximately 3.4 EGP/USD (Figure 2, Panel a). In 2001, the regime shifted to a crawling peg, leading to a depreciation of the EGP to 4.48 EGP/USD by the end of the period. Between 2000Q4 and 2004Q4, the NER against the USD depreciated by nearly 66 percent, from 3.69 to 6.13 EGP/USD, driven largely by a sequence of discretionary devaluations aimed at addressing overvaluation (Mohieldin and Kouchouk, 2003; Hosni and Rofael, 2015; Noureldin, 2018). Following this episode, the EGP gradually appreciated, reaching 5.4 EGP/USD by 2009Q4, before weakening again in the aftermath of the 2011 revolution, when the exchange rate slipped to 6.01 EGP/USD amid heightened economic and political uncertainty.

A major turning point occurred in 2016, when Egypt formally adopted a floating exchange rate regime. The floatation, introduced as part of a wider reform program supported by the IMF, was designed to restore macroeconomic stability, address external imbalances, and improve export competitiveness. The transition triggered a sharp depreciation, with the NER reaching 18.12 EGP/USD in 2016Q4. Although the currency appreciated slightly in subsequent years, recording 17.6 EGP/USD in 2017Q4 and stabilizing around 15.9–15.66 EGP/USD between 2019 and 2021, it underwent a second major depreciation in 2022, when the CBE enacted another floatation. By 2022, the EGP had depreciated by nearly 58 percent, reaching 24.6 EGP/USD.

Figure 3 traces the evolution of Egypt's NER and RER vis-à-vis its main trading partners. The NER displays a general trend of depreciation, with a few exceptions. For instance, from 1996Q4 to 2002Q4, the EGP appreciated slightly against the Turkish lira, and between 2013Q4 and 2015Q4, it appreciated modestly against the euro, British pound, and Turkish lira, developments largely driven by periods of USD appreciation.

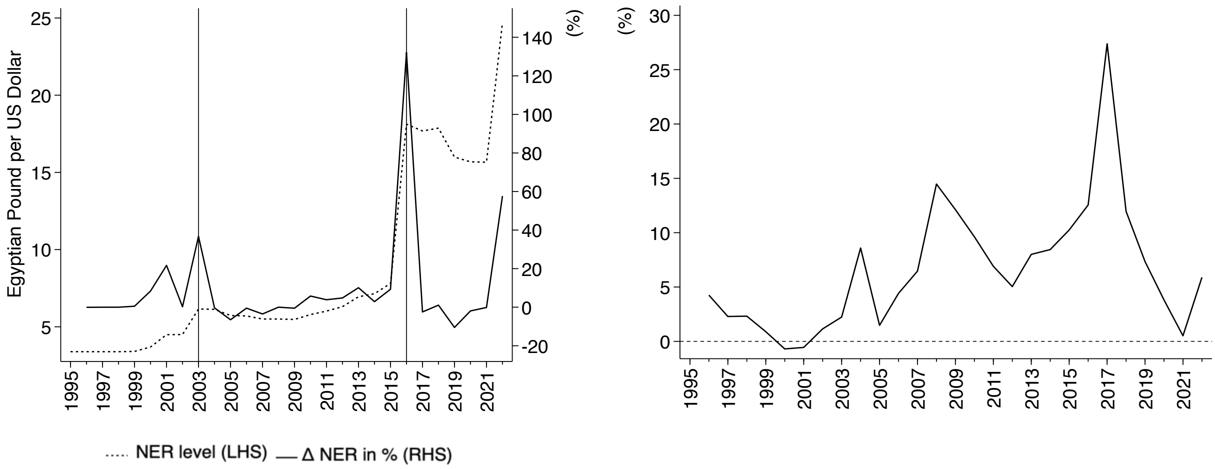
Changes in the bilateral RER reflect both NER movements and inflation differentials. Between 2000Q4-2003Q4, Egypt witnessed a sharp RER depreciation driven by successive nominal devaluations. A modest real appreciation followed from 2005 onward, supported by improved economic fundamentals (Noureldin, 2018), nominal appreciation of the EGP (Figure 2, Panel a), and a significant rise in Egypt's inflation relative to the USA (Panel b). With the economic and political turmoil in Egypt starting 2011, the post-2011 environment witnessed a renewed mild real depreciation, driven by a combination of declining inflation differentials and a gradual nominal depreciation of the currency.

Between 2013Q4 and 2015Q4, the nominal depreciation against the USD averaged 7.4 percent, resulting in only a marginal real appreciation due to Egypt's relatively high inflation. Moreover, despite this nominal weakening, Egypt witnessed a real appreciation against other major currencies (Figure 3), causing the EGP strongly to diverge from its equilibrium level and contributing to the emergence of a parallel market[8]. This pattern reversed sharply in 2016 after floating the currency, as discussed above,

In sum, Egypt's exchange rate trajectory has been marked by alternating periods of managed and market-determined regimes, with significant implications for trade performance and GVC participation. These fluctuations make Egypt a highly relevant case for analyzing how exchange rate depreciation affects GVC participation and sectoral integration.

Figure 2. Exchange Rate and Inflation Developments

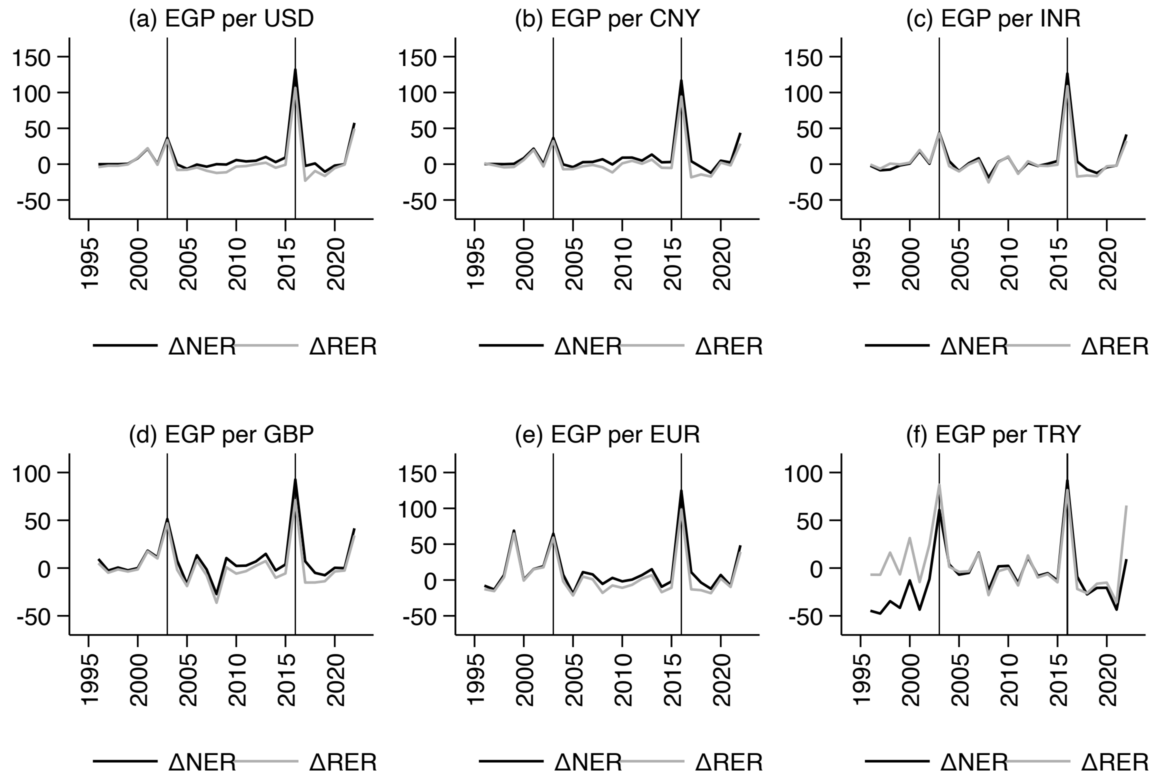
(a) Nominal Bilateral Exchange Rate (b) Inflation Differential



Note: The plotted series are based on data from the IMF International Financial Statistics (IFS) database, and the Central Bank of Egypt. Rates are calculated on an annual and not quarterly basis. An increase (decrease) means a depreciation (appreciation) of the EGP relative to the foreign currency.

[8] See Noureldin (2008) for a detailed discussion of the factors behind the liquidity squeeze and the emergence of the parallel market.

Figure 3. Bilateral NER and RER Development over Years – Egypt's Top Partners (%)



Source: Author's own calculations using data from the IFS (IMF) and the WDI.
Note: The Deutschmark (DEM) is plotted for Germany (Panel (e)) until 2002. An increase (decrease) means a depreciation (appreciation) of the EGP relative to the foreign currency.

With respect to Egypt's integration into GVCs and its performance compared to its peers, Figure 4 maps the share of GVC participation in total exports across countries. The highest shares of GVC participation are observed in Europe, where Luxembourg, Slovakia, and Belgium record shares of 86 percent, 80 percent, and 78 percent of their exports, respectively. In Asia, Singapore leads with 78 percent, followed by Hong Kong (71 percent), Malaysia (65 percent), and the Philippines (63 percent). Within North Africa, Algeria ranks first with 66 percent, followed by Tunisia (57 percent), Mauritania (56 percent), Morocco (52 percent), and Egypt (47 percent). This relatively low level of integration is noteworthy given the series of exchange rate reforms and depreciations that, in principle, should have enhanced Egypt's export competitiveness.

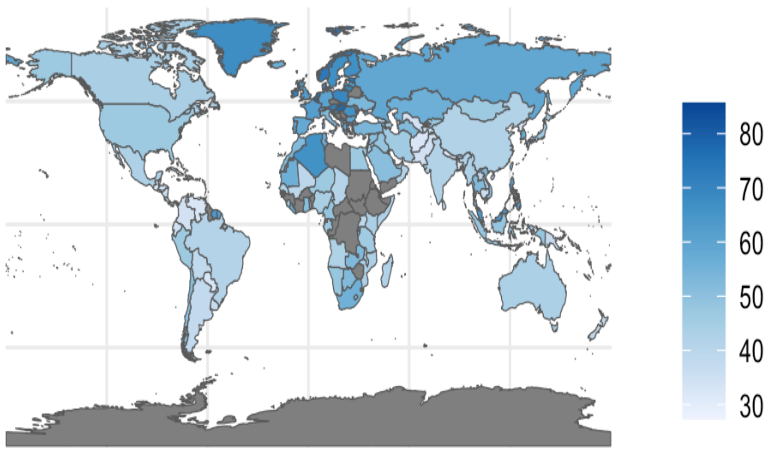
Turning to the evolution of Egypt's GVC participation over time (Figure 5), the data reveal a gradual increase from the mid-1990s until 2003, followed by a faster acceleration between 2003 and 2008, when participation peaked at 55 percent of total exports. During this expansion phase, both forward and backward linkages contributed to the rise in participation, with forward participation increasing by 16 percent and backward participation by 13.4 percent. However, consistent with the global slowdown in GVC trade after the 2008–09 financial crisis (OECD, 2023), Egypt's participation declined to about 50.01 percent, a reduction of 10 percent, between 2008 and 2009.

Sectorally, Figure A1 in Appendix A shows that GVC participation is highest in Petroleum, Chemical and Non-Metallic Mineral Products, Metal Products, Textiles and Wearing Apparel, Transport Equipment, and Electrical and Machinery. When sectors are classified by technological intensity (see Table A2 in Appendix A) to primary, low-tech, and high-tech sectors, Figure A4 shows that Egypt is most integrated into GVCs through high-tech sectors, followed by low-tech and primary sectors. Over time, participation in primary sectors has declined, while participation in high- and low-technology sectors has increased.

Disentangling forward and backward linkages, Figure 6 reveals a more nuanced pattern: forward participation is dominated by primary sectors, and the share of primary sectors has increased further since 2016. By contrast, backward participation is driven mainly by low- and high-technology sectors, with primary sectors playing a marginal and declining role, especially after 2016.

