Trading up for development: the effect of deep trade liberalization on participation in global value chains (GVCs)

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Abstract

Preferential trade agreements (PTAs) are powerful institutional tools for trade integration. In recent years, PTAs have increased in number and become more comprehensive to include beyond-tariff policy areas. It is well evidenced in the political economy of trade that PTAs increase members' participation in international trade and, by implication, have a welfare-enhancing effect. However, what has received little attention is whether these agreements and their "deepening" have the same effect on members' participation in new international trade patterns that have evolved in the past few years under the globalization of production and the formation of global value chains (GVCs). This doctoral thesis contributes to the study of PTAs and GVCs and asks whether and when the deepening of the preferential trade regime helps members and their producers to integrate and trade more with GVCs, and if they do, what are the implications for development and trade policy, especially for developing countries?

The project empirically examines these questions in three papers. The guiding argument is that deep PTAs are more effective in facilitating the participation of countries and firms in GVC because deep PTAs provide a unified institutional framework conducive to long-term stability in trade, investment, and production relations among countries and firms. The thesis takes a comprehensive conceptual, analytical, and empirical approach. Conceptually, it embeds itself in the new regionalism, trade theory, development, and GVC studies literature. Analytically, it divides the analysis process into macro (country) and micro (firm) levels and examines the expected effect at the country and firm levels. Empirically, it builds three separate datasets, combining macro (country-level) and micro (firm-level) on PTAs, GVCs, firms, and institutional quality and examines the expected effect using causal inference techniques. Chapter two (paper 1) examines if the proliferation of deep bilateral integration increases states' participation in global value chains (GVCs). It provides robust evidence that deep trade integration increases states' participation in GVCs, but the size of this effect varies across the design features of PTAs. Chapter three (paper 2) offers a unique measure of firms' participation in GVCs and brings the question of local institutions into the discussion of firms' participation in GVCs. It finds that when the regulatory quality of domestic institutions is high, the deepening of trade integration increases productive firms' participation in GVCs. Finally, Chapter four (paper 3) examines if deep PTAs enhance the resilience of firms' trade in GVC against unexpected supply chain disruptions, such as pandemics. It shows that deep PTAs mitigate the negative impact of supply chain disruptions on firms' GVC relations.

Results suggest deep trade agreements are a powerful and enduring policy tool that can effectively organize trade in GVCs for development. However, the context matters. Participation in GVCs is conditioned not only on deep trade integration and the heterogeneous characteristics of firms but also on the design features of trade agreements and the quality of local institutions. This project contributes to the study of the new generation of trade agreements and their development impact on members in the context of the evolving patterns of international production and GVCs. Additionally, it draws implications for an evidence-based trade and development policy discussion on the PTAs-GVCs nexus.

Résumé

Les accords commerciaux préférentiels (ACPs) sont des outils institutionnels puissants pour l'intégration commerciale entre les membres. Ces dernières années, le nombre d'accords préférentiels de commerce s'est accru et ils sont devenus plus complets pour inclure des domaines de politique non tarifaire. Il est bien établi dans l'économie politique du commerce que les ACPs augmentent la participation des membres au commerce international et, par conséquent, ont un effet d'amélioration de la prospérité. Cependant, on s'est peu intéressé à la question de savoir si ces accords et leur "approfondissement" ont le même effet sur la participation des membres aux nouveaux modèles de commerce international qui ont évolué ces dernières années dans le cadre de la mondialisation de la production et de la formation de chaînes de valeur mondiales (CVMs). Cette thèse de doctorat contribue à ce domaine de recherche et examine si l'approfondissement du régime commercial préférentiel aide les membres et leurs producteurs à s'intégrer et à commercer davantage avec les CVMs. Si tel est le cas, quelles sont les implications de cet effet sur le développement et la politique commerciale, en particulier dans les pays en développement?

Le projet examine empiriquement ces questions dans trois chapitres. L'argument principal est que les ACPs approfondis sont plus efficaces pour faciliter la participation des pays et des entreprises aux CVMs, car l'intégration commerciale approfondie fournit un cadre institutionnel unifié propice à la stabilité à long terme des relations de commerce, d'investissement et de production entre les pays et les entreprises. La thèse adopte une approche conceptuelle, analytique et empirique complète. Sur le plan conceptuel, elle s'inscrit dans la littérature sur le nouveau régionalisme, la théorie du commerce, le développement et les études sur les CVMs. Sur le plan analytique, elle divise le processus d'analyse en niveaux macro (pays) et micro (entreprise) et examine l'effet attendu au niveau du pays et de l'entreprise. Sur le plan empirique, elle construit trois ensembles de données distincts, combinant des données sur les caractéristiques de conception des accords de partenariat économique, les institutions et les caractéristiques au niveau des pays, les caractéristiques au niveau des entreprises et le commerce dans les CVMs, et examine l'effet attendu en utilisant des techniques d'inférence causale.

Le chapitre deux (document 1) examine si la prolifération d'une intégration bilatérale profonde augmente la participation des États aux CVMs. Il fournit des preuves solides que l'intégration commerciale profonde augmente la participation des États aux CVMs, mais l'ampleur de cet effet varie selon les caractéristiques des accords de partenariat économique. Le chapitre 3 (document 2) propose une mesure unique de la participation des entreprises aux CVMs et introduit la question des institutions locales dans le débat sur la participation des entreprises aux CVMs. Il constate que lorsque la qualité réglementaire des institutions nationales est élevée, l'approfondissement de l'intégration commerciale augmente la participation des entreprises productives aux CVMs. Enfin, le chapitre 4 (document 3) examine si les ACPs approfondis améliorent la résilience du commerce des entreprises dans les CVMs face à des perturbations inattendues de la chaîne d'approvisionnement, telles que les pandémies. Il montre que les ACPs approfondis atténuent l'impact négatif des perturbations de la chaîne d'approvisionnement sur les relations des entreprises dans les CVMs.

Les résultats suggèrent que les accords commerciaux approfondis sont un outil politique puissant et durable qui peut organiser efficacement le commerce dans les CVMs pour le développement. Cependant, il faut également noter que le contexte a son importance. La participation aux CVMs est conditionnée non seulement par l'intégration commerciale profonde et les caractéristiques hétérogènes des entreprises, mais aussi par les caractéristiques de conception des accords commerciaux et la qualité des institutions locales. Ce projet contribue à l'étude de la nouvelle génération d'accords commerciaux et de leur impact sur le développement des membres dans le contexte de l'évolution des modèles de production internationale et des CVMs. En outre, il tire les conséquences d'un débat sur les politiques de commerce et de développement fondé sur des données probantes concernant le lien entre les ACPs et les CVMs et jette les bases de travaux ultérieurs plus nuancés.

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Authorship and contributions

This thesis is a manuscript-based doctoral thesis. It includes three single-authored (by me) research articles. These papers have been published in the past year or will be submitted to peer-reviewed journals for publication. While these manuscripts are stand-alone research projects, they were implemented in the sequence presented here. For this reason, they coherently build on the findings of one another to answer the overarching research question. Each manuscript (Chapters 2-4) has its introduction, literature review, dataset, methodology, discussion, conclusion, and bibliography sections. In addition, Chapter 1 provides a review of the relevant literature to set the stage for the analyses and discussions in the three articles. Finally, Chapter 5 provides an overall discussion of the findings in the three articles and broadens their implications for theory, policy, and future research.

The summary of the original contributions of this thesis to the global political economy of trade and development is twofold. First, at the theory level, the thesis extends the study of trade regimes, specifically the new generation of trade agreements, to the area of GVCs. It focuses specifically on the variation across many design features of trade agreements and their welfare implications, which offers novel explanations for when and why trade in GVCs may benefit from the deepening of trade integration. Additionally, the thesis brings the question of domestic institutions, and their distributional effect, into the study of GVCs at the micro (firm) level. Second, at the analytical level, I use micro-level data to calculate a unique measure of GVC participation for firms, which has not been done in other studies at the moment of writing this thesis. In addition, the thesis combines macro (country) to micro (firm) level analyses. It examines the PTAs-GVCs nexus across countries and time, including the pandemic period, expanding the current focus of the literature on both dimensions.

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Chapter 1

Introduction

1.1 Summary

Global trade and production have undergone important transformations in recent years. Two key observations in this area are the increasing number and depth of preferential trade agreements (PTAs) and the globalization of production through global value chains (GVCs), which have seen active participation from developing countries. Multilateral trade liberalization has faced challenges since the Doha Development Agenda broke down, but PTAs have continued to proliferate and expand in scope. Between the 1990s and 2010s, the cumulative number of PTAs tripled, growing from just under 150 to over 600 agreements, with most concluded between developed (North) and developing (South) countries. In addition, the "new" generation of PTAs in the past two decades has become "deeper" and includes policy areas, such as investment, services, intellectual property rights (IPRs), competition policies and others, beyond tariff cuts (Baccini 2019; Dür et al. 2014).[1]

At the same time, the globalization of production has reorganized the composition

1. In regional studies, the North and South refer to developed and developing countries accordingly – regardless of their geographic areas. I use these interchangeably here.

and organization of international trade, leading to the emergence of highly integrated and interdependent production linkages among firms and countries, which are known today as GVCs (Antràs 2020; Gereffi 2018). Compared to prior periods, the production of a specific product is hardly *made in* one location (country) by one firm. Instead, globalization of production and relocation has allowed firms to divide, offshore, outsource, and coordinate their production across multiple countries and suppliers. As trade statistics confirm, between 2000 and 2008 alone, more than 50% of global trade consisted of trade in parts and components, especially in the manufacturing sector, and the projections show it will reach 60% by 2030 (WB 2020b).

At the policy level, deep trade integration and more participation in GVCs are currently the defining features of states' and international development organizations' trade and development priorities (UNCTAD 2013a; WB 2020a, 2020b; WTO 2021, 2011; OECD 2019, 2021). Furthermore, the rising geopolitical and economic tensions, tariff escalations, supply chain disruption during the global pandemic, and the weaponization of trade policy in recent years turned the analytical spotlight on GVCs and states' dependence on them for their economic security and development. Therefore, understanding whether, when, and how deep trade agreements shape GVC relations is of utmost theoretical and empirical importance for the political economy of trade and development.