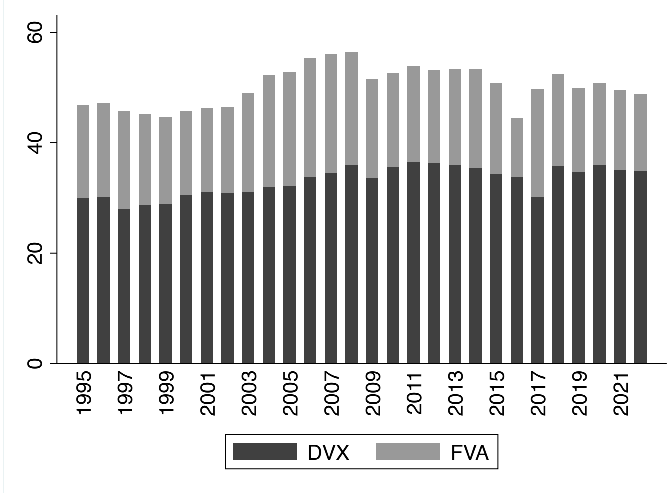
Taken together, the combination of Egypt's modest GVC integration relative to regional peers along the structural shift toward technology-intensive backward linkages and the major shifts in exchange rate policy, represents a compelling basis for analyzing how bilateral RER depreciation affect both sectoral GVC integration and upgrading.

Figure 4. GVC Participation (DVX+FVA), as Share of Exports



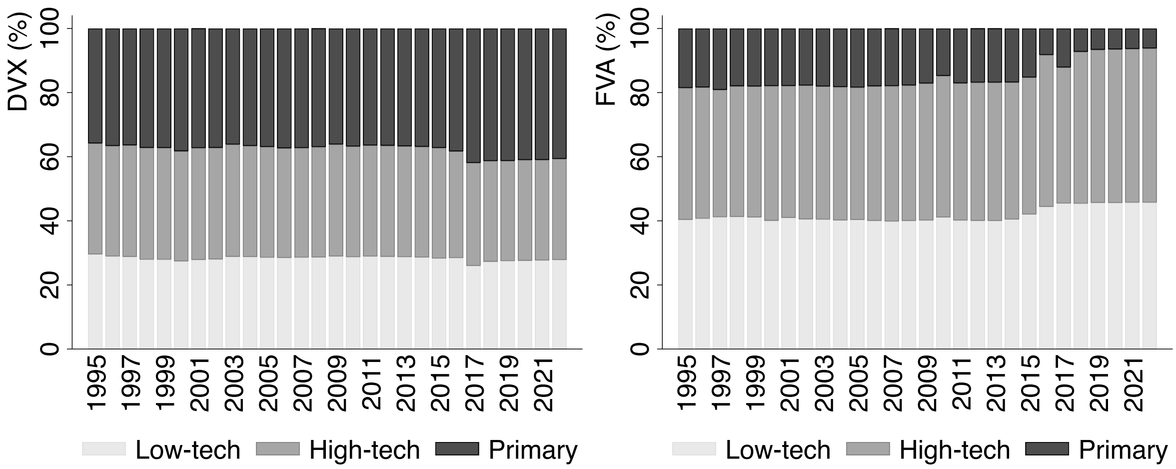
Source: Author's own construction using EORA dataset.
Note: The Map is an average over the period 1995-2018. Countries in gray are not covered by our sample.

Figure 5. Egypt's GVC Participation (DVX+FVA), as Share of Exports



Source: Author's own construction using EORA dataset.

Figure 6. DVX and FVA by Technological Intensity, as Share of Exports



Source: Author's own construction using EORA dataset.

4. Empirical Strategy

This section outlines the empirical strategy used to assess the impact of bilateral RER depreciation on Egypt's integration into GVCs and its positioning along the value chain. The first part (Section 4.1) investigates how RER depreciation affects GVC participation through both, the forward and backward linkages. The second part (Section 4.2) examines the potential for sectoral upgrading, and the underlying channels that drive this process.

4.1 Bilateral RER and GVC Integration

To estimate the effect of the bilateral RER on Egypt's GVC participation, we follow the Poisson Pseudo-Maximum Likelihood (PPML) approach (Santos Silva and Tenreyro, 2006; 2011). This estimator is well-suited for trade data, as it effectively handles the presence of zero trade flows and heteroskedasticity. We estimate the following equation:

$$GVC_{Egy,j,s,t} = \exp[\alpha_1 \ln(RER_{Egy,j,t}) + \alpha_2 \ln(Tariffs_{Egy,j,s,t} + 1) + \alpha' W_{j,t} + \psi_{j,s} + \phi_{t,s}] + \tau_{Egy,j,s,t} \quad (2)$$

Where $GVC_{Egy,j,s,t}$ is Egypt's GVC participation index with partner country j, in sector *s,* and year *t.* This index is measured through three variables: (i) forward linkage (DVX), i.e., the domestic value added of Egypt embodied in its partner's exports; (ii) backward linkage (FVA), i.e., the foreign value added embodied in Egyptian exports; and total GVC participation index (DVX + FVA). These measures are expressed as share of exports. $\ln(RER_{Egy,j,t})$ is the log of the bilateral RER, as defined in Section 3.2. $\ln(Tariffs_{Egy,j,s,t} + 1)$ represent sector-specific bilateral weighted average applied tariffs[9] to control for trade openness. $W_{j,t}$ is a vector of partner-specific controls, including the real GDP per Capita (in log) to proxy economic development; and the total natural resource rents (in log), capturing resource dependence. A higher level of rents is generally seen as a factor reducing economic diversification due to the Dutch disease or the curse of raw materials. Moreover, oil dependence hampers innovation by concentrating economies in low value-added extractive sectors (Namazi & Mohammadi, 2018). $\psi_{j,s}$ and $\phi_{t,s}$ denote partner-sector and year-sector fixed effects, respectively. $\tau_{Egy,j,s,t}$ is the error term. Standard errors are clustered at the partner-year level, the same dimension as the variable of interest to control for further error correlation bias.

4.2 Bilateral RER and GVC Upgrading

While participation in GVCs is important, it is not in itself indicative of economic transformation. True competitiveness also requires upgrading, moving to higher value-added segments of the value chain, and escaping the low-technology trap.

Due to the limited availability of firm-level and task-specific data, particularly in developing countries such as Egypt, the various forms of upgrading previously discussed are difficult to measure empirically. To address this challenge, the analysis adopts Egypt's GVC position as a proxy for upgrading or movement up the value chain. GVC position is captured through upstreamness and downstreamness indices (Costinot et al., 2013; Montalbano and Nenci, 2022). Upstreamness measures the distance of a country or sector's production from final demand, the greater this distance, the higher the upstreamness index (Antràs et al., 2012). Conversely, downstreamness captures the distance from factors of production (value-added sources), with higher values indicating greater separation from input provision (Antràs and Chor, 2013). The use of GVC position or increase in domestic value-added content, especially in high-tech, more productive, or more skill-intensive sectors as a proxy for upgrading has been motivated and widely used in the literature (e.g., Raei et al., 2019; Mehta, 2022).

The literature has long expressed concern that developing countries are predominantly confined to downstream segments, often characterized as low wage (Kummritz, 2016). Yet, upstreamness and downstreamness indices should be interpreted with caution. A country's position along the value chain, without considering the sector of operation and its technological intensity, does not inherently signal upgrading. In advanced economies, upstream positions are

[9] Following Fontagné et al. (2015), we include ln(tariffs +1) to take into account the case of zero tariffs.

often associated with the provision of high-value intangible assets—such as R&D, and design. For instance, the United States plays an upstream role in the IT sector (high-tech sector) by contributing core intellectual inputs to products like the iPhone. In contrast, an upstream position in developing countries may reflect participation limited to low-value-added activities, such as the extraction or supply of raw materials, with limited prospects for functional upgrading (Foster- McGregor et al., 2015). For instance, Egypt's upstream position in the metal products and wood and paper sectors (see Figure A1 in Appendix A) primarily reflects activities related to the supply and basic processing of raw materials rather than advanced manufacturing or design, offering relatively modest prospects for technological advancement.

To accurately assess whether Egypt's position represents genuine upgrading, we follow two complementary strategies. First, we analyze the GVC position of each sector separately to capture sector-specific dynamics. Second, we classify sectors into primary, low-, and high-tech categories, following Foster-McGregor et al. (2015), to contextualize Egypt's position according to the sector's technological intensity (see Table A2 in Appendix A).

Following Koopman et al. (2010), Ahmed et al. (2017), and Wang et al. (2021), Upstreamness Index at the partner-sector-year level is defined as follows:

$$Upstreamness_{Egy,j,s,t} = \ln\left(\frac{DVX_{Egy,j,s,t}}{EXP_{Egy,j,s,t}}\right) - \ln\left(\frac{FVA_{Egy,j,s,t}}{EXP_{Egy,j,s,t}}\right) \qquad (3)$$

If Egypt is an upstream in the production process, its domestic value added (forward linkage) is more likely to be higher than its foreign value added (backward linkage). On the other hand, if Egypt specializes in the last steps of production (downstream supplier), it is likely to import a lot of intermediate inputs and has high backward relative to forward linkages. Constructed in this way, a positive value indicates upstream positioning (greater domestic value-added relative to foreign inputs), and a negative value reflects downstream positioning.

To estimate the impact of bilateral RER on the upstreamness index, we run the following OLS fixed-effects model:

$$Upstreamness_{Egy,j,s,t} = \beta_1 \ln\left(RER_{Egy,j,t}\right) + \beta_2 \ln\left(Tariffs_{Egy,j,s,t} + 1\right) + \beta' W_{j,t} + \psi_{j,s} + \phi_{t,s} + \mu_{Egy,j,s,t} \qquad (4)$$

Where the right-hand side includes the same covariates and fixed effects as in Eq. (2), and $\mu_{Egy,j,s,t}$ is the error term.

We estimate Eq. (2) in three steps. First, regressions are run over the full sample to capture aggregate effects across all sectors. Second, sectors are classified according to their technological intensity into primary, low-technology, and high-technology categories. Third, we conduct sector-specific regressions to account for sectoral heterogeneity.

In contrast, for the analysis of GVC upgrading (Eq. 3), we focus on the second and third steps only. This approach allows us to evaluate whether Egypt's position and performance within GVCs differ across sectors and technological levels, while abstracting from aggregate effects that may obscure upgrading dynamics.

We extend the analysis in two additional directions. First, we examine the role of knowledge embedded in imported inputs in driving GVC upgrading (Section 5.2.1). Second, we explore two sources of heterogeneity. First, we distinguish between South–North and South–South trade flows to assess whether exchange rate movements affect Egypt's integration differently depending on the development level of its trading partners (Section 6.1). Second, we split the sample into three subperiods to assess potential temporal variations in the findings (Section 6.2). Finally, we assess the robustness of all results through a set of additional checks, including lagged-RER specifications and top partners-exclusion tests (Section 7).

5. Empirical Findings

Section 5.1 presents the empirical results on the impact of bilateral RER depreciation on Egypt's GVC integration, examining both forward and backward linkages, differences across sectors classified by technological intensity, and sector-specific responses. Section 5.2 then turns to the question of GVC upgrading and assesses whether foreign knowledge embedded in imported inputs serves as a channel through which the RER can foster upgrading along the value chain.

5.1 Bilateral RER & GVC Integration

The results for the entire sample[10] are reported in Table 1. Bilateral RER depreciation is found to significantly enhance Egypt's overall GVC integration (column 1), with positive effects observed for both forward and backward linkages (columns 2 and 3, respectively). It is important to distinguish between these two indicators of GVC participation for two reasons. First, the forward linkage, which captures the value added of Egypt that is embodied in its partners' exports, should in theory respond positively to RER depreciation in line with the conventional trade theory and standard export elasticity expectation. In contrast, the backward linkage, which measures the foreign value added embodied in Egypt's exports, depends on intermediate input imports, the share of foreign inputs in total exports, and the availability (or lack) of domestic substitutes. Second, as illustrated in Figure A1 in Appendix A, Egypt's forward and backward linkages display markedly different sectoral compositions. Egypt predominantly occupies upstream positions in primary, such as agriculture, fishing, and mining and quarrying, and low-tech sectors, such as wood and paper, and metal products. In contrast, the backward linkages are largely concentrated in high-tech sectors, including electrical and machinery, and transport equipment. These distinct patterns across sectors underscore Egypt's asymmetric position within GVCs, upstream in resource-based industries and downstream in technology-intensive ones, thereby highlighting the importance of distinguishing between forward and backward GVC participation.

The results are intuitive in two respects. First, in a GVC context, recent studies suggest that forward and backward linkages tend to be complementary rather than substitutive (Cheng et al., 2016; Montalbano and Nenci, 2022; Abdou et al., 2024). Increasing Egypt's forward integration (exporting more domestic value added) often requires a greater use of imported

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[10] We run the baseline regression with alternative fixed-effects and controlling for gravity variables, the results are presented in Appendix B.

intermediate inputs, thereby strengthening backward linkages. Thus, both linkages are likely to respond similarly to RER depreciation or appreciation.

Second, Egypt's strong reliance on foreign intermediate inputs, especially in high-tech sectors, including electrical and machinery and transport equipment, constraints its ability to substitute these imports with domestic alternatives. Building the necessary domestic capabilities in these sectors would demand substantial investments in human capital, infrastructure, and technological development. Even in relatively less sophisticated sectors, such as textiles and wearing apparel or food and beverages, Egypt's production processes remain closely tied to global input chains. As noted by Ali et al. (2016), protectionist measures that restrict access to foreign inputs may undermine competitiveness and hinder industrial specialization. Yet, an excessive reliance on imported inputs, without parallel efforts to develop domestic capacity, risks jeopardizing structural transformation and binding endeavors to move the economy away from low value-added activities, a pattern observed in several developing economies.

At the sectoral level, and distinguishing sectors by technological intensity, the results in Table 2 confirm that RER depreciation increases GVC integration across all categories, with the effects being more pronounced in high- and low-tech sectors. When disentangling the impact across forward and backward linkages, the findings reveal that primary sectors respond most strongly on the forward side, whereas both low-tech and high-tech sectors exhibit substantial gains in backward participation. The muted forward response in high-tech sectors is unsurprising, given Egypt's limited comparative advantage in producing technologically sophisticated inputs. Instead, Egypt's forward linkages remain concentrated in primary sectors (e.g., extractives and fishing) and low-tech industries (e.g., metal products).

The strong and significant results for backward linkages, particularly within high-tech sectors, are encouraging. Backward participation provides a key channel for learning and upgrading, as it exposes domestic firms in developing economies to more sophisticated inputs and production technologies (Tian et al., 2022). Such exposure fosters knowledge transfer, productivity gains, and shifts in sectoral composition that support upward movement along the value chain, a pattern widely observed in many Asian countries (Raei et al., 2019). This mechanism of learning through imported inputs is examined in greater depth in Section 5.2.1.

A closer look at sector-specific outcomes reinforces these dynamics. Plot 1 shows that the impact of RER depreciation on overall GVC participation is most pronounced in the electrical and machinery sector, followed by food and beverages sectors. Plot 2, which focuses on forward linkages, highlights that metal products (low-tech) and mining and quarrying (primary) benefit the most from RER depreciation. Meanwhile, Plot 3 reveals that transport equipment (high-tech), followed by textiles and wearing apparel and food and beverages (low-tech), exhibit the strongest response in backward linkages. Such imports of equipment, machinery, and electronics act as vehicles for *know-how* and *know-what,* enabling domestic firms to acquire knowledge embodied in foreign capital goods (Kim, 1980; Bloom, 1993; Kim and Lee, 2002). Taken together, these patterns reinforce earlier findings: RER depreciation raises domestic value added in primary sectors while simultaneously increasing imports of foreign inputs in both high- and low-tech sectors. This suggests a gradual restructuring of Egypt's production system, potentially laying the groundwork for future upgrading.

Controlling for bilateral sector-specific applied tariffs, the analysis indicates that tariffs hinder GVC integration, particularly through backward linkages (Table 1). Tariffs, particularly those imposed on intermediate inputs, restrict access to foreign inputs, raise production costs, and ultimately impede the growth of downstream industries. Accordingly, trade liberalization emerges as an important determinant of GVC participation. In this context, recent protectionist measures adopted in various countries risk limiting developing economies' participation in GVCs and reinforcing global production fragmentation.

When controlling for the real GDP per capita of Egypt's trading partners, used as proxy for income level, the findings show that higher partner income is associated with greater GVC integration through both forward and backward linkages. This result is consistent across the full sample (Table 1) and the sectoral breakdown (Table 2) and aligns with Egypt's trade profile, which shows deep integration with high-income and upper-middle-income partners (see Figure A2 in Appendix A). Finally, the variable capturing natural resources rent does not yield significant effects in most specifications. This suggests that resource dependence has not played a major role in shaping Egypt's sectoral integration into GVCs over the period of analysis.

Table 1. Bilateral RER and GVC Integration – PPML Estimations

	(1) GVC	(2) DVX	(3) FVA
ln(RER)	0.026***	0.018***	0.022***
	(0.006)	(0.007)	(0.008)
ln(Tariffs +1)	-0.014*	0.010	-0.032***
	(0.008)	(0.011)	(0.008)
ln(GDPPC_Par)	0.894***	0.742***	0.998***
	(0.048)	(0.076)	(0.039)
ln(Rents_Par)	-0.012	-0.019	-0.005
	(0.011)	(0.013)	(0.012)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,918	3,918	3,918
Mean of dep. Δ	0.378	0.229	0.149
Observations	37,022	37,022	37,022
Pseudo R^2	0.658	0.632	0.594

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

Note: The intercept is included. GVC participation index, DVX, and FVA are expressed as share of exports.

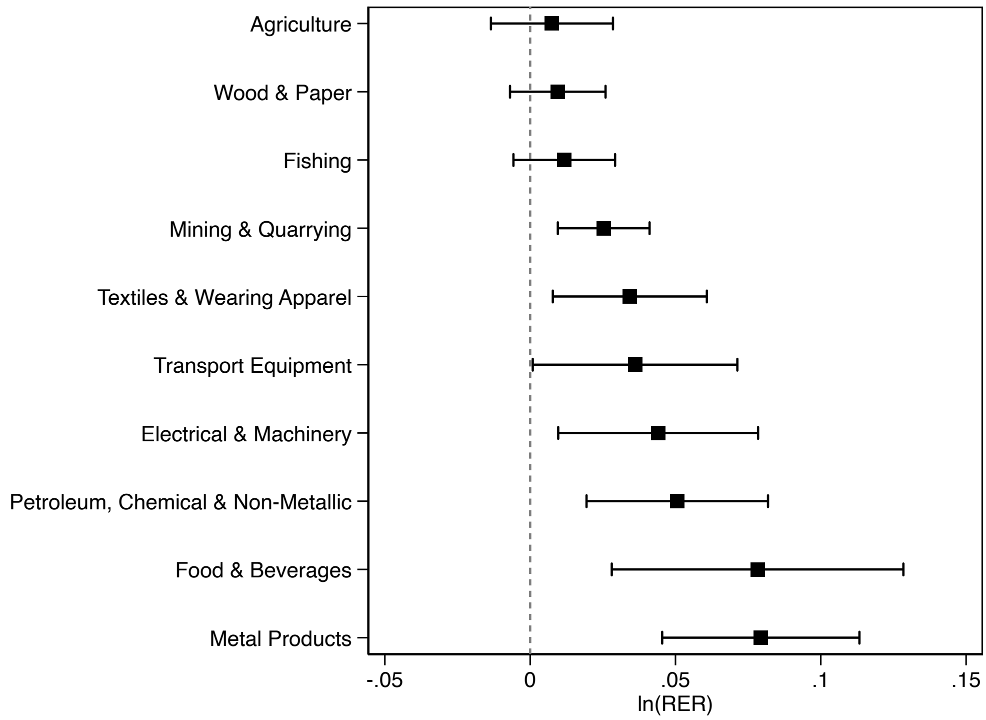
Table 2. Bilateral RER and GVC Integration – by Technological Intensity

	GVC			DVX			FVA		
	Primary	Low-Tech.	High-Tech.	Primary	Low-Tech.	High-Tech.	Primary	Low-Tech.	High-Tech.
ln(RER)	0.019***	0.031***	0.042***	0.021***	0.016	0.015	0.001	0.055***	0.077***
	(0.0063)	(0.010)	(0.014)	(0.008)	(0.011)	(0.017)	(0.007)	(0.014)	(0.014)
ln(Tariffs +1)	0.013	-0.012	-0.028**	0.034**	0.007	-0.020	-0.008	-0.028***	-0.036***
	(0.014)	(0.009)	(0.011)	(0.016)	(0.010)	(0.014)	(0.007)	(0.010)	(0.011)
ln(GDPPC_Par)	0.718***	0.876***	0.961***	0.810***	0.657***	0.766***	0.971***	0.930***	1.043***
	(0.063)	(0.049)	(0.050)	(0.081)	(0.082)	(0.076)	(0.049)	(0.040)	(0.040)
ln(Rents_Par)	0.001	-0.017	-0.011	0.001	-0.028**	-0.023	0.003	-0.0004	-0.009
	(0.013)	(0.012)	(0.012)	(0.014)	(0.012)	(0.014)	(0.013)	(0.013)	(0.013)
Year-Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Partner-Sec FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Clusters	jt	jt	jt	jt	jt	jt	jt	jt	jt
# of clusters	3,797	3,795	3,762	3,797	3,795	3,762	3,797	3,795	3,762
Mean of dep. Δ	0.339	0.387	0.417	0.274	0.224	0.235	0.065	0.163	0.182
Observations	8,446	14,316	10,719	8,446	14,316	10,719	8,446	14,316	10,719

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

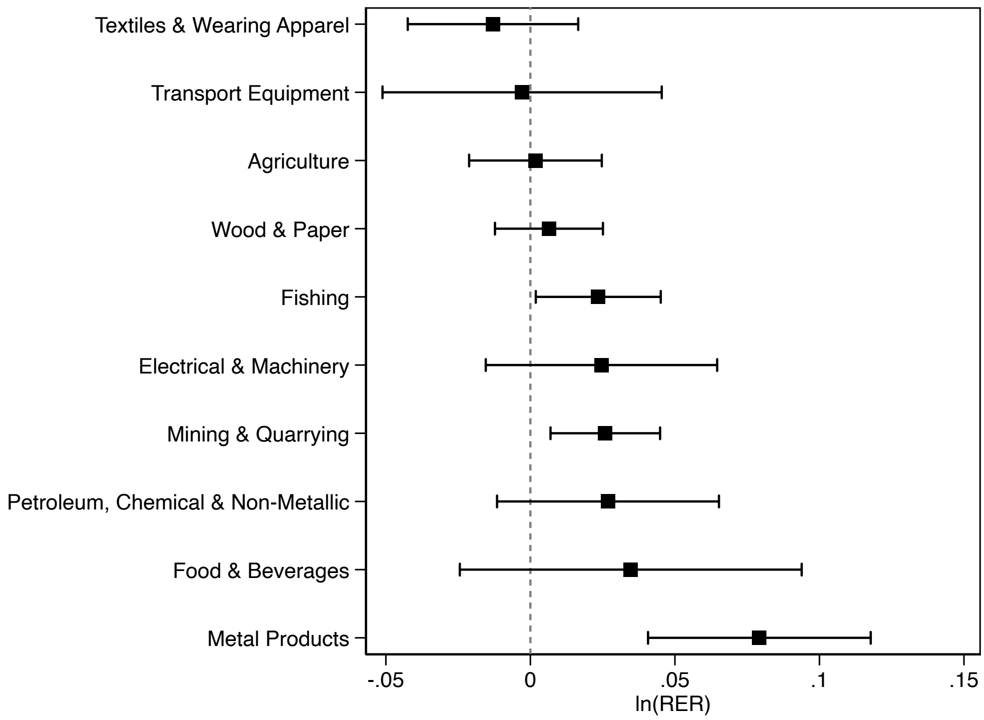
Note: The intercept is included. The GVC participation index, forward, and backward linkages are expressed as share of exports.

Plot 1. Bilateral RER and GVC Participation (DVX + FVA) – by Sector



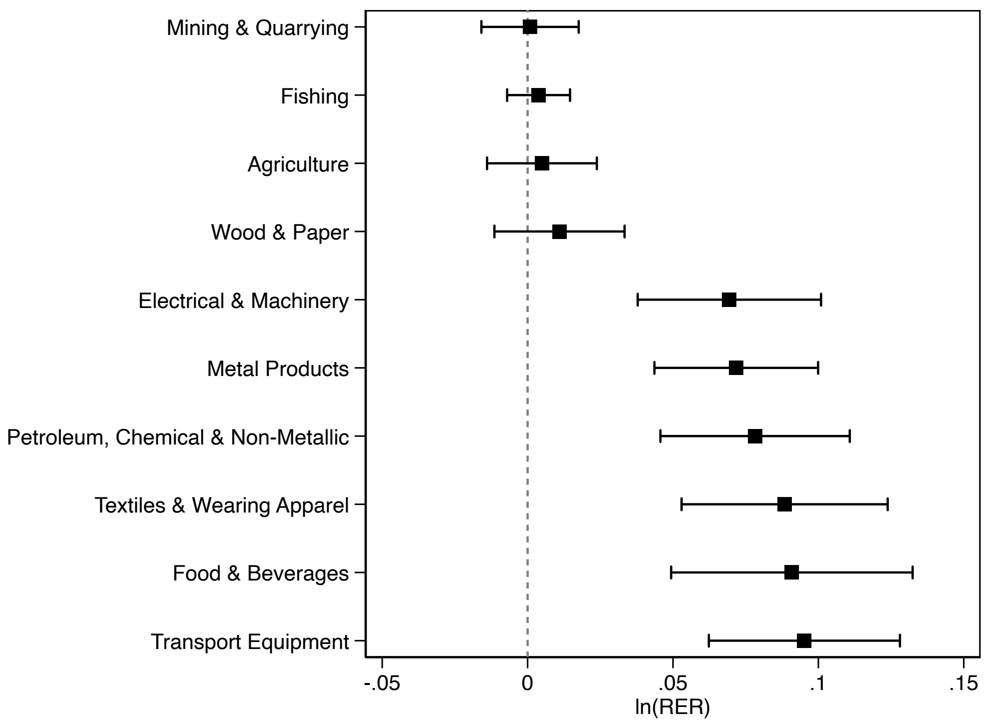
Note: The specification includes all control variables, along with year and partner fixed effects. Standard errors are clustered at the partner-year level. Only the estimated Coefficients for the RER are reported for brevity.