In addition, given the fragmentation of production processes across sectors and the expansion of GVCs, traditional export data tend to mask the actual effect of trade policy on economic development. For example, according to final export data, Cambodia was one of the largest exporters of bicycles to the EU in 2022. It accounted for 25% of Europe's imports and 5% of the world's export of bicycles as a final product. However, in terms of value produced and added locally to the exported bicycles, Cambodia contributed less than 1%. This is because while Cambodia assembles and exports the final product, the most expensive and sophisticated bicycle parts, i.e., the

frame or wheels, are produced in other countries such as China, Italy, and Vietnam (see Figure 1.4 in Appendix).[2] For this reason, an analysis of trade liberalization and the effect of deep integration on Cambodian economic development would not be accurate with traditional export data, which shows a surge in final export.

Despite the significant implications of these transformations for theory and policy, the relationship between the deepening of trade integration and GVCs is poorly understood. Where this linkage has been examined recently, the analysis is limited regarding years and countries and focuses only on the macro bilateral country level (Laget et al. 2020; Boffa et al. 2019). The literature on new regionalism suggests that preferential trade agreements have a significant welfare effect on members by expanding and intensifying their final trade (Baier and Bergstrand 2007; Baccini 2019; Dür et al. 2014). Similarly, the literature on GVCs and development suggest that the rise of GVCs presents a unique opportunity for developing countries to increase the value of their export by specializing in small but more value-adding tasks instead of aiming to industrialize across various tasks and sectors (Gereffi et al. 2001; Gereffi 2018; Giuliani et al. 2005; Taglioni and Winkler 2016; Pahl and Timmer 2020).

The broad goal of this project is to fill this gap. The general question that motivates the three papers in this thesis is whether deep PTAs increase countries' (and firms') participation in GVCs, under what conditions, and with what implication for trade and development policy. A unified argument across papers suggests that deep PTAs are more effective than shallow agreements in facilitating the participation of countries and firms in GVC. Deep PTAs provide a unified institutional framework conducive to long-term stability in trade, investment, and production relations among countries and firms.[3]

2. *"Cambodia earns $900 million from bicycle exports, up 43 percent"*, Khmer Times, January 30, 2023, here.

3. It must be noted that deep PTAs, more generally, are often referred to as comprehensive trade

The thesis contributes to the political economy of trade and development at three levels. First, at the theory level, the thesis extends the study of the new generation of PTA and their welfare implications to the area of GVCs and concentrates specifically "on variation across PTAs in design and content rather than treat all PTAs as if they were the same" (Dür et al. 2014, 373). The focus on the PTAs-GVCs nexus in this project brings novel insights into studying modern trade and production regimes, crossing disciplinary boundaries. Additionally, the thesis brings the question of domestic institutions into the study of GVCs (Eckhardt and Poletti 2018) at the firm level and adds to the literature on the distributive effect of domestic institutions after trade liberalization (Baccini et al. 2022). It shows that firm heterogeneous characteristics, such as productivity, may not fully explain who loses and gains from the deepening of trade integration. Instead, the quality of domestic institutions also matters for how and when firms (and countries) participate in GVCs.

Second, at the analytical level, the thesis takes a comprehensive approach and examines the question at the country and firm levels. The analysis moves from macro (country) to micro (firm) level analysis and examines the PTAs-GVCs nexus across countries and time, including the pandemic period. Chapter 3 offers a unique measure of GVC participation for firms, using firm-level data, which has not been done in other studies at the moment of writing this thesis. Given that firms are the drivers behind the production and trade decisions in GVCs, deep PTAs could be said to have a development effect on local economies only if it enables firms to participate more in GVCs. Additionally, the thesis uses firm-level data to assess whether the effect of deep PTAs on GVC integration, observed in papers two and three, remain robust to major disruptions in trade and supply chains during COVID-19.

agreements in recent years. Throughout this thesis, these terms are used interchangeably, and where the context requires, they are replaced with deep trade integration, which is the ultimate objective of deep trade agreements.

Finally, at the policy level, the thesis draws several recommendations from its findings to inform trade and development policy. First, it suggests that trade and investment regimes reinforce each other's effect on GVCs. For this reason, deep PTAs should be implemented alongside investment agreements to increase production quality over the long run. Second, the thesis also shows that in comparison to shallow and multilateral agreements, deep PTAs increase trade in GVCs over the long rather than the short term. The significance of deep PTAs over the long term indicates that these institutions are more conducive to creating an enabling environment for local firms to produce and add more value to their exports. It also means that deep PTAs are more comprehensive trade integration that involves more extensive industrial and institutional changes in the member countries. Given the significant and restructuring effect of deep PTAs on GVC integration in the long run, developing countries will benefit from the globalization of production and the deepening of trade integration if they receive additional support and investments to join and implement more comprehensive trade deals.

Third, the significant effect of deep PTAs on the GVC trade of dyads, including developing countries, highlights the comparative advantages of developing countries in terms of low production costs and resource endowment. At the same time, it emphasizes the importance of an open international trade system for developing countries to access downstream buyers, most of whom are in developed countries. Therefore, intentional or unintentional disruptions of supply chains may have more severe consequences for developing than developed countries, especially in the current fragile economic and geopolitical environment.

Fourth, results indicate that while firm-level factors such as large size, foreign ownership, and high productivity may explain who wins and losses from trade liberalization, the context of the institutional environment within which firms operate also

matters. The role of domestic institutions found little attention in trade theory and analysis of GVCs. However, the role of domestic institutions has not become obsolete, and they remain a vital source of comparative advantage for trade and development. Although states may not have complete control over all factors contributing to their welfare gains from globalization and trade integration, investing in the quality of domestic institutions is one key area that national and international development policies could prioritize.

Finally, the results show that deep trade agreements effectively fulfill their primary objectives in normal and difficult times by increasing the certainty and stability of trade relations under GVCs. Promoting more comprehensive trade integration through deep PTAs may be a viable policy option for states and international development organizations to make GVCs work for development and mitigate the negative effects of future supply chain disruptions on trade and development.

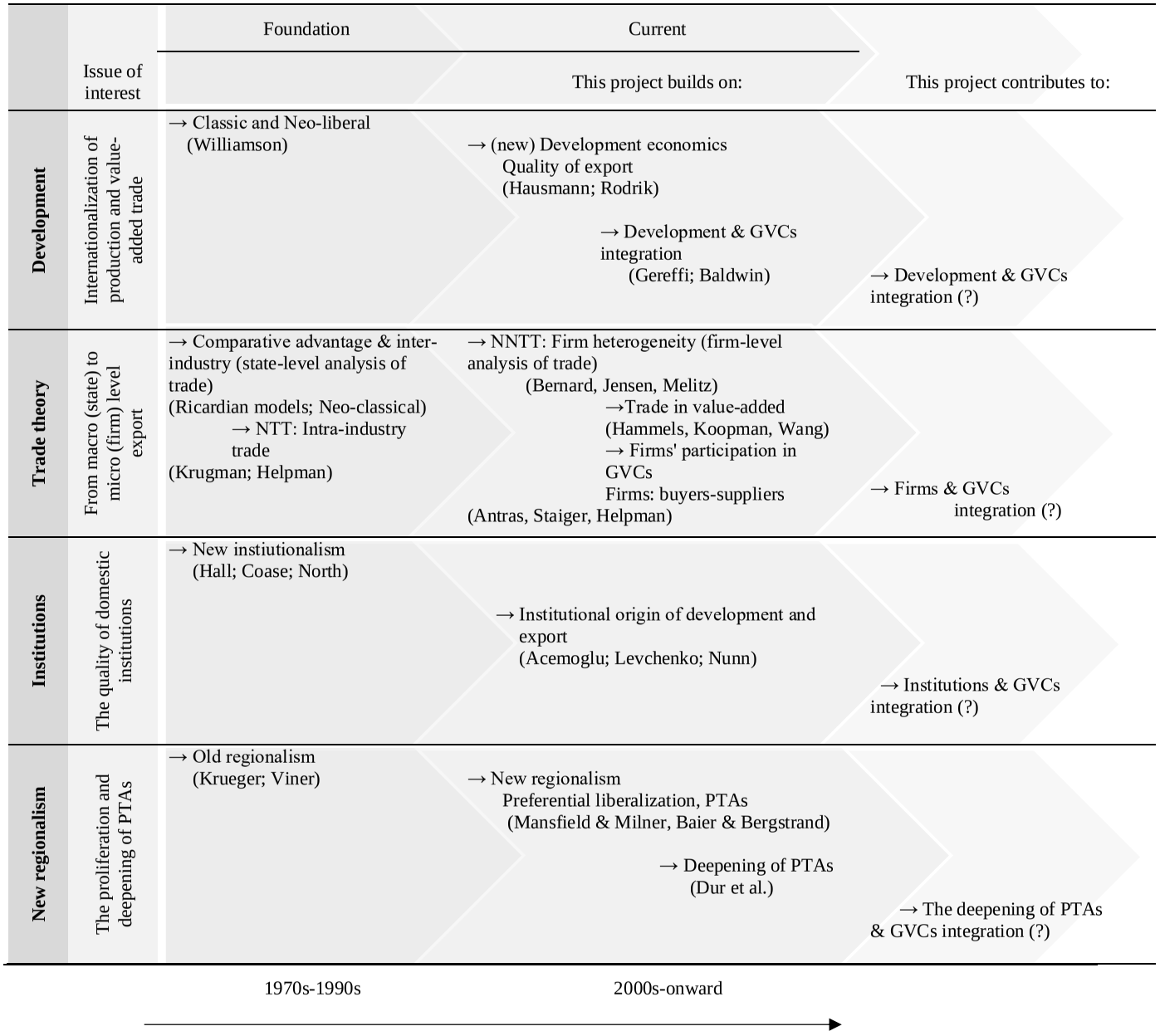
1.2 Literature: PTAs-GVCs nexus

Each paper in this thesis is a stand-alone study and discusses its own theoretical foundation. This section aims to provide an overview of the four key streams of the literature relevant to the empirical analysis of the PTA-GVC nexus: development and GVCs, trade theory and GVCs, quality of domestic institutions and GVCs, and the design of trade agreements (new regionalism). An overview of this discussion is summarized in Figure 1.1.