Plot 2. Bilateral RER and Forward Linkage (DVX) – by Sector



Note: The specification includes all control variables, along with year and partner fixed effects. Standard errors are clustered at the partner-year level. Only the estimated Coefficients for the RER are reported for brevity.

Plot 3. Bilateral RER and Backward Linkage (FVA) – by Sector



Note: The specification includes all control variables, along with year and partner fixed effects. Standard errors are clustered at the partner-year level. Only the estimated Coefficients for the RER are reported for brevity.

5.2 Bilateral RER & GVC Upgrading

As noted earlier, a country's competitiveness is not determined solely by its ability to join a value chain, but by the strategic position it occupies along the value chain and its capacity to upgrade from low- to high-value-added sectors. Since the upstreamness index serves as an indicator of positioning and a proxy for upgrading, presenting results for the full sample would be misleading: an increase in upstreamness cannot automatically be interpreted as upgrading unless sectors are classified by technological intensity (Table 3) or examined individually (Plot 4).

Table 3 shows that the bilateral RER does not exhibit any statistically significant impact on the upstreamness index across any of the three technological categories. A sector-by-sector analysis (Plot 4) confirms the same conclusion. These findings reinforce the idea that, while the exchange rate policy is a significant policy tool that for enhancing Egypt's GVC integration across all sectors, it is not sufficient on its own to generate upgrading. Moving up the value chain requires more than trade costs adjustments: it requires changes in the structure of production, investment in skills, and access to new knowledge and technology, all of which differ markedly across sectors.

In the following section, we therefore examine the role of foreign knowledge embedded in imported inputs as a potential driver of Egypt's movement up the value chain. We also assess whether this knowledge channel enables the exchange rate to translate not only into greater GVC integration, but into better strategic positioning along the chain.

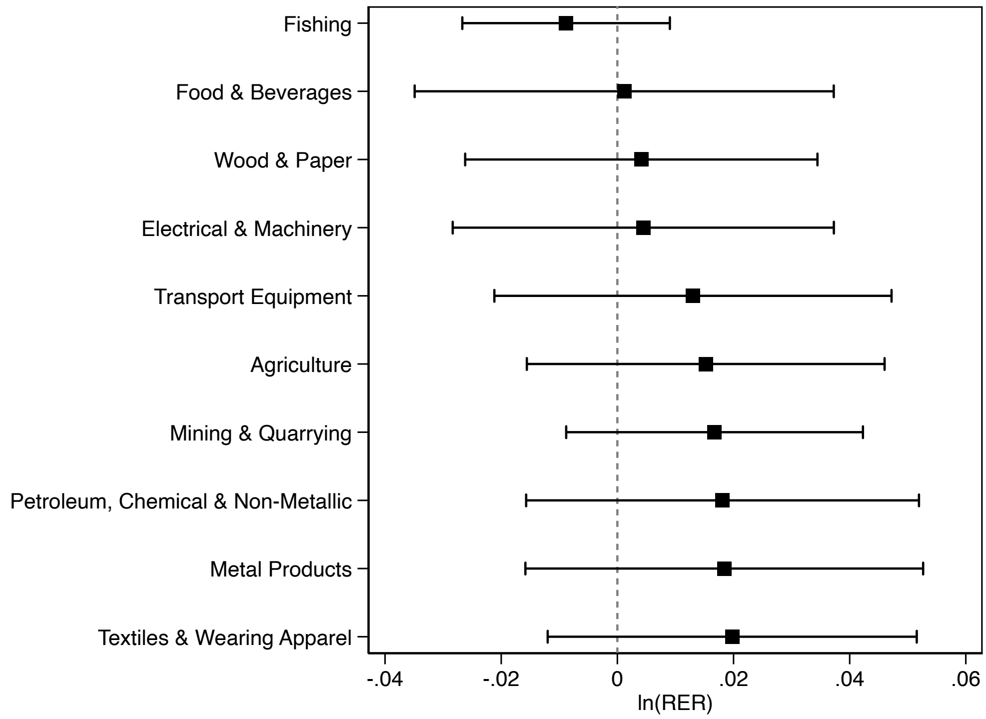
Table 3. Bilateral RER and GVC Upgrading – by Technological Intensity

	Upstreamness		
	(1) Primary Sectors	(2) Low Tech. Sectors	(3) High Tech. Sectors
ln(RER)	0.012	0.011	0.012
	(0.011)	(0.017)	(0.017)
ln(Tariffs +1)	-0.016*	-0.030***	-0.043***
	(0.008)	(0.008)	(0.008)
ln(GDPPC_Par)	-0.367***	-0.423***	-0.464***
	(0.039)	(0.044)	(0.043)
ln(Rents_Par)	-0.003	-0.003	-0.006*
	(0.003)	(0.004)	(0.00343)
Partner-Sector FE	✓	✓	✓
Year-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,963	4,012	3,977
Mean of dep. Δ	0,973	0,070	0,509
Observations	9,028	15,167	11,325

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

Note: The intercept is included.

Plot 4. Bilateral RER and GVC Upgrading – by Sector



Note: The specification includes all control variables, along with year and partner fixed effects. Standard errors are clustered at the partner-year level. Only the estimated Coefficients for the RER are reported for brevity.

5.2.1 Knowledge Spillover Effect

As clarified earlier in the literature review section, knowledge gained though importing from technologically advanced trade partners serves as a channel through which RER depreciation can lead to upgrading and a shift in the technological composition of the DVX. This idea is consistent with the early work of Coe et al. (1997), who demonstrate that by trading with industrial countries that possess large stocks of knowledge accumulated through R&D efforts, developing countries can boost productivity by importing a wider range of intermediate goods and capital equipment that embody foreign knowledge, as well as by accessing information that would otherwise be costly to obtain.

Following Eissa and Zaki (2023), and building on the offshoring definition of Feenstra and Hanson (1996), we construct a GVC knowledge spillover index to capture the learning effect embodied in Egypt's imports of intermediate inputs from its trade partners. The rationale behind this index is to highlight how technological upgrading and movement up the value chain can be driven by exposure to foreign knowledge, particularly via the import of technology-intensive intermediate inputs. To quantify the potential for learning through imported inputs, we define the knowledge spillover index as follows:

$$Knowledge\ Spillover\ Index_{ijt} = \frac{\sum_i^t VA_{ijt}\,.\,RD_{jt}}{(\sum_i^t VA_{ijt}\,.\,RD_{jt}) + (DVA_{it}\,.\,RD_{it})} \quad (5)$$

Where *i* refers to the destination country (Egypt in our case), *j* to the partner (exporter) country, and t to the year. VA_{ijt} is absorbed foreign value added[11], DVA_{it} is direct domestic value added from the EORA dataset, and RD is R&D measured by resident patent applications from the WDI, used as a proxy for the stock of knowledge.

Controlling for this spillover index in our estimations (Table 4), we find no statistically significant effect of either the RER or the spillover index on upstreamness in primary sectors. This result is intuitive, since these sectors are typically less reliant on foreign imported inputs and technology-driven production processes. By contrast, the spillover index exhibits a positive and highly significant effect for both low-tech and high-tech sectors, suggesting a strong learning effect from foreign intermediate inputs, consistent with technology diffusion via backward GVC participation (Tian et al., 2022; Stojčić and Matić, 2024).

Furthermore, the interaction term between the RER and the spillover index is also positive and significant in both low-tech and high-tech sectors, with a more pronounced effect observed on the latter. This indicates that when coupled with active industrial policies encouraging the import of technologically intensive inputs, exchange rate depreciation can foster upgrading by enabling domestic firms to acquire foreign knowledge, expand technological capabilities, and improve productivity.

Sector-specific analysis (Plot 5) shows that the interaction between the RER and the spillover index is most pronounced in the electrical and machinery sector (high-tech), followed by metal products (low-tech) and transport equipment (high-tech).

We assess the robustness of these findings using two alternative approaches. First, inspired by Raei et al. (2019), we measure upgrading as the share of high-tech sectors in Egypt's value-added exports. Table A7 in Appendix B shows that the RER alone does not increase this share; however, once foreign learning is incorporated through the spillover index, RER depreciation is associated with a higher share of high-tech value added, reflecting an upgrading effect consistent with our main results. Second, we recalculate the knowledge spillover index using FVA from EORA (Columns 1-3, Table A7), and the findings remain unchanged: controlling for foreign knowledge embedded in imported inputs, RER depreciation significantly increases upstreamness, with the strongest effect being observed in high-tech sectors followed by low-tech sectors.

These findings underscore the importance of distinguishing between sectoral dynamics. True upgrading in a GVC context is driven not by primary sectors, but by gains in high- and low-tech sectors. Encouragingly, the results highlight the dual role of RER depreciation: it not only improves competitiveness, but when paired with foreign knowledge embedded in imported intermediate inputs, it fosters technological learning, productivity improvements, and upward movement along the value chain.

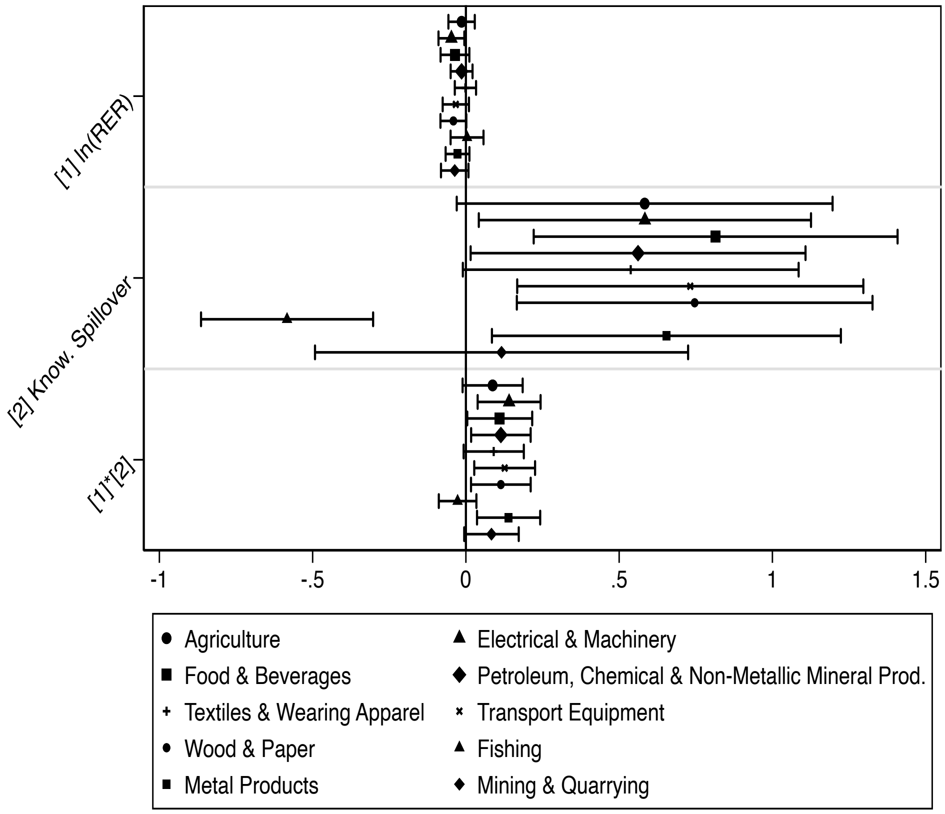
[11] Following the UN Systems of National Accounts 1993, VA is measured as the sum of 6 variables: the compensation of employees, subsidies on production, taxes on production, net mixed income, net operation surplus, and consumption of fixed capital using GLORIA multi-region input output database.

Table 4. Bilateral RER, Knowledge Spillover, and GVC Upgrading

	Upstreamness		
	(1) Primary Sectors	(2) Low Tech. Sectors	(3) High Tech. Sectors
[1] ln(RER)	-0.021	-0.026	-0.030
	(0.020)	(0.020)	(0.019)
[2] Know. Spillover Index	0.174	0.685**	0.634**
	(0.260)	(0.288)	(0.278)
[1] * [2]	0.064	0.112**	0.126**
	(0.040)	(0.050)	(0.049)
ln(Tariffs +1)	-0.022**	-0.035***	-0.071***
	(0.011)	(0.011)	(0.013)
ln(GDPPC_Par)	-0.348***	-0.434***	-0.504***
	(0.048)	(0.055)	(0.056)
ln(Rents_Par)	-0.000	-0.003	-0.005*
	(0.003)	(0.003)	(0.003)
[1]*[2] Marginal Effect (at median)	0.034 (0.021)	0.058** (0.025)	0.065*** (0.025)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	2,276	2,259	2,249
Mean of dep. Δ	1.212	0.156	0.417
Observations	5,719	8,763	6,570

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Note: The intercept is included.

Plot 5. RER, Knowledge Spillover, and GVC Upgrading – by Sector



Note: The specification includes all control variables, along with year and partner fixed effects. Standard errors are clustered at the partner-year level. Only the estimated Coefficients for the RER are reported for brevity.

6. Heterogeneity Analysis

The previous analysis has examined the impact of RER depreciation on Egypt's GVC integration without distinguishing between trade partners, their income classification, or key time periods shaped by policy reforms or global shocks. This section introduces these sources of heterogeneity by estimating the model across tailored subsamples. In particular, we analyze the trade direction (Table 5) and the impact across different sub-periods (Table 6).

6.1 Direction of Trade: South-South vs. South-North

Caglayan and Demir (2019) emphasize that both the composition and direction of trade are critical in determining how RER movements affect bilateral trade flows. Their analysis categorizes trade into four groups[12]- South-South, South-North, North-South, and North-North– and shows that Southern exports are generally more sensitive to RER depreciation than Northern exports, except in the case of primary goods. Moreover, they argue that South-North trade tends to react more to RER depreciation than South-South trade, due to differences in development levels and macroeconomic channels (see Dahi and Demir, 2017).

Motivated by this insight, and treating Egypt as a Southern country, we examine whether the effect of RER depreciation differs depending on the income level of its trading partners. Following the World Bank country income classification (Appendix A), we first disaggregate Egypt's partners into four groups: low, lower-middle, upper-middle, and high income. Then, we group them into two categories: Egypt-North and Egypt-South and estimate separate regressions for each group while allowing sectoral composition to vary. Table 5 reports only the RER coefficients for brevity.

We find that overall GVC participation responds positively and significantly to RER depreciation only in Egypt-North. By contrast, no significant effect is observed in Egypt-South trade, regardless of sectoral breakdown. Disaggregating further, we observe that in Egypt-South trade, DVX increases with RER depreciation only in primary sectors. In Egypt-North trade, however, DVX rises significantly across all sectors, with the strongest effects observed in high-tech sectors. This pattern is consistent with Caglayan and Demir (2019), who note that primary exports from the South are less sensitive to RER depreciation when destined for the North, since primary goods exported by the South are typically priced in hard currencies, especially the USD. Freund and Pierola (2012) and Chen and Juvenal (2016) further suggest that RER depreciation facilitates high-tech Southern exports to Northern markets via macroeconomic and developmental channels, enabling less competitive Southern firms that produce high-skill products to penetrate Northern markets. However, this dynamic does not apply to South-South trade in high-tech goods.

A clear asymmetry emerges when examining backward linkages. When inputs originate from Southern partners, the effect of RER depreciation on FVA becomes negative, suggesting a contraction in imported inputs sourcing from the South. In contrast, FVA increases significantly when inputs originate from Northern partner, with the largest effects in high-tech sectors. This aligns with Coe et al. (1997), who show that developing economies can boost productivity by

[12] South refers to a developing economy while North refers to developed one.

trading with technologically advanced economies. By importing a wider range of inputs and capital equipment that embody foreign knowledge, they not only benefit from embedded technology, but also gain access to information and know-how that would otherwise be costly or difficult to acquire domestically. The findings for low-tech sectors further support Caglayan and Demir (2019), who argue that RER depreciation gives Northern exporters a competitive edge in low-skill products for which they have a comparative disadvantage, due to the increasing importance of noncore (less efficient) products in Northern exports basket (Chatterjee et al., 2013).

In summary, relative to the baseline estimates, the heterogeneity results reveal that forward participation is primarily driven by trade with Southern partners, whereas backward participation is predominantly driven by Northern partners. This distinction reinforces the idea that Egypt's role in GVCs is shaped not only by sectoral characteristics, but also by the development level of its trade partners and the direction of value-added flows.

Table 5. RER Depreciation and GVC Integration – Direction of Trade

	GVC Participation							
	Emerging Partner				High Income Partner			
	Full Sample	Primary	Low-Tech	High-Tech	Full Sample	Primary	Low-Tech	High-Tech
ln(RER)	0.037	0.059	0.041	0.021	0.031***	0.025**	0.040***	0.067***
	(0.034)	(0.070)	(0.033)	(0.026)	(0.006)	(0.010)	(0.011)	(0.018)
FE[1]	✓	✓	✓	✓	✓	✓	✓	✓
Clusters	jt	jt	jt	jt	jt	jt	jt	jt
Obs.	23,521	4,958	9,340	6,966	13,501	3,488	4,976	3,753
Pseudo R^2	0.635	0.549	0.652	0.657	0.585	0.484	0.544	0.582
	Forward Linkage							
	Emerging Partner				High Income Partner			
	Full Sample	Primary	Low-Tech	High-Tech	Full Sample	Primary	Low-Tech	High-Tech
ln(RER)	0.061*	0.146***	0.062	0.026	0.026***	0.024***	0.024**	0.032*
	(0.036)	(0.054)	(0.038)	(0.031)	(0.007)	(0.008)	(0.010)	(0.019)
FE[1]	✓	✓	✓	✓	✓	✓	✓	✓
Clusters	jt	jt	jt	jt	jt	jt	jt	jt
Obs.	23,521	4,958	9,340	6,966	13,501	3,488	4,976	3,753
Pseudo R^2	0.506	0.535	0.504	0.490	0.568	0.578	0.585	0.533
	Backward Linkage							
	Emerging Partner				High Income Partner			
	Full Sample	Primary	Low-Tech	High-Tech	Full Sample	Primary	Low-Tech	High-Tech
ln(RER)	-0.046*	-0.078**	-0.037	-0.051**	0.033***	0.009	0.080***	0.125***
	(0.026)	(0.034)	(0.028)	(0.026)	(0.011)	(0.008)	(0.020)	(0.023)
FE[1]	✓	✓	✓	✓	✓	✓	✓	✓
Clusters	jt	jt	jt	jt	jt	jt	jt	jt
Obs.	23,521	4,958	9,340	6,966	13,501	3,488	4,976	3,753
Pseudo R^2	0.666	0.479	0.684	0.680	0.491	0.372	0.488	0.500

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

Note: [1]All the regressions include Year-Sector and Partner-Sector fixed effects. Control variables and the intercept are included in all the regressions but not reported for brevity.

6.2 Analysis over different subperiods

The second heterogeneity analysis examines the impact of RER depreciation across different subperiods within the sample from 1995-2022. To capture the temporal variation associated with major economic events, the sample is split into four comparable sub-periods with respect to major events: (i) the Internet bubble (2001) and the devaluation of the Egyptian pound (2003), (ii) the global financial crisis (2008), and (iii) economic reforms and major devaluation of the Egyptian pound (2016). This allows to assess how the effect of RER depreciation on Egypt's integration evolves over time.

The results (Table 6) show that during the first period, the coefficients are mostly negative or statistically insignificant across all three measures of GVC integration, irrespective of sectoral technological intensity. A similar pattern appears in the fourth period (2016–2022), where the effects of RER depreciation are generally insignificant across the regressions. By contrast, the second and third periods display positive and statistically significant coefficients, suggesting that the impact of RER depreciation is stronger during these intervals, coinciding with the 2003 devaluation episode and the aftermath of the 2008 global financial crisis. Compared to the baseline estimates, the magnitude of the effects in these two periods is relatively larger across most sector categories.

In summary, the direction and composition of trade, along with the timing of analysis, significantly influence the estimated impact of RER depreciation. The findings suggest that South-North VA trade flows are more responsive to RER depreciation, and the responsiveness varies across sub-periods, with stronger effects observed during 2001-2007 and 2008-2015.

Table 6. RER Depreciation and GVC Integration – Subperiods

GVC Participation	1995-2000	2001-2007	2008-2015	2016-2022
Full Sample	-0.013**	0.073**	0.081**	-0.033
	(0.006)	(0.038)	(0.034)	(0.067)
Primary	-0.020**	0.098*	0.063**	-0.113*
	(0.008)	(0.053)	(0.026)	(0.069)
Low-Tech	0.000	0.058*	0.077**	-0.042
	(0.005)	(0.031)	(0.035)	(0.054)
High-Tech	-0.016	0.062*	0.091**	-0.004
	(0.015)	(0.033)	(0.040)	(0.091)
Forward Linkage	**1995-2000**	**2001-2007**	**2008-2015**	**2016-2022**
Full Sample	-0.022***	0.062*	0.038	0.014
	(0.008)	(0.037)	(0.025)	(0.107)
Primary	-0.027***	0.108*	0.055**	-0.094
	(0.010)	(0.060)	(0.026)	(0.073)
Low-Tech	-0.007	0.044	0.029	0.002
	(0.006)	(0.027)	(0.024)	(0.080)
High-Tech	-0.030*	0.037	0.037	0.079
	(0.016)	(0.027)	(0.026)	(0.170)
Backward Linkage	**1995-2000**	**2001-2007**	**2008-2015**	**2016-2022**
Full Sample	0.001	0.112**	0.180***	-0.004
	(0.006)	(0.050)	(0.066)	(0.062)
Primary	-0.002	0.106**	0.182***	0.098
	(0.006)	(0.048)	(0.058)	(0.149)
Low-Tech	0.014	0.009**	0.163**	0.006
	(0.009)	(0.045)	(0.060)	(0.072)
High-Tech	0.003	0.128**	0.203***	-0.029
	(0.020)	(0.055)	(0.076)	(0.046)

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

Note: Each cell represents a separate regression. All the regressions include Year-Sector and Partner-Sector fixed effects. Control variables and the intercept are included in all the regressions but not reported for brevity.

7. Robustness Checks

After showing the heterogeneity of the results across trade directions and subperiods. We conduct a series of robustness checks to ensure the stability of findings. First, we re-estimate the baseline regressions using the one-year lag of the RER in place of its contemporaneous value. Second, we assess the dynamic effects of the RER by introducing sequential yearly lags into the regressions. Third, we test the sensitivity of the results to the composition of Egypt's trading partners by re-estimating the models after progressively excluding the top 10 percent, 30 percent, and 50 percent of Egypt's trade partners, thereby verifying that the results are not driven solely by Egypt's largest trading relationships.

7.1 Dynamic and Lagged Effects of the RER

To assess whether the effect of RER depreciation on GVC integration is purely contemporaneous or unfolds gradually over time, we begin by re-estimating the baseline models using a one-year lag of the RER. This exercise also helps mitigate endogeneity concerns linked to expectations of exchange rate movements. The results (Tables A8-A11 in Appendix B) are fully consistent with the baseline findings for total GVC participation, forward and backward linkages, and GVC upgrading.

Building on this, we further extend the analysis by estimating separate regressions that incorporate yearly lagged values of the RER, up to five years prior[13], for overall GVC participation, forward, and backward linkages. While the baseline estimates (Table 1) indicate that RER depreciation exerts an immediate effect on GVC participation and on both domestic and foreign value added, such effects may not be fully contemporaneous, since firms typically adjust sourcing strategies, production structures, and export decisions over time. To account for these delayed adjustments and following Bas et al. (2025), we estimate a dynamic specification in which lagged RER terms are sequentially introduced.