Trade in GVCs and development

From the "fragmentation" of global production in recent years, highly integrated and interdependent production and trade relations among firms (and countries) have emerged, which are known today as global value and global supply chains (GSCs and

Figure 1.1: Mapping the literature



Source: by author.

GVCs). Although GSCs and GVCs are used interchangeably at the aggregate level, there is a crucial difference between the two from the perspective of trade, which helps illuminate the importance of GVCs for development. GSCs mean the interconnectedness of production tasks and processes that turn raw inputs into a final product, such as design, production (or purchase) of raw materials or parts and components, packaging, marketing, sales, post-sales services, and others. In other words, GSCs denote the division and organization of tasks and processes.

GVCs also show the interconnectedness of the named production stages but focus empirically on the net value (in dollar terms) produced and added by a country (firm) at each production stage. A classic textbook example of value-added (VA) production in one country's context is the production of a loaf of bread from raw materials to store shelves (see Figure 1.5 in Appendix). Although the wheat farmer produces the most important ingredient, her contribution to the product's final value is less than the VA contribution of the miller or baker. When these three producers are in different countries and linked to one another through the export and import of foreign and domestic inputs, they form a GVC in which gains from trade are reflected in terms of trade in VA rather than trade in final export.

Because trade in GVCs is essentially about the trade in foreign or domestic VA to export rather than just total export, it is "structurally different from its predecessors" wherein "trade was largely in finished goods" (Gereffi 2018, 431). From the perspective of conventional trade, the final value of exported items recorded in the contract (and reported to the customs) is counted towards the trade balance of the exporting country. GVC trade, in contrast, counts only the VA content of the final export. For this reason, it draws a different picture of the causal link between trade integration and development than the one currently informing trade and development policy.

First, countries that process more foreign VA or produce more domestic VA should

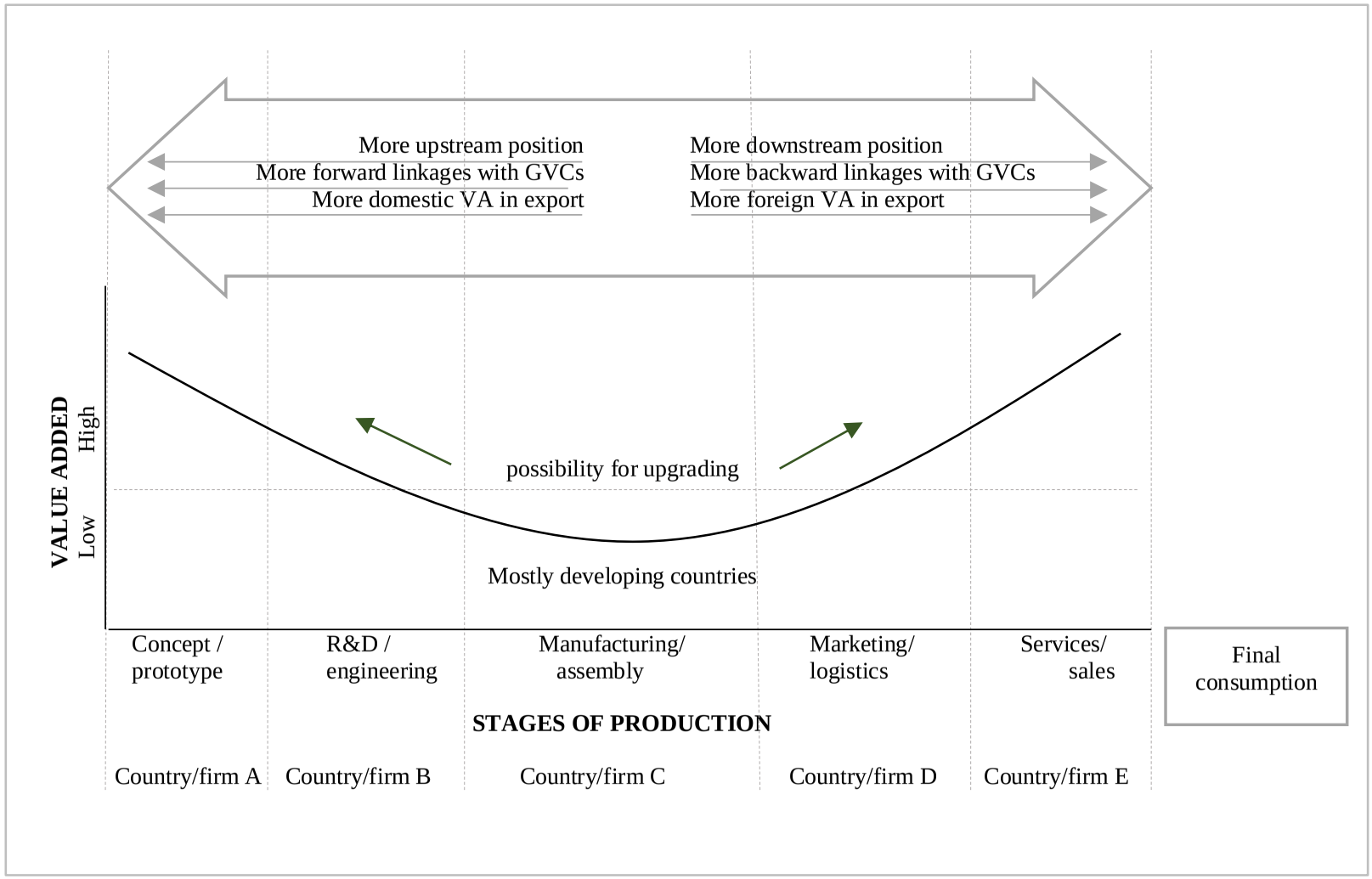
benefit more from trade liberalization than countries that export more in aggregate terms. As the convex shape of the VA curve, which is hypothetically referred to as the "smile curve"[4] of global production, shows, VA to a product is not the same at each stage of production and changes depending on the complexity of tasks performed. VA at the assembly stage, which does not require advanced skills or innovation, is smaller than VA at the design or post-sale services (see Figure 1.2).

For example, countries that assemble electronics or produce T-shirts may be the largest exporters of these final products. However, their development gain from participating in the GVCs of electronics and T-shirts may be much less than that of countries that produced processors or cleaned and carded fibre cotton. While the average market price of the iPhone 4 in 2011 was $560, China's (the manufacturing country's) captured only about 2.5% of the price. Other economies like the US, South Korea, and Taiwan implemented high VA activities. As Pascal Lamy said, "what we call 'Made in China' is indeed assembled in China" because "its commercial value comes from those numerous countries that precede its assembly" (see also Appendix A, Chapter 2).[5]. Therefore, while large exporting countries with abundant cheap labour may win from trade liberalization in terms of gross export, they nonetheless capture very little value from trade integration if they perform simple tasks with less VA.

Second, GVCs are relational structures, and as such, firms' (and countries') decisions and success in GVCs depend on the decisions and actions of their counterparts. For example, firms (and countries) located at the initial stages of production are upstream suppliers for firms located at the final stages. Similarly, firms (countries) located at the final stages of production are downstream buyers for those located at the prior stages. In other words, firms (and countries) under trade in GVCs are more

4. The term was coined by Acer's founder, Stan Shih, in the 1990s.
5. Pascal Lamy, Financial Times, January 24, 2011, available here

Figure 1.2: A "smile" curve of value-added trade



Source: by author, based on Baldwin (2012).

closely linked to one another through backward (buyer) and forward (supplier) production relations than firms (and countries) under trade in finals. In addition, under trade in GVCs, the production of parts and components is more customized to the buyer countries' (and firms') needs than traditional trade. For this reason, most export items that move through GVCs cannot be bought on the spot market from any other producers on a brief note or without high costs (Nunn 2007; Antras and Chor 2021).

In this context, while firms along the value chain operate independently, the value and quality of their export depend on how effectively different inputs and parts move from one country (and firms) to the next. For this reason, firms' (and countries') decisions and activities within GVCs may be more responsive to trade policies and institutional changes, especially at the bilateral level. This view of production and trade relations underlines the importance of customized policies enabling firms (and countries) from one or more countries to establish long-term production and trade relations and participate in GVCs.

Focusing on GVC trade relations instead of traditional export also holds profound policy implications for bilateral trade relations among countries. As Koopman et al. (2014) show, China's trade surplus with the US would significantly drop if measured in VA rather than in gross export terms. Because China is a downstream (manufacturer) country for many consumer products and imports components and parts from other upstream (supplier) countries for final processing and assembly, the foreign content of its export to the US is higher than its domestic VA. In contrast, Japan's trade surplus with the US would increase if measured in VA rather than gross export terms. Because Japan performs more sophisticated tasks and exports highly processed parts and components to other downstream countries worldwide, its share of VA to the US' import is higher than what is reported by traditional export statistics.

In the current debates about decoupling from China and the weaponization for trade policy from both sides, a GVC view of trade relations would also help to refine previous conclusions that import competition from net importers harms domestic workers. For example, seminal works using traditional export trade data argued that import competition from China in the early 2000s had a profound negative effect on the wages of low-skilled workers in the US (Autor et al. 2013). However, using data that decomposed gross trade into foreign and domestic VA components to account for China's share of VA to US imports, others reported a much-reduced impact on the US labour market from its exposure to the rising import from China in 2000-2007 (Jakubik and Stolzenburg 2021). Given the growing internationalization of production, focusing on the changes in GVC trade instead of traditional trade is a more accurate measure of the welfare effect of the deepening trade integration.

A central issue that has emerged from the described complexity of trade relations under GVCs, which has impeded the research on GVC trade, is the coverage and availability of easy-to-access statistics capturing GVC participation of countries (and firms). One of the contributions of this thesis is precisely in this area, as it shows that GVCs trade can be measured with the data already available for a more nuanced analysis of the changes in the trade regime and its welfare implications.