The results (Table A12) show that the effect of RER depreciation is more persistent for domestic rather than foreign value added. The coefficient remains statistically significant up to the fourth lag for the forward linkage, but only up to the second lag for the backward linkage. Regarding the magnitude of effects, the first lag of the RER is almost identical in size and significance to the contemporaneous coefficient for both the GVC participation index and the FVA. This indicates that the impact of RER depreciation is not only immediate, but also stable and persistent across the first two years. Thereafter, the coefficients decline gradually for the GVC index but fall sharply for the FVA.

In contrast, the forward linkage behaves differently: the effect of first-lag RER exceeds that of the contemporaneous value, implying that DVX adjusts more slowly to exchange rate movements. This lagged response is consistent with the fact that expanding domestic production requires structural changes in production capacity, technology, and market access. Therefore, it takes time to materialize.

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[13] The regressions were estimated using lags of up to ten years; however, the results are reported only up to the point at which the coefficients cease to be statistically significant for the three GVC indicators.

Taken together, these findings point to an asymmetric dynamic response across the two dimensions of GVC participation: backward linkages react quickly but their effects dissipate sooner, whereas forward linkages adjust more slowly but persist for a longer period.

7.2 Eliminating Top Partners

Given the bilateral structure of our dataset, reverse causality is unlikely to pose a threat to identification. In other words, Egypt's exchange rate policy is not determined by sector- or partner-specific domestic or foreign value-added flows, and therefore bilateral GVC participation cannot plausibly drive movements in the RER. Nonetheless, to ensure that our findings are not disproportionally driven by Egypt's major trading partners, we re-estimate all regressions on progressively restricted samples in which the largest partners, ranked by their contribution to bilateral domestic and foreign value added, are removed.

Tables A13-A16 (Appendix B) report the results after successively excluding the top 10 percent, 30 percent, and 50 percent of partners with the highest GVC participation shares in Egypt's exports. Across all specifications, including the baseline GVC integration regressions, the upgrading regressions, and the estimations incorporating the knowledge spillover index, the results remain fully consistent with the main findings. This confirms that the estimated effects are not driven by small subset of dominant trade partners and that the results do not suffer from reverse causality or partner-concentration-bias.

To sum up, RER depreciation exerts a positive impact on GVC integration through both forward and backward linkages, while foreign knowledge embedded in imported intermediate inputs operates as a transmission channel through which RER depreciation fosters GVC upgrading. The robustness checks, whether lagged specifications or partner exclusion exercises, reinforce the validity and stability of the baseline results.

8. Conclusion and Policy Implications

To conclude, this paper examines the impact of RER depreciation on Egypt's integration into GVCs at the sectoral level, as well as its potential to foster sectoral upgrading along the value chain. Using bilateral sectoral input-output tables from UNCTAD-EORA over 1995-2022, the main findings show that RER depreciation increases GVC integration through both forward and backward linkages. When distinguishing sectors by technological intensity, the results show that forward linkages respond most strongly in primary sectors, reflecting Egypt's comparative advantage is resource-based activities. By contrast, backward linkages are most responsive in high-tech sectors, followed by low-tech sectors.

Turning to upgrading, measured by a sectoral upstreamness index, the results show that RER depreciation alone does not generate statistically significant gains in any of the three technological categories. However, once the role of foreign knowledge embedded in imported intermediate inputs is accounted for through a knowledge spillover index, a positive and statistically significant effect on upstreamness emerges, most notably in high-tech sectors. this supports the view that exchange rate policy can contribute to upgrading only when coupled with complementary industrial policy and tailored structural reforms, encouraging knowledge acquisition from technologically advanced trade partners.

Further heterogeneity analysis reveals that South-North value-added trade flows are substantially more responsive to RER depreciation than South-South flows. Moreover, the effect of RER varies across subperiods. All results are robust to a wide range of robustness checks.

In terms of policy implications, the results highlight the critical role of exchange rate flexibility in promoting Egypt's integration into GVCs. Policymakers can leverage exchange rate flexibility to foster integration, while recognizing that sector-specific strategies are essential given the heterogeneous responses across sectors. Yet, the exchange rate policy alone is not sufficient for upgrading and escaping the low value-added trap. A more comprehensive approach that combines exchange rate flexibility with structural reforms to strengthen Egypt's productive capacity is needed.

Such an approach should include trade and tariff reforms to rationalize tariffs and non-tariff measures, particularly those that raise the cost of knowledge-intensive imported inputs; labor market policies to enhance skills and productivity; investment and innovation policies to attract FDI and encourage technology upgrading; tax and incentive reforms to redirect fiscal support toward export-oriented and high-productivity sectors. At the same time, policymakers must strike a balance between greater reliance on foreign value added, an important source of embodied knowledge and learning, and sustained investment in domestic R&D and technological capabilities. This underscores the need for careful resource allocation: while foreign inputs can accelerate integration and learning, long-term competitiveness ultimately depends on building domestic innovation capacity.

Taken together, this comprehensive policy mix would enable Egypt not only to participate more in GVCs, but also to climb the value chain toward more innovation-driven and sustainable integration.

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Appendix A: Data and Stylized Facts

Table A1. EORA26 Sectors

1. Agriculture	14. Construction
2. Fishing	15. Maintenance and Repair
3. Mining and Quarrying	16. Wholesale Trade
4. Food and Beverages	17. Retail Trade
5. Textiles and Wearing Apparel	18. Hotels and Restaurants
6. Wood and Paper	19. Transport
7. Petroleum, Chemical and Non-Metallic Mineral Products	20. Post and Telecommunications
8. Metal Products	21. Financial Intermediation and Business Activities
9. Electrical and Machinery	22. Public Administration
10. Transport Equipment	23. Education, Health and Other Services
11. Other Manufacturing	24. Private Households
12. Recycling	25. Re-export & Re-import
13. Electricity, Gas and Water	26. Others

Source: EORA dataset.

Note: Sectors shown in bold are those included in our analysis.

Table A2. Sectors Classification by Technological Intensity

Primary Sectors	Low-Tech. Manufacturing	High-Tech Manufacturing
Agriculture	Food & Beverages	Electrical & Machinery
Fishing	Metal Products	Petroleum, Chemical & Non-Metallic Mineral Pr.
Mining and Quarrying	Wood & Paper	Transport Equipment
	Textiles & Wearing Apparels	

Source: Foster-Mcgregor et al. (2015).

Table A3. Harmonized EORA Sectors and the ISIC Rev 3. Classification

EORA Sectors	ISIC Rev 3. Correspondence
Agriculture	1, 2
Fishing	5
Mining & Quarrying	10, 11, 12, 13, 14
Food & Beverages	15, 16
Textiles & Wearing Apparel	17, 18, 19
Wood & Paper	20, 21, 22
Petroleum, Chemical and Non-Metallic Mineral Products	23, 24, 25, 26
Metal Products	27, 28
Electrical and Machinery	29, 30, 31, 32, 33
Transport Equipment	34, 35
Other Manufacturing	36

Source: EORA and WITS-TRAINS datasets.

Table A4. Summary Statistics

	Full Sample				
	Obs	Mean	Std. Dev.	Min	Max
GVC_EXP	37022	.378	1.089	0	14.651
DVX_EXP	37022	.229	.756	0	12.955
FVA_EXP	37022	.149	.509	0	13.881
ln(RER)	37022	-1.05	2.789	-9.324	12.607
ln(Tariffs +1)	37022	1.609	1.317	-4.2	6.33
ln(GDPPC_Par)	37022	2.248	1.254	-.87	4.942
ln(Rents_Par)	37022	.318	2.431	-9.143	4.191
Upstreamness	37022	.373	1.538	-13.982	9.849
	Low-Technology Intensive Sectors				
	Obs	Mean	Std. Dev.	Min	Max
GVC_EXP	14316	.387	1.132	0	14.651
DVX_EXP	14316	.224	.759	0	11.017
FVA_EXP	14316	.163	.576	0	13.881
ln(Tariffs +1)	14316	1.797	1.326	-3.401	6.33
Upstreamness	14316	.083	1.726	-13.982	7.531
	High-Technology Intensive Sectors				
	Obs	Mean	Std. Dev.	Min	Max
GVC_EXP	10719	.418	1.164	0	11.29
DVX_EXP	10719	.235	.721	0	10.405
FVA_EXP	10719	.182	.561	0	7.377
ln(Tariffs +1)	10719	1.555	1.257	-4.2	5.74
Upstreamness	10719	.527	1.247	-11.803	7.867
	Primary Sectors				
	Obs	Mean	Std. Dev.	Min	Max
GVC_EXP	8446	.34	1.017	0	14.256
DVX_EXP	8446	.274	.903	0	12.955
FVA_EXP	8446	.065	.18	0	3.179
ln(Tariffs +1)	8446	1.257	1.256	-3.912	5.721
Upstreamness	8446	.974	1.405	-11.161	9.849

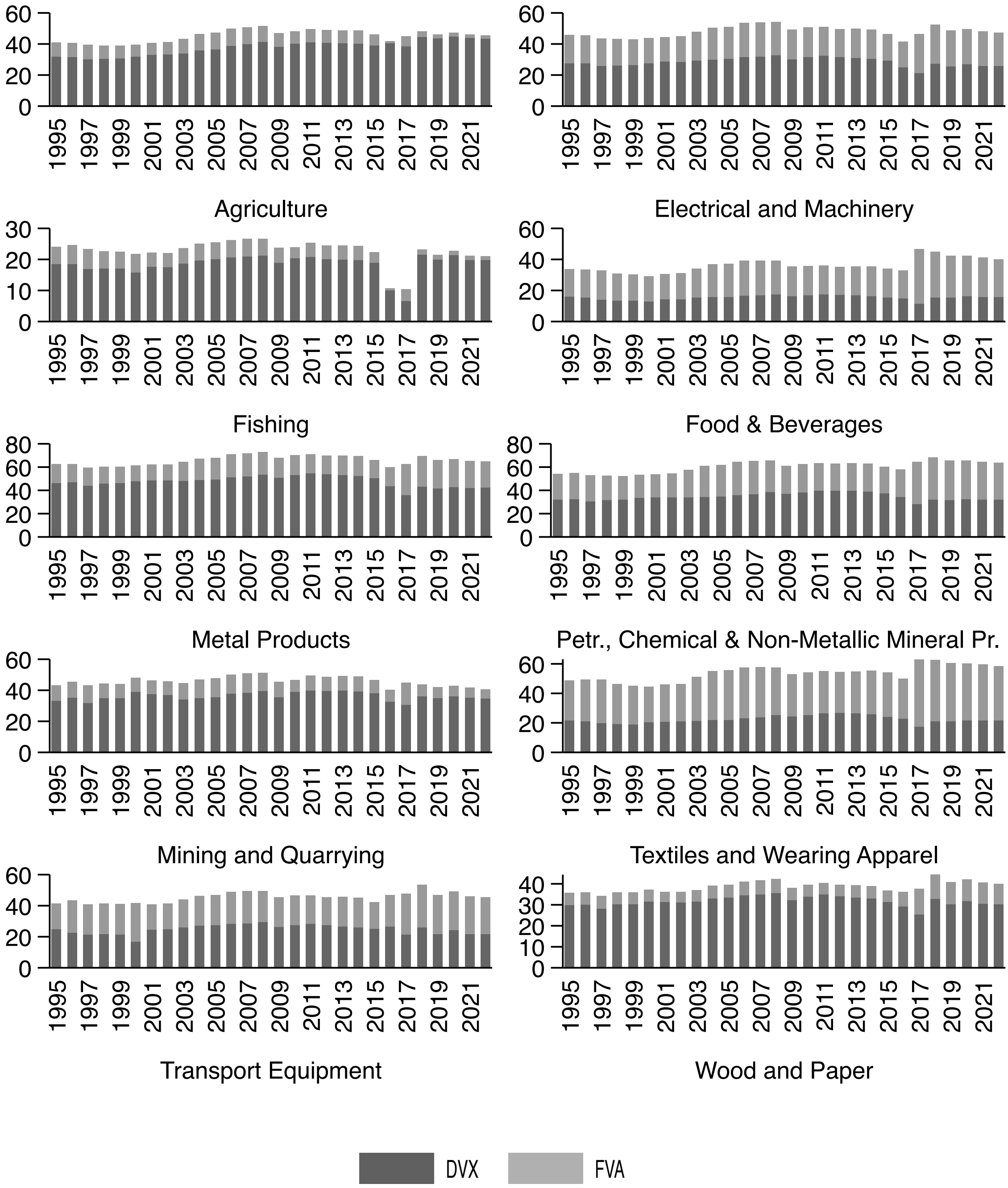
Source: Author’s own calculations.