One of the critical questions for states and international organizations in recent years has been how trade policy could help developing countries to move up along either end of the VA curve, i.e., upgrade their position and capture more value from their export. The answer to this question lies in the design of those policies that focus not only on tariff cuts but also on improving the quality of domestic production and creating the conditions for specializing in more customized parts and components.

Trade theory and GVCs

How has the analysis of GVCs and firms been approached in trade theory and analysis? GVC studies have flourished mainly in the business literature (Hopkins and Wallerstein 1986; Bair and Gereffi 2001; Gereffi et al. 2005), independent of trade theory and analysis. The analysis of GVCs in trade theory has been approached as "just trade" (Dallas 2015, 882) and remained focused until recently on the conventional (final) trade framework despite its evolutionary shift towards the micro-study of trade and firms (Melitz 2003; Helpman et al. 2004). Trade policy, too, in the words of Pascal Lamy, has been finding it hard to make "the transition from thinking about trade in traditional terms to the new realities of global supply chains" (Gereffi 2018, xvii). In recent years, a distinct stream of works has emerged that brings the question of GVCs closer to the analysis of firms and trade. This project draws on their arguments and insights to examine the effect of macro-level trade institutions, such as PTAs, on GVCs at the micro- (firm-) level units of GVCs, such as firms. This section summarizes the progress of these works and shows the place of this project in the context.

From classical to new trade theory

Progress in trade theory has followed a Kuhnian path of "scientific revolution", where new models and theories were developed and refined to explain what the old models could no longer explicate (Antràs 2015, 31). Two notable paradigmatic shifts in this progress were the shift from the classical and neo-classical to new trade theory (NTT) and from the NTT to the new NNT (NNTT). In the classical and neo-classical theories, before the 1970s, trade in final products was the key unit of analysis (Ranjan and Raychaudhuri 2016; WB and WTO 2017). It was assumed that countries engaged mostly in inter-industry trade, i.e., in dissimilar final products produced in dissimilar industries. The welfare effect of trade liberalization was accordingly measured in terms of more export of finished and heterogeneous non-substitute products. Specialization

and upgrading could be achieved through export diversification at the national level by countries that were naturally blessed with favourable conditions and resources by "Mother Nature" (Gilpin 2000, 96).

By the beginning of the 1980s, new facts arising from less aggregated trade data showed that many countries were producing and exchanging similar products in similar industries because they had the same comparative advantage. Based on these observations, new trade theory suggested that countries were not simply engaging in inter but also in intra-industry (i.e., similar-similar) trade in products that were substitutes or complements (Grubel and Lloyd 1975; Helpman and Krugman 1985; Krugman 1980). Moreover, in addition to factor endowment, there was a range of other factors influencing countries' trade patterns and their ability to specialize, e.g., product differentiation driven by the "love of variety preferences" (consumer elasticity of substitution), intra-industry trade under imperfect competition, the geography of production, vertical specialization with product sharing, and economies of scale.

The shift in the level of analysis from macro to industry-level determinants of trade and economic development was already revolutionary because it aligned trade theory with the empirics. However, similar to classic and neoclassical theories, NTT was not departing significantly from the neo-classical economics assumption that liberalization is good for growth because even the slightest effect will eventually "trickle down" through an aggregate increase in export and employment (Figini and Santarelli 2006, 131; Sachs et al. 1995).

In agreement with the assumptions of Heckscher–Ohlin and Stolper–Samuelson (HOSS) theorems, NTT also sustained that since labour benefits from trade liberalization, countries with abundant labour (i.e., less-developed countries) will be the winners and pro-trade (Helpman et al. 2004; Rudra and Tobin 2017, 288-290). The chain of causation unfolded like this: more liberalization leads to more demand, ex-

port revenue, and employment and wages for low-skilled labour. These challenges have steered the trajectory of trade theory towards its second shift.

Towards firm-level analysis

With the growing complexity and globalization of production and investment, the macro and industry-level view of NTT was not precise enough to explicate "a number of stylized facts, observed in firm micro-data, around the 1990s" (Ranjan and Raychaudhuri 2016, 4); neither it was equipped to answer what drives national competition and success in similar-similar trade, or why some firms engage in export while others do not. Moreover, why are exporting firms so heterogeneous in productivity, size, and other characteristics? Furthermore, while product differentiation and trade in intermediate were important in the NTT framework, intra-industry trade in differentiated products was nonetheless modelled as final export, which posed a challenge given that intermediate products could cross several borders.

By the beginning of the 2000s, these general and other context-specific factors have directed the trajectory of trade theory towards the second shift: the NNTT. Marc Melitz's model (2003) revolutionized trade theory by bringing firms and their decisions into the analysis and explaining why and under what conditions certain firms produce and export after liberalization while many others do not. In explaining the micro-foundation of the effect of liberalization on the economy, his model has become the hallmark of a collection of works on firm-level analysis (Bernard et al. 2003; Eaton and Kortum 2002), known today as the NNTT.

In general terms, NNTT holds that because firms differ in their productivity and performance, trade liberalization has a variable effect on their capacity and decision to engage in international trade, mainly through export (Antràs 2015, 28). In the framework of NNTT, the aggregate welfare effect of trade liberalization materializes

through the microeconomic mechanisms that travel from firms to the national level. The effect of liberalization stems from the reallocation of economic resources towards more productive firms (given that market conditions are not distorted to prevent reallocation), enabling these firms to expand and export while forcing less productive firms to exit. Additionally, an increase in market competition caused by trade liberalization reduces markups and provides an additional mechanism of gain from trade (Bernard et al. 2003).

Towards GVC analysis

Subsequent empirical works applying Melitz's model to international trade and liberalization analysis are extensive. In general, they can be divided into two streams. The first stream includes studies that take firms and their characteristics seriously in analyzing trade liberalization and economic development. They usually test (and refine) the assumptions of NTT, using firm-level data and integrating Melitz's model in a different setting. They explain different modes of internationalization, the choice between FDI and export (Helpman et al. 2004), the elasticity of trade flows to trade barriers and their variation by firms' productivity and elasticity of substitution (Chaney 2008), and the effect of heterogeneity of firms' productivity and export on bilateral trade flows (Helpman et al. 2008).

The second stream includes emerging works that use the NNTT's assumptions to analyze trade in intermediates (instead of just final trade) and firms as both exporters and importers. These works directly address the link between firms' heterogeneity and intermediate trade and show that under GVCs, firms' trade decisions are interdependent. One firm's export is another firm's import within GVCs because firms "not only export but also make global sourcing decisions related to the location and quantity of inputs to buy from different countries" (Antràs 2015, 40-41). Although these works are still evolving, they provide more systematized insights into the het-

erogeneity of firms in performance, GVC linkages, and trade and production decisions with significant implications for understanding the micro-foundation of countries' positions in GVCs and their options to upgrade.

There are two key arguments arising from post-Melitz's contributions to NNTT. First, Melitz's export-only model does not account for intermediate trade crossing multiple borders (often multiple times) and usually in an ordered pattern. While firms are heterogeneous in productivity, their export decisions are not independent of one another. Instead, in a value chain, exporters are both buyers and suppliers. Their decisions depend on the decision and success of other firms located elsewhere in the supply chain (see Figure 1.2). Second, trade in intermediates and value chains is highly differentiated, wherein the output is customized to the need of importers in the supply chain (Antràs and Rossi-Hansberg 2009). Differentiated demand for highly customized intermediate parts produced in the same sector (e.g., Apple versus Android demand for processors) requires more specialized (but with smaller tasks) suppliers.

These limitations, along with the poverty of micro-level data, have hindered the insights of empirical works examining firm-level factors in trade politics and especially under the globalization of production and GVCs. Additionally, as will be shown further in Chapters 3 and 5, NNTT's main models do not engage with the question of trade institutions and their relation to firms' performance. In the main model of NNTT, firm productivity and characteristics are treated as the most important factor in the expansion of the export base of an economy, which is limiting given that those institutions too can distribute growth and opportunities for local firms (producers). These ideas will predominantly inform the analysis in Chapters 3 and 4.

Institutions and GVCs

The quality of domestic institutions has long been recognized as a central driver of economic development and the comparative advantage of nations in trade. As new institutionalism argues, nations' comparative advantage and economic development are the direct consequences of the quality of their institutions. Countries with low-quality institutions, i.e., the weak rule of law and regulations, political instability, high corruption, and low contract enforcement, show much less economic progress and experience more underdevelopment than countries that have high-quality institutions (Acemoglu et al. 2001; Hall and Jones 1999; Coase 1992).

In international trade, in particular, the differences in the export pattern across countries have empirically been linked to the differences in the overall quality of domestic institutions (Chor 2010). High quality of various dimensions of domestic institutions, e.g., financial regulations, labour regulations, regulatory and judicial institutions, intellectual property rights institutions, and contract enforcement institutions, have consistently shown a strong and positive effect on the gain from trade (Beck et al. 2003; Costinot 2009; Long 2010; Ang et al. 2014; Ottaviano 2008).

However, from a macro perspective, theoretical (Gereffi et al. 2005) and empirical (Taglioni and Winkler 2016; Laget et al. 2020) research on GVCs have been institutional-free for most of their parts. As research indicates (Eckhardt and Poletti 2018), the effect of various configurations of domestic institutions found little attention in the analysis of GVC integration of countries (and their firms). In the context of GVCs, the role of domestic institutions and local government is important because GVCs involve not only cross-border trade (i.e., export and import) but also production and supply chains. A more constructive institutional environment can help local firms to specialize in producing high VA inputs and products and establish more production linkages with foreign suppliers and buyers.

In the context of GVCs, the same mediating effect of the domestic institution is expected. With the globalization of production and the rise of GVCs, the role of local institutions supporting domestic production and trade has not become obsolete. In contrast, domestic institutions are more important for GVC integration because they can be relied on to improve production quality and determine the intensity and size of firms' participation in export and GVCs. The effect of good institutions, for example, regulatory institutions, which backs up the stability of supply chain relations, is important for firms to participate more in GVCs. Because trade in GVCs can be characterized as more customized, relationship-specific (i.e., dependent on the durability of supplier-buyer relations), and contract-intensive, firms' success depends on the certainty and clarity of rules and regulations. More certainty can guarantee the stability of supplier-buyer relations and eliminate the costs (and risks) associated with frequently switching to new suppliers of inputs without prolonged interruption in their supply chains. As trade integration becomes deep, firms in countries where the quality of contract enforcement and regulations is good can establish more production linkages with GVCs than firms with a similar level of productivity in other countries.

Therefore, institutions can redistribute the gain from trade integration towards countries with high-quality institutional infrastructure, facilitating GVC integration at the macro and micro levels. Bringing the question of domestic institutions into the discussion of GVCs (Eckhardt and Poletti 2018; Poletti et al. 2021; Gereffi 2018) and examining the distributional consequences of trade integration in this context is one area of this thesis' contribution to knowledge.

New regionalism: PTAs and development

States sign PTAs to promote trade and economic integration. Some of the first PTAs were formed as regional free trade areas (FTAs) and customs unions to reduce and unify cross-border tariffs and regulations among states from the same region (Hettne 2006). The older generation of PTAs, before the 1990s, were also intra-regional, signed among states sharing a border or region, and predominantly shallow in their coverage, hardly going beyond tariff cuts and trade liberalization. Therefore, the welfare effect of this early generation of PTAs was defined in terms of their trade creation and diversion qualities (Krueger 1998; Viner 1950). PTAs were considered welfare-enhancing if they could create more trade by increasing the intensive margin of final export among members after trade liberalization instead of diverting trade away from more effective trade partners by raising discriminatory trade barriers against them.

The new generation of PTA, which evolved in the 1990s and onward, is less protectionist, non-hegemonic (Söderbaum 2016, 16-37), and more heterogeneous in design in several ways (Baccini et al., 2015). First, more fine-grained datasets on the design of PTAs show that the new generation of PTAs is deeper and more comprehensive than the previous generation. Many new PTAs include provisions that move beyond tariff liberalization and regulate other non-tariff areas such as investment, intellectual property rights (IPRs), government procurement policy, standards, services, investment, and competition policy (Dür et al. 2014; Hofmann et al. 2017). Second, the new generation of PTAs is also more flexible because they may include transitional and escape clauses, which give members more time to implement the necessary reforms and longer phase-in periods for implementing regulations and standards.[6] Third, because the PTAs are now more cross-regional, they also include many devel-

6. Transitional clauses determine the maximum (number of years across all tariff categories) during which member countries are expected to complete the liberalization reforms. Escape clauses allow the suspension of tariff cuts in case of balance of payments problems, general safeguards, and the imposition of countervailing and antidumping duties.

oping countries. In addition, most of these PTAs are between the South and North and are "substantially deeper than both North–North and South-South agreements" (Baccini et al. 2015, 769).

Because of their more-than-tariff features, the welfare effect of the new generation of PTAs is defined in terms of their impact on beyond-tariff areas and regulatory convergence among members, making them more conducive to economic integration and development. Comprehensive trade agreements that regulate more than tariff cuts among their members create the condition for developing long-term trade, investment, and production relations among members. Research shows that PTA that cover more provisions have indeed a positive effect on final export (Baier and Bergstrand 2007; Dür et al. 2014; Egger and Nigai 2015), FDI (Büthe and Milner 2014), and trade intermediates (Johnson and Noguera 2012; Orefice and Rocha 2014) than PTAs that are shallow and cover only one or two provisions. More flexibility associated with deep PTAs is essential to create an enabling policy environment for developing members and adjust to the new rules and standards before aiming for more developed markets.

Without deep PTAs, developing countries may find it more challenging to integrate into global production and GVCs. These challenges may include limited access to technology, capital, markets, and production know-how, which affect the country's overall productivity, the quality of its output, and, subsequently, its competitiveness (UNCTAD 2013b). More specific factors preventing countries from connecting to GVCs include IPRs and investment protection, trade regulations, access to local markets, various standards, licensing, taxes and credit, and human capital and skills (Berger et al. 2016).

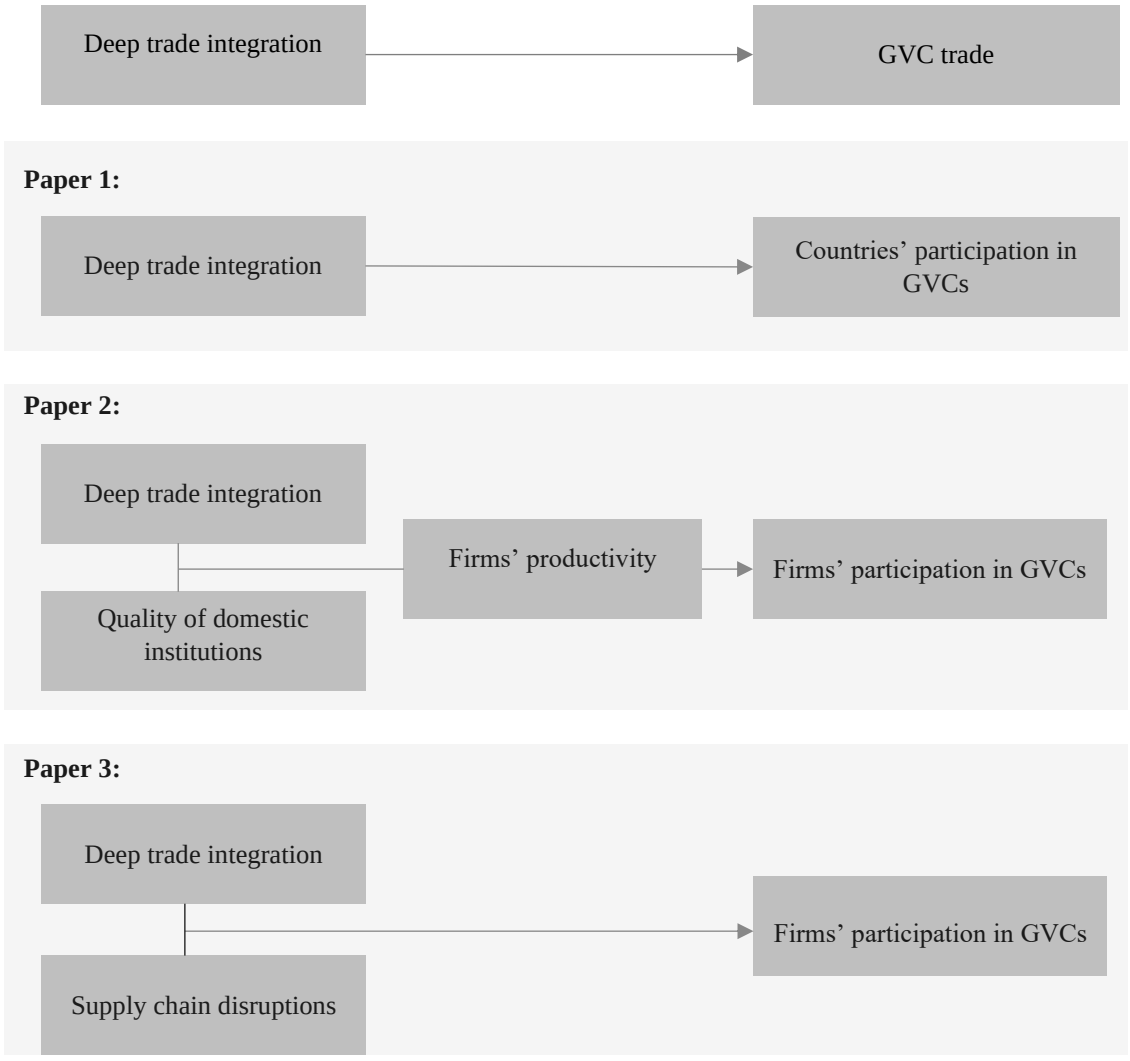
Therefore, compared to multilateral agreements, PTAs, in general, provide states with a "more individualized" institutional arrangements that "can better reflect member-specific idiosyncratic needs" (Antràs et al. 2012, 3144). Moreover, compared to shal-

low agreements, deep PTAs, in particular, allow members to tailor the agreements to their industrialization and development priorities and target those issue areas that specifically prevent them from trading more VA content with their partners. Deep PTAs are, for these reasons, more effective in upgrading the VA capacity of countries and firms because, with a more comprehensive approach towards trade integration, they can create an enabling environment not only for trade but also for production and GVC participation.

1.3 Organization

The rest of this thesis is organized as follows. Chapters 2-4 present the three papers on the PTAs-GVCs nexus and examine the effect of deep PTAs on GVCs. While the first paper focuses on the macro level of analysis, the two other papers take the analysis to the firm level. Figure 1.3 gives an overview of the causal linkages empirically examined in this thesis. It also highlights the synergy and the connection between the three stand-alone papers. Finally, Chapter 5 summarizes the overarching findings and shows how they relate to the broader literature in the international political economy of trade and development.

Figure 1.3: An overview of causal claims



1.4 Bibliography

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91, (5): 1369–1401.

Ang, James S., Yingmei Cheng, and Chaopeng Wu. 2014. "Does Enforcement of Intellectual Property Rights Matter in China? Evidence from Financing and Investment Choices in the High-Tech Industry." *Review of Economics and Statistics* 96, (2): 332–348.

Antràs, Pol. 2015. *Global Production: Firms, Contracts, and Trade Structure.* Princeton University Press.

———. 2020. "Conceptual Aspects of Global Value Chains." *The World Bank Economic Review* 34, (3): 551–574.

Antras, Pol, and Davin Chor. 2021. "Global Value Chains." In *National Bureau of Economic Research.* Working Paper. National Bureau of Economic Research.

Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry. 2012. "Measuring the Upstreamness of Production and Trade Flows." *American Economic Review* 102, (3): 412–416.

Antràs, Pol, and Esteban Rossi-Hansberg. 2009. "Organizations and Trade." *Annual Review of Economics* 1, (1): 43–64.

Autor, David, David Dorn, and Gordon Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *American Economic Review* 103, (6): 2121–68.

Baccini, Leonardo. 2019. "The Economics and Politics of Preferential Trade Agreements." *Annual Review of Political Science* 22, (1): 1–18.