Table A5. Income Classification of Egypt's Partners in the Sample

Low Income	Lower-Middle Income	Upper Middle Income	High Income
Afghanistan – Benin (before 2018)- Burkina Faso- Burundi- Central African Republic- Chad- Congo- DR Congo- Eritrea- Ethiopia- Gambia- Guinea- Liberia- Madagascar- Malawi- Mali- Mozambique- Niger- Rwanda- Sierra Leone- Somalia- South Sudan- Sudan- Syria- Togo- Uganda- Yemen	Algeria- Angola- Bangladesh- Belize- Benin (after 2018)- Bhutan- Bolivia- Cambodia- Cameroon- Cape Verde- Côte d'Ivoire- Djibouti- El Salvador- Gaza Strip- Ghana- Haiti- Honduras- India- Indonesia- Iran- Kenya- Kyrgyzstan- Laos- Lesotho- Mauritania- Mongolia- Morocco- Myanmar- Nepal- Nicaragua- Nigeria- Pakistan- Papua New Guinea- Philippines- Samoa- Sao Tome and Principe- Senegal- Sri Lanka- Swaziland- Tajikistan- Tanzania- Tunisia- Ukraine- Uzbekistan- Vanuatu- Vient Nam- Zambia- Zimbabwe	Albania- Argentina- Armenia- Azerbaijan- Belarus- Bosnia and Herzegovina- Botswana- Brazil- Bulgaria- China- Colombia- Costa Rica- Cuba- Dominican Republic- Ecuador- Fiji- Gabon- Georgia- Guatemala- Guyana- Iraq- Jamaica- Jordan- Kazakhstan- Lebanon- Libya- Malaysia- Maldives- Mauritius- Mexico- Moldova- Montenegro- Namibia- Panama- Paraguay- Peru- Romania- Russia- Serbia- South Africa- Suriname- TFYR Macedonia- Taiwan- Thailand- Turkey- Turkmenistan- Venezuela	Andorra- Antigua- Aruba- Australia- Austria- Bahamas- Bahrain- Barbados- Belgium- Bermuda- British Virgin Islands- Brunei- Canada- Cayman Islands- Chile- Croatia- Cyprus- Czech Republic- Denmark- Estonia- Finland- France- French Polynesia- Germany- Greece- Greenland- Hong Kong- Hungary- Iceland- Ireland- Israel- Italy- Japan- Kuwait- Latvia- Liechtenstein- Lithuania- Luxembourg- Macao SAR- Malta- Monaco- Netherlands- Netherlands Antilles- New Caledonia- New Zealand- Norway- Oman- Poland- Portugal- Qatar- San Marino- Saudi Arabia- Seychelles- Singapore- Slovakia- Slovenia- South Korea- Spain- Sweden- Switzerland- Trinidad and Tobago- United Arab Emirates- United Kingdom- United States of America- Uruguay

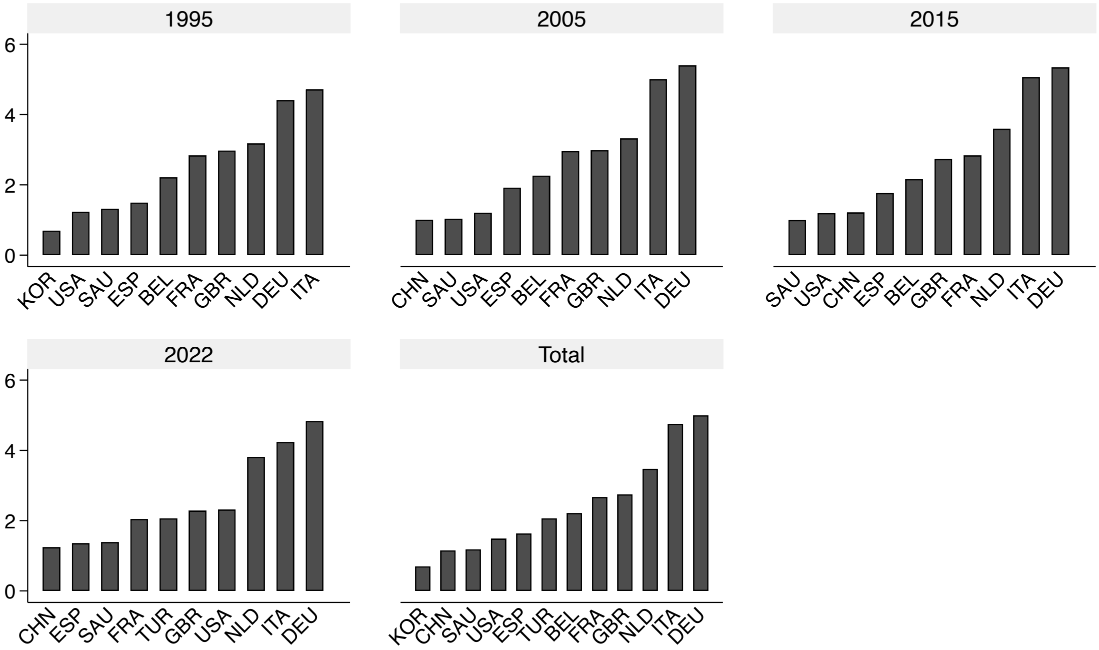
Source: Author's own elaboration following the World Bank online classification.

Figure A1. Egypt Sectoral GVC Participation (DVX + FVA), 1995-2022



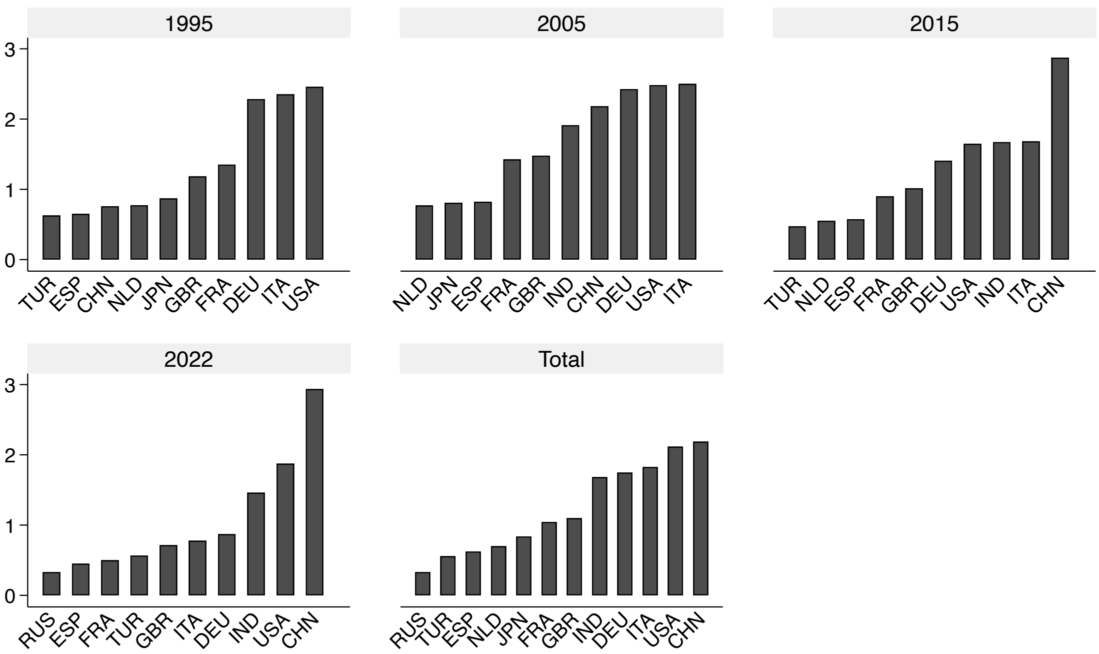
Source: Author’s own construction using EORA dataset. DVX and FVA are shares of gross exports.

Figure A2. Top 10 Trade Partners – Forward Linkage, as share of exports



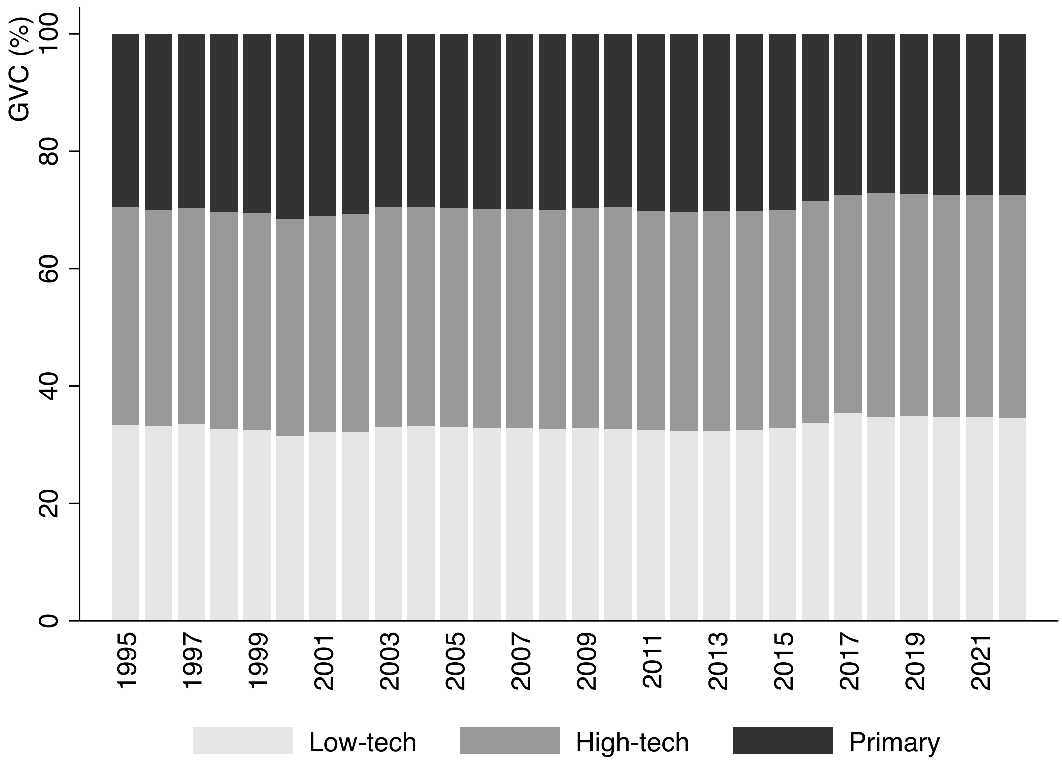
Source: Author's own construction using EORA dataset.

Figure A3. Top 10 Trade Partners – Backward Linkage, as share of exports



Source: Author's own construction using EORA dataset.

Figure A4. GVC by Technological Intensity, as Share of Exports



Source: Author's own construction using EORA dataset.

Appendix B: Robustness Checks

Table A6. Bilateral RER and GVC Integration – Alternative Specification

	(1) GVC	(2) DVX	(3) FVA
ln(RER)	0.148***	0.160***	0.133***
	(0.016)	(0.019)	(0.015)
ln(Tariffs +1)	-0.121***	-0.188***	-0.112***
	(0.023)	(0.031)	(0.019)
ln(GDPPC_Par)	0.567***	0.624***	0.495***
	(0.040)	(0.043)	(0.047)
ln(Rents_Par)	-0.081***	-0.104***	-0.047***
	(0.010)	(0.011)	(0.011)
ln(Distance)	-0.046	-0.149***	0.104**
	(0.043)	(0.048)	(0.047)
FTA (dummy=1)	0.205**	0.573***	-0.319***
	(0.094)	(0.094)	(0.105)
Contiguity	-0.704***	-0.621***	-0.749***
	(0.126)	(0.144)	(0.120)
Year-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,918	3,918	3,918
Observations	37,022	37,022	37,022
Pseudo R^2	0.229	0.279	0.172

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

Note: The intercept is included.