Baccini, Leonardo, Andreas Dür, and Manfred Elsig. 2015. "The Politics of Trade Agreement Design: Revisiting the Depth-Flexibility Nexus." *International Studies Quarterly* 59, (4): 765–775.

Baccini, Leonardo, Mattia Guidi, Arlo Poletti, and Aydin B. Yildirim. 2022. "Trade Liberalization and Labor Market Institutions." *International Organization* 76, (1): 70–104.

Baier, Scott, and Jeffrey Bergstrand. 2007. "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of international Economics* 71, (1): 72–95.

Bair, Jennifer, and Gary Gereffi. 2001. "Local Clusters in Global Chains: The Causes and Consequences of Export Dynamism in Torreon's Blue Jeans Industry." *World Development* 29, (11): 1885–1903.

Baldwin, Richard. 2012. "Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going." CEPR Discussion Paper No. DP9103.

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 2003. "Law and Finance: Why Does Legal Origin Matter?" *Journal of Comparative Economics* 31, (4): 653–675.

Berger, Axel, Dominique Bruhn, Andrea Bender, Julia Friesen, Katharina Kick, Felix Kullmann, Robert Roßner, and Svenja Weyrauch. 2016. *Deep Preferential Trade Agreements and Upgrading in Global Value Chains: The Case of Vietnam*. 92. Bonn: Deutsches Institut für Entwicklungspolitik (DIE).

Bernard, Andrew, Jonathan Eaton, Bradford Jensen, and Samuel Kortum. 2003. "Plants and Productivity in International Trade." *American Economic Review* 93, (4): 1268–1290.

Boffa, Mauro, Marion Jansen, and Olga Solleder. 2019. "Do We Need Deeper Trade Agreements for GVCs or Just a BIT?" *The World Economy* 42, (6): 1713–1739.

Büthe, Tim, and Helen V. Milner. 2014. "Foreign Direct Investment and Institutional Diversity in Trade Agreements: Credibility, Commitment, and Economic Flows in the Developing World, 1971-2007." *World Politics* 66, (1): 88–122.

Chaney, Thomas. 2008. "Distorted Gravity: The Intensive and Extensive Margins of International Trade." *American Economic Review* 98, (4): 1707–21.

Chor, Davin. 2010. "Unpacking Sources of Comparative Advantage: A Quantitative Approach." *Journal of International Economics* 82, (2): 152–167.

Coase, Ronald H. 1992. "The Institutional Structure of Production." In *Handbook of New Institutional Economics,* 31–39. Springer.

Costinot, Arnaud. 2009. "On the Origins of Comparative Advantage." *Journal of International Economics* 77, (2): 255–264.

Dallas, Mark P. 2015. "'Governed' Trade: Global Value Chains, Firms, and the Heterogeneity of Trade in an Era of Fragmented Production." *Review of International Political Economy* 22, (5): 875–909.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig. 2014. "The Design of International Trade Agreements: Introducing a New Dataset." *The Review of International Organizations* 9, (3): 353–375.

Eaton, Jonathan, and Samuel Kortum. 2002. "Technology, Geography, and Trade." *Econometrica* 70, (5): 1741–1779.

Eckhardt, Jappe, and Arlo Poletti. 2018. "Introduction: Bringing Institutions Back in the Study of Global Value Chains." *Global Policy* 9,5–11.

Egger, Peter, and Sergey Nigai. 2015. "Effects of Deep versus Shallow Trade Agreements in General Equilibrium." In *Trade Cooperation: The Purpose, Design and Effects of Preferential Trade Agreements,* edited by Andreas Dür and Manfred Elsig. Cambridge University Press.

Figini, Paolo, and Enrico Santarelli. 2006. "Openness, Economic Reforms, and Poverty: Globalization in Developing Countries." *The Journal of Developing Areas:* 129–151. JSTOR: 4193008.

Gereffi, Gary. 2018. *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism.* Cambridge University Press.

Gereffi, Gary, John Humphrey, Raphael Kaplinsky, and Timothy J. Sturgeon. 2001. "Introduction: Globalisation, Value Chains and Development." *IDS Bulletin* 32, (3): 1–8.

Gereffi, Gereffi, John Humphrey, and Timothy Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy* 12, (1): 78–104.

Gilpin, Robert. 2000. *The Challenge of Global Capitalism: The World Economy in the 21st Century.* Princeton University Press.

Giuliani, Elisa, Carlo Pietrobelli, and Roberta Rabellotti. 2005. "Upgrading in Global Value Chains: Lessons from Latin American Clusters." *World development* 33, (4): 549–573.

Grubel, Herbert G, and Peter John Lloyd. 1975. *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products.* Vol. 12. Macmillan London.

Hall, Robert E., and Charles I. Jones. 1999. "Why Do Some Countries Produce so Much More Output per Worker than Others?" *The Quarterly Journal of Economics* 114, (1): 83–116.

Helpman, Elhanan, and Paul R Krugman. 1985. *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy.* MIT Press.

Helpman, Elhanan, Marc Melitz, and Yona Rubinstein. 2008. "Estimating Trade Flows: Trading Partners and Trading Volumes." *The Quarterly Journal of Economics* 123, (2): 441–487.

Helpman, Elhanan, Marc Melitz, and Stephen Yeaple. 2004. "Export versus FDI with Heterogeneous Firms." *American Economic Review* 94, (1): 300–316.

Hettne, Björn. 2006. "Beyond the 'New' Regionalism." In *Key Debates in New Political Economy,* edited by Anthony Payne, 128–160. Routledge.

Hofmann, Claudia, Alberto Osnago, and Michele Ruta. 2017. *Horizontal Depth: A New Database on the Content of Preferential Trade Agreements. Policy Research Working.* World Bank Policy Research Working Paper No. 7981.

Hopkins, Terence, and Immanuel Wallerstein. 1986. "Commodity Chains: Construct and Research," edited by Gary Gereffi and Miguel Korzeniewicz. Westport, CT: Praeger.

Jakubik, Adam, and Victor Stolzenburg. 2021. "The 'China Shock' Revisited: Insights from Value Added Trade Flows." *Journal of Economic Geography* 21, (1): 67–95.

Johnson, Robert, and Guillermo Noguera. 2012. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of International Economics* 86, (2): 224–236.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104, (2): 459–494.

Krueger, Anne. 1998. *The WTO as an International Organization.* University of Chicago Press.

Krugman, Paul. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade." *The American Economic Review* 70, (5): 950–959.

Laget, Edith, Alberto Osnago, Nadia Rocha, and Michele Ruta. 2020. "Deep Trade Agreements and Global Value Chains." *Review of Industrial Organization* 57, (2): 379–410.

Long, Cheryl Xiaoning. 2010. "Does the Rights Hypothesis Apply to China?" *The Journal of Law and Economics* 53, (4): 629–650.

Melitz, Marc. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71, (6): 1695–1725.

Nunn, Nathan. 2007. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *The Quarterly Journal of Economics* 122, (2): 569–600.

OECD. 2019. *Guide to OECD's Trade in Value Added (TiVA) Indicators, 2018 Edition*. OECD, Directorate for Science, Technology and Innovation.

———. 2021. *Global Value Chains: Efficiency and Risks in the Context of COVID-19*. OECD Policy Responses to Coronavirus (COVID-19), OECD Policy Responses to Coronavirus (COVID-19).

Orefice, Gianluca, and Nadia Rocha. 2014. "Deep Integration and Production Networks: An Empirical Analysis." *The World Economy* 37, (1): 106–136.

Ottaviano, Gianmarco IP. 2008. "Contract Enforcement, Comparative Advantage and Long-Run Growth." In *In Elhanan Helpman, Dalia Marin, and Thierry Verdier, Eds. "The Organization of Firms in a Global Economy"*. Harvard University Press.

Pahl, Stefan, and Marcel P. Timmer. 2020. "Do Global Value Chains Enhance Economic Upgrading? A Long View." *The Journal of Development Studies* 56, (9): 1683–1705.

Poletti, Arlo, Daniela Sicurelli, and Aydin B. Yildirim. 2021. "Promoting Sustainable Development through Trade? EU Trade Agreements and Global Value Chains." *Italian Political Science Review / Rivista Italiana di Scienza Politica* 51, (3): 339–354.

Ranjan, Priya, and Jibonayan Raychaudhuri. 2016. "The "New-New" Trade Theory: A Review of the Literature." In *International Trade and International Finance,* 3–21.

Rudra, Nita, and Jennifer Tobin. 2017. "When Does Globalization Help the Poor?" *Annual Review of Political Science* 20,287–307.

Sachs, Jeffrey D., Andrew Warner, Anders Åslund, and Stanley Fischer. 1995. "Economic Reform and the Process of Global Integration." *Brookings papers on economic activity* 1995, (1): 1–118. JSTOR: 2534573.

Samuelson, Paul A., and William D. Nordhaus. 2010. *Economics.* 19th ed. Boston: McGraw-Hill Irwin.

Söderbaum, Fredrik. 2016. "Old, New, and Comparative Regionalism." *The Oxford handbook of comparative regionalism:* 16–37.

Taglioni, Daria, and Deborah Winkler. 2016. *Making Global Value Chains Work for Development.* World Bank Publications.

UNCTAD. 2013a. *Global Value Chains and Development: Investment and Value Added Trade in the Global Economy.* United Nations New York.

———. 2013b. *Global Value Chains: Investment and Trade for Development. World Investment Report.* New York: United Nations Press.

Viner, Jacob. 1950. *The Customs Union Issue.* Carnegie Endowment for International Peace.

WB. 2020a. *Handbook of Deep Trade Agreements.* Washington, DC: World Bank.

———. 2020b. *World Development Report 2020: Trading for Development in the Age of Global Value Chains.* Washington, DC: World Bank.

WB and WTO. 2017. *Measuring and Analyzing the Impact of GVCs on Economic Development: Global Value Chains Development Report 2017*. Washington, DC: World Bank Group.

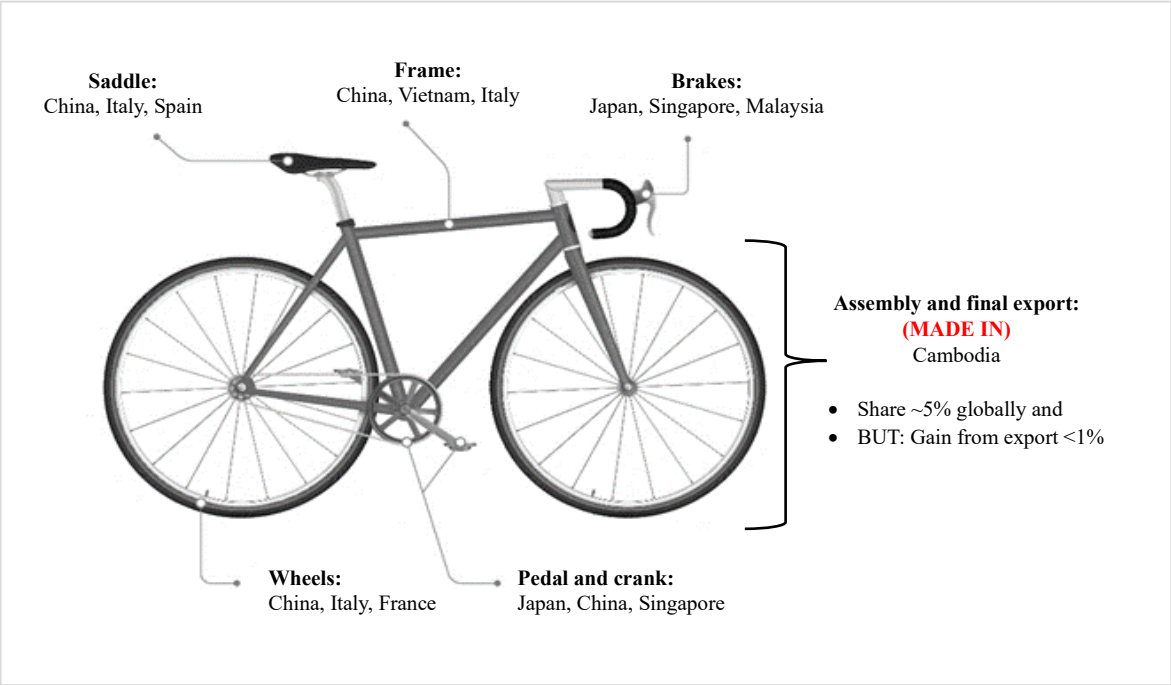
WTO. 2011. *The WTO and Preferential Trade Agreements: From Co-Existence to Coherence WTO*. World Trade Organization.

———. 2021. *Global Value Chain Development Report 2021: Beyond Production*. Manila, Philippines: Asian Development Bank.

1.5 Appendix to Chapter 1

Appendix A

Figure 1.4: Cambodia in the EU's bicycle market

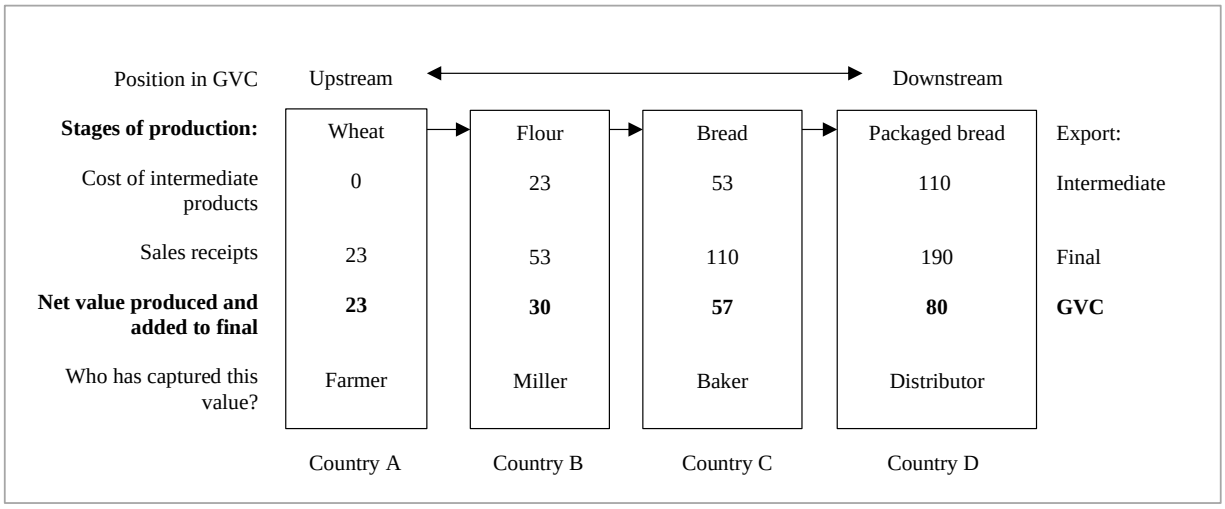


Source: adapted from World Development Report, 2020.

Source: adopted from World Development Report, 2020.

Export of intermediate products and finals tend to mask the net value of trade captured by each country. For example, while the value of Country C's export equals $110, Country C's gain from participation in the cross-border trade of bread is only $57. The rest ($53) is foreign-added and imported from Country B. The same logic is followed when we compare trade in intermediates and trade in GVCs: the net development impact of trade is not reflected in the final export.

Figure 1.5: A hypothetical example of value-added production



Source: by author, based on the example from Samuelson and Nordhaus (2010, 390).

Chapter 2

Deep trade integration and North-South participation in global value chains

Abstract

Do comprehensive trade agreements increase states' participation in global value chains (GVCs) and contribute to their development? While there is extensive evidence that deep preferential trade agreements (PTAs) increase states' bilateral export of final goods and, by implication, contribute to local development, there is much less known about the characteristics of this effect on GVC relations. This paper answers the question in the gravity model framework. It uses a comprehensive dyadic dataset on trade in GVCs, PTAs, export, and other characteristics for 188 countries and economies between 1990 and 2018. Results provide robust evidence that deep PTAs increase members' bilateral trade in GVCs over the long term, especially when these agreements involve at least one developing country and include provisions that support investment. These results underscore that GVC-facilitating deep PTAs are a powerful policy tool that can mobilize the potential of production and trade in GVCs for development.

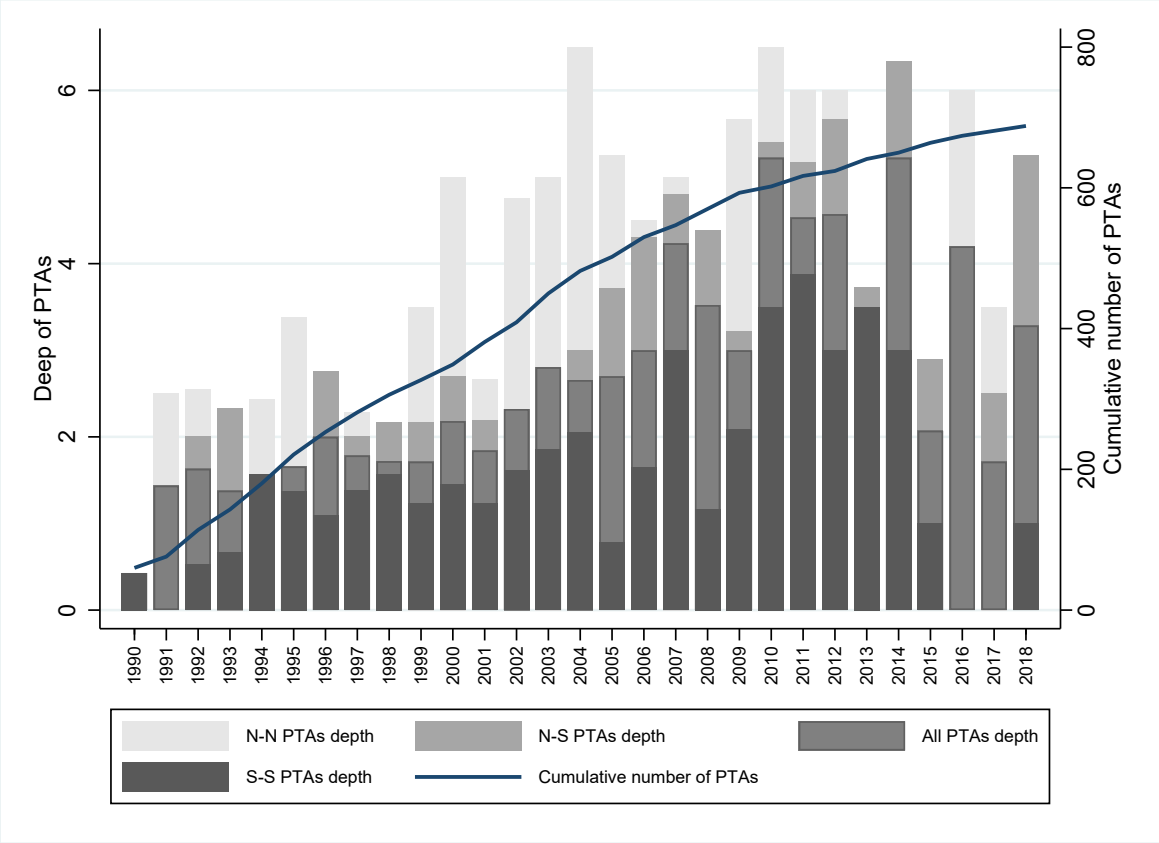
Keywords: global value chains, trade agreements, investment, integration, development
JEL codes: F14, F15, F55, F63

2.1 Introduction

Over the past three decades, there have been two important changes in the organization and institutions of international trade and production: the proliferation and deepening of preferential trade agreements (PTAs) and the globalization of production and the rise of global value chains (GVCs). In terms of PTAs, the gridlock in progress towards multilateral trade liberalization after the Doha Round has made preferential trade liberalization a de facto (and often more preferable) instrument for states to organize their bilateral trade relations (Hartman 2013). Between the end of the 1990s and 2018, the cumulative number of PTAs signed globally, especially with and among developing countries, tripled, reaching over 600 PTAs (Dür et al. 2014). Over the same period, the share of more comprehensive (deep) PTAs, which cover tariff but also beyond-tariff areas such as investment, market access, services, competition, procurement policies, and others, also increased (see Figure 2.1).