Table A7. Bilateral RER, Knowledge Spillover, and GVC Upgrading – Alternative Measures

	High-Tech. Sectors in VA Exports	Upstreamness (1) Primary	(2) Low Tech.	(3) High Tech.
[1] ln(RER)	-0.009***	0.017	0.032*	0.034*
	(0.003)	(0.014)	(0.019)	(0.0179)
[2] Know. Spillover Index	0.115***	0.619***	0.530***	0.561***
	(0.029)	(0.184)	(0.180)	(0.207)
[1] * [2]	0.011***	0.145**	0.123*	0.247***
	(0.004)	(0.066)	(0.072)	(0.088)
Year-Sector FE	✓	✓	✓	✓
Partner-Sector FE	✓	✓	✓	✓
Intercept & Controls	✓	✓	✓	✓
Clusters	jt	jt	jt	jt
# of clusters	2,200	2,343	2,328	2,318
Observations	21,665	5,838	9,019	6,749
Estimation Method	PPML	OLS	OLS	OLS

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

Table A8. Lagged RER and GVC Integration – PPML Estimations

	(1) GVC	(2) DVX	(3) FVA
RER_{t-1} (ln)	0.025***	0.020***	0.022***
	(0.005)	(0.006)	(0.008)
ln(Tariffs +1)	-0.012	0.012	-0.031***
	(0.009)	(0.011)	(0.008)
ln(GDPPC_Par)	0.883***	0.730***	0.985***
	(0.048)	(0.078)	(0.039)
ln(Rents_Par)	-0.014	-0.020	-0.008
	(0.011)	(0.013)	(0.012)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,769	3,769	3,769
Observations	35,727	35,727	35,727
Pseudo R^2	0.6593	0.6331	0.5949

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Note: The intercept is included.

Table A9. Lagged RER and GVC Integration by Technological Intensity – PPML Estimations

	GVC			DVX			FVA		
	Primary	Low-Tech.	High-Tech.	Primary	Low-Tech.	High-Tech.	Primary	Low-Tech.	Hogh-Tech.
RER_{t-1} (ln)	0.023***	0.025***	0.036***	0.027***	0.010	0.009	0.002	0.047***	0.073***
	(0.005)	(0.007)	(0.010)	(0.007)	(0.007)	(0.013)	(0.006)	(0.011)	(0.011)
ln(Tariffs +1)	0.019	-0.010	-0.030***	0.041**	0.007	-0.023	-0.004	-0.025**	-0.037***
	(0.015)	(0.010)	(0.011)	(0.017)	(0.010)	(0.014)	(0.007)	(0.011)	(0.012)
ln(GDPPC_Par)	0.710***	0.866***	0.947***	0.813***	0.641***	0.749***	0.942***	0.923***	1.029***
	(0.064)	(0.050)	(0.050)	(0.082)	(0.083)	(0.076)	(0.049)	(0.041)	(0.039)
ln(Rents_Par)	-0.003	-0.018	-0.012	-0.002	-0.028**	-0.023	-0.001	-0.002	-0.010
	(0.013)	(0.012)	(0.012)	(0.014)	(0.013)	(0.014)	(0.014)	(0.013)	(0.013)
Year-Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Partner-Sec FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Clusters	jt	jt	jt	jt	jt	jt	jt	jt	jt
# of clusters	3,661	3,666	3,631	3,661	3,666	3,631	3,661	3,666	3,631
Observations	8,157	13,862	10,361	8,157	13,862	10,361	8,157	13,862	10,361
Pseudo R^2	0.6250	0.6701	0.6780	0.6276	0.6527	0.6258	0.4415	0.6054	0.6128

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

Note: The intercept is included. GVC participation, forward, and backward linkages are expressed as share of exports.

Table A10. Lagged RER and GVC Upgrading by Technological Intensity

	Upstreamness		
	(1) Primary Sectors	(2) Low Tech. Sectors	(3) High Tech. Sectors
RER_{t-1} (ln)	0.004	-0.005	-0.003
	(0.012)	(0.017)	(0.017)
ln(Tariffs +1)	-0.015*	-0.031***	-0.044***
	(0.009)	(0.008)	(0.009)
ln(GDPPC_Par)	-0.368***	-0.418***	-0.458***
	(0.040)	(0.046)	(0.045)
ln(Rents_Par)	-0.003	-0.003	-0.006
	(0.003)	(0.004)	(0.004)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,814	3,872	3,835
Mean of dep. Δ	0,973	0,070	0,509
Observations	8,710	14,675	10,938
Adj. R-squared	0.7033	0.4340	0.6523

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Note: The intercept is included.

Table A11. Lagged RER, Knowledge Spillover and GVC Upgrading by Tech. Intensity

	Upstreamness		
	(1) Primary Sectors	(2) Low Tech. Sectors	(3) High Tech. Sectors
[1] RER_{t-1} (ln)	-0.036*	-0.037*	-0.036*
	(0.021)	(0.021)	(0.020)
[2] Know. Spillover Index	0.213	0.723**	0.661**
	(0.264)	(0.294)	(0.284)
[1] * [2]	0.072*	0.105**	0.114**
	(0.040)	(0.050)	(0.049)
ln(Tariffs +1)	-0.024**	-0.037***	-0.073***
	(0.011)	(0.011)	(0.013)
ln(GDPPC_Par)	-0.357***	-0.443***	-0.510***
	(0.050)	(0.058)	(0.059)
ln(Rents_Par)	-7.62e-05	-0.003	-0.005*
	(0.003)	(0.003)	(0.003)
[1] * [2] Marginal Effect (at median)	0.026 (0.020)	0.043* (0.024)	0.051** (0.025)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	2,189	2,182	2,170
Mean of dep. Δ	1.212	0.156	0.417
Observations	5,517	8,483	6,352
Adj. R-squared	0.6705	0.4712	0.6920

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

Note: The intercept is included.

Table A12. Dynamic Effects of RER and GVC Integration – PPML Estimations

	RER (ln)	RER_{t-1} (ln)	RER_{t-2} (ln)	RER_{t-3} (ln)	RER_{t-4} (ln)	RER_{t-5} (ln)
GVC	0.026***	0.025***	0.021***	0.013**	0.009*	0.003
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
DVX	0.018***	0.020***	0.018***	0.013**	0.010*	0.005
	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
FVA	0.022***	0.022***	0.014*	0.004	0.001	-0.005
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Year-Sector FE	✓	✓	✓	✓	✓	✓
Partner-Sector FE	✓	✓	✓	✓	✓	✓
Clusters	jt	jt	jt	jt	jt	jt
# of clusters	3,918	3,769	3,617	3,471	3,325	3,174
Observations	37,022	35,727	34,404	33,102	31,777	30,412

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

Note: GVC, DVX, and FVA are the dependent variables in each regression expressed as share of exports. Intercept and controls are included in all the regressions. Each cell represents a separate regression.

Table A13. RER Depreciation and GVC Participation – Top Partners Eliminated, PPML

	GVC Participation		
	(a) Top 10%	(b) Top 30%	(c) Top 50%
ln(RER)	0.025***	0.021**	0.015*
	(0.007)	(0.009)	(0.009)
ln(Tariffs +1)	-0.008	-0.012	-0.010
	(0.007)	(0.007)	(0.008)
ln(GDPPC_Par)	0.884***	0.846***	0.801***
	(0.053)	(0.047)	(0.063)
ln(Rents_Par)	-0.009	-0.011	-0.035***
	(0.011)	(0.011)	(0.010)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,891	3,839	3,758
Observations	36,835	36,338	35,532
Pseudo R^2	0.6405	0.5948	0.5294

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

Note: The intercept is included.

Table A14. RER Depreciation and GVC Participation by Tech. Intensity – Top Partners Eliminated, PPML

	Top 10%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
ln(RER)	0.021***	0.035***	0.037***
	(0.008)	(0.011)	(0.013)
ln(Tariffs +1)	0.010	-0.004	-0.022**
	(0.014)	(0.008)	(0.010)
ln(GDPPC_Par)	0.774***	0.854***	0.947***
	(0.068)	(0.053)	(0.053)
ln(Rents_Par)	-0.001	-0.012	-0.009
	(0.012)	(0.011)	(0.012)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,770	3,777	3,744
Observations	8,394	14,250	10,669
Pseudo R^2	0.6113	0.6519	0.6564
	Top 30%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
ln(RER)	0.017	0.033***	0.029**
	(0.012)	(0.012)	(0.012)
ln(Tariffs +1)	-0.002	-0.006	-0.026**
	(0.013)	(0.007)	(0.011)
ln(GDPPC_Par)	0.825***	0.791***	0.900***
	(0.068)	(0.045)	(0.048)
ln(Rents_Par)	-0.001	-0.016	-0.011
	(0.012)	(0.011)	(0.011)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,718	3,730	3,699
Observations	8,254	14,074	10,537
Pseudo R^2	0.5455	0.6079	0.6186
	Top 50%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
ln(RER)	0.017	0.021*	0.020*
	(0.013)	(0.011)	(0.011)
ln(Tariffs +1)	0.004	-0.009	-0.024**
	(0.014)	(0.007)	(0.011)
ln(GDPPC_Par)	0.769***	0.743***	0.862***
	(0.090)	(0.060)	(0.065)
ln(Rents_Par)	-0.012	-0.044***	-0.040***
	(0.013)	(0.010)	(0.011)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,637	3,655	3,624
Observations	8,030	13,789	10,321
Pseudo R^2	0.4741	0.5483	0.5479

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

Table A15. RER Depreciation and GVC Upgrading by Tech. Intensity – Top Partners Eliminated

	Top 10%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
ln(RER)	0.011	0.011	0.012
	(0.012)	(0.017)	(0.0170)
ln(Tariffs +1)	-0.016*	-0.030***	-0.043***
	(0.009)	(0.008)	(0.008)
ln(GDPPC_Par)	-0.363***	-0.425***	-0.469***
	(0.040)	(0.045)	(0.044)
ln(Rents_Par)	-0.003	-0.004	-0.006
	(0.003)	(0.004)	(0.003)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,936	3,988	3,953
Observations	8,952	15,077	11,257
	Top 30%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
ln(RER)	0.010	0.010	0.012
	(0.012)	(0.017)	(0.017)
ln(Tariffs +1)	-0.017**	-0.031***	-0.044***
	(0.009)	(0.008)	(0.009)
ln(GDPPC_Par)	-0.366***	-0.427***	-0.470***
	(0.040)	(0.046)	(0.044)
ln(Rents_Par)	-0.003	-0.003	-0.006
	(0.003)	(0.004)	(0.003)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,882	3,939	3,906
Observations	8,801	14,893	11,120
	Top 50%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
ln(RER)	0.010	0.011	0.013
	(0.012)	(0.017)	(0.017)
ln(Tariffs +1)	-0.017*	-0.032***	-0.045***
	(0.009)	(0.008)	(0.009)
ln(GDPPC_Par)	-0.380***	-0.436***	-0.478***
	(0.041)	(0.047)	(0.045)
ln(Rents_Par)	-0.005	-0.003	-0.005
	(0.003)	(0.004)	(0.004)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	3,801	3,864	3,831
Observations	8,577	14,608	10,904

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

Table A16. RER Depreciation, Knowledge Spillover and GVC Upgrading by Tech. Intensity – Top Partners Eliminated

	Top 10%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
[1] ln(RER)	-0.021	-0.026	-0.029
	(0.020)	(0.020)	(0.019)
[2] Know. Spillover Index	0.171	0.685**	0.628**
	(0.262)	(0.288)	(0.279)
[1] * [2]	0.064	0.112**	0.124**
	(0.042)	(0.051)	(0.049)
[1] * [2] Marginal Effect[1]	0.034 (0.022)	0.058** (0.024)	0.064*** (0.024)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	2,252	2,237	2,226
Observations	5,650	8,678	6,505
	Top 30%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
[1] ln(RER)	-0.020	-0.026	-0.029
	(0.020)	(0.020)	(0.019)
[2] Know. Spillover Index	0.176	0.689**	0.628**
	(0.263)	(0.289)	(0.280)
[1] * [2]	0.062	0.112**	0.123**
	(0.042)	(0.051)	(0.049)
[1] * [2] Marginal Effect[1]	0.032 (0.021)	0.054** (0.023)	0.060*** (0.023)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	2,209	2,198	2,188
Observations	5,531	8,531	6,395
	Top 50%		
	(a) Primary	(b) Low Tech.	(c) High Tech.
[1] ln(RER)	-0.016	-0.022	-0.024
	(0.020)	(0.020)	(0.019)
[2] Know. Spillover Index	0.179	0.682**	0.618**
	(0.266)	(0.291)	(0.281)
[1] * [2]	0.058	0.107**	0.118**
	(0.042)	(0.051)	(0.050)
[1] * [2] Marginal Effect[1]	0.031 (0.020)	0.050** (0.021)	0.055*** (0.021)
Year-Sector FE	✓	✓	✓
Partner-Sector FE	✓	✓	✓
Clusters	jt	jt	jt
# of clusters	2,134	2,127	2,117
Observations	5,320	8,259	6,189

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

Note: The intercept and the control variables are included in all the regressions but not reported for brevity.

[1] Marginal effect is estimated at the median value.