In terms of production, globalization has made the fragmentation and outsourcing of production less costly, giving rise to GVCs, which are product-specific sets of interconnected production stages, "with each stage adding value, and with at least two stages being produced in different countries" (Antràs 2020, 553). In the first decade of the 2000s alone, nearly half of the global trade was already in inputs exported for further processing or assembly (WB and WTO 2017; WB 2020b); and between 1990 and 2019, the value-added (VA) production of foreign affiliates of large firms increased five folds (UNCTAD 2020, 22). An increase in participation by developing and emerging economies is notable if we compare states' participation in GVC trade across the globe between 1990 and 2018, using the dataset built for this paper (Figure 2.2).

Figure 2.1: Cumulative number and average annual depth of PTAs, 1985-2018

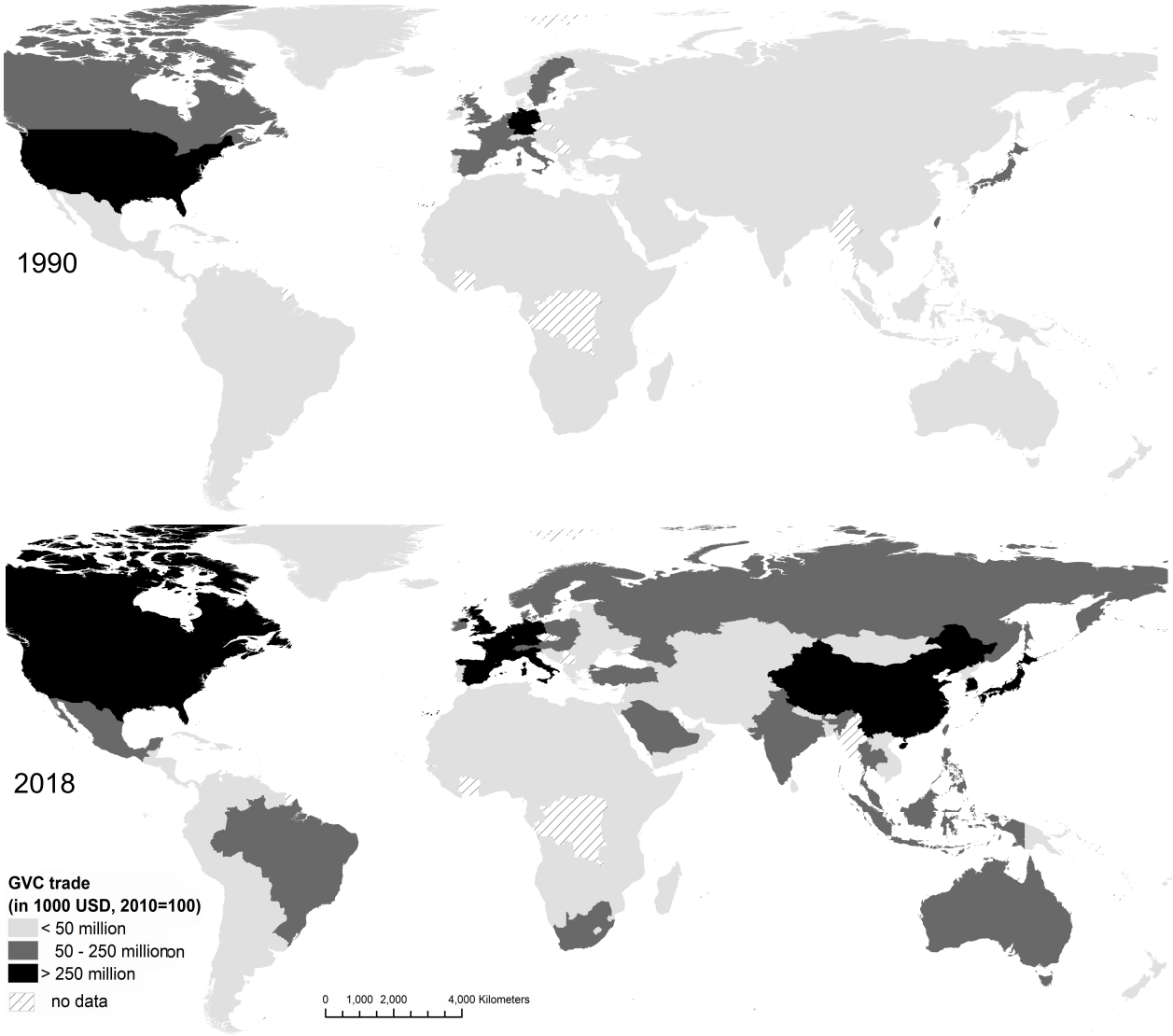


Source: Author's calculation, based on the Design of Trade Agreements (DESTA).

Note: N-N=North-North dyads, N-S=North-South dyads, S-S=South-South dyads.

The interplay of these two changes has already been subject to extensive discussions and reassessments of trade and development strategies, especially for the developing world (UNCTAD 2013a; WB and WTO 2017; WB 2020a). Despite the surge in policy interest, a systematic analysis of the causal relation of these global dynamics has been limited in the literature, and while there is extensive evidence that deeper PTAs increase trade in final goods (Baccini et al. 2015; Baier and Bergstrand 2007; Rose 2004; Spilker et al. 2018) there is still much less known about whether PTAs that are designed primarily to address trade in final goods (Antràs et al. 2012) have

Figure 2.2: GVC trade in 1990 and 2018



Source: Author's calculation, based on Eora-UNCTAD dataset.
Note: GVC trade is the sum of foreign VA (FVA) and indirect VA (DVX) to export.

a similar policy and theoretical implications for the growing trade in GVCs.

One reason for this gap has been the limitation of statistics for rigorous cross-country analysis, which has emerged from both empirical and conceptual complexities associated with GVC relations. The organization of production and trade is "structurally different from its predecessors" wherein "trade was largely in finished goods" (Gereffi 2018, 431). Within GVC, the value of items that move from a source to a destination country for further processing or assembly increases only by the value of the modification and changes that the destination country can add domestically to the imported items.

The gain from bilateral trade in GVCs is not simply the total value of export but the value of domestic VA (DVA), which is the difference between the total value of export and foreign VA (FVA) to export (UNCTAD 2013a, 4; Table 2.4, Appendix A). In other words, the amount of VA exported by each country depends directly on the quality and capacity of local production. Countries involved in simple and low value-added stages, such as the assembly of ready-to-use parts, contribute little domestically towards their exported items. In contrast, those involved in more complex stages of production, such as the design of prototypes, produce most of the value of their exported items (Gereffi 2018). In this context, the pattern and size of conventional export trade between two countries can differ significantly from their trade in GVCs, measured in terms of VA to export.

From the perspective of trade in GVCs, deeper integration and more participation in global trade may not always equate to more gain from bilateral trade if countries cannot generate and add more value to their exported items. Electronics are an oft-

given example: Although iPhone X's label shows *Made in China*, only 10% of its pre-sale commercial value is produced and added by firms in China. The rest is added by ten different upstream and downstream countries involved in various bilateral agreements (see Table 2.5 in Appendix A for a tear-down of iPhone X major parts, firms, countries, and PTAs involved). Therefore, in bilateral terms, countries that trade more in final goods with one another, e.g., China and the US or Japan and Taiwan, may not be those that trade more in GVCs with one another.

For these reasons, GVC trade and conventional trade qualitatively and quantitively draw different pictures of bilateral trade (Johnson and Noguera 2012; Koopman et al. 2014; Casella et al. 2019; UN 2009, 2013); hence, analyzing trade in terms of GVCs holds more direct implications for development. In this context, conducting a detailed cross-country analysis of the effect of trade integration on GVCs will improve our understanding of whether and how deep integration can help countries upgrade and increase their production capacity and, by implication, contribute to their development.

The goal and empirical contribution of this paper are in this area. By speaking to the literature on bilateral trade integration (Dür et al. 2014; Baccini et al. 2015) and GVCs (Antràs et al. 2012; Koopman et al. 2008; Lenzen et al. 2013), and by building a comprehensive dyadic dataset with data on PTAs (from WTI-DESTA), trade in GVCs (from Eora and the UNCTAD), and other country-level dyadic variables, the paper empirically examines the effect of deep integration on bilateral trade in GVCs. The variations across time, PTAs' features, and countries' income levels are of particular interest. To further qualify that trade in GVCs and conventional trade are qualitatively and quantitively different, I also estimate the effect of deep PTAs on bilateral

export flows. Methodologically, the paper follows best practices in the gravity model of trade analysis and applies panel-data techniques with a full set of fixed effects (FE), accounting for the endogeneity of trade policy to the extent possible (Yotov et al. 2016).

In doing so, it improves upon and adds to the coverage and mechanisms of a scant and recent number of empirical works on the subject (Laget et al. 2020; Boffa et al. 2019). Using both Eora and DESTA allows for covering the entire universe of PTAs and bilateral GVC relations from 1990 to 2018 for 188 countries, including many developing countries. Laget et al. (2020), in contrast, uses a selected sample of 260 PTAs compiled by the World Bank and Wang et al.'s (2013) estimations of GVC trade for 40 major economies, which covers the period 1995-2011, leaving the 2010s trade recovery post-2008 and a number of PTAs and developing countries out of the analysis. Boffa et al. (2019) uses Eora-UNCTAD but the same data for PTAs and compares their effect on GVC trade with the effect of bilateral investment treaties (BITs).

The measure of GVC trade is the estimation of bilateral VA trade flows from Eora-UNCTAD. The measure of the deepness of trade agreements is also different from the mentioned studies on the subject and is an absolute index of PTAs' depth from DESTA. Depth index is based on direct coding and aggregation of over one hundred issue areas mentioned directly in the texts of PTAs into seven major provisions: scope of coverage, investment, services, procurement, intellectual property, competition, and standards. It ranges between zero (when a PTA is shallow and does not include any issue area) and seven (when a PTA is deep and includes all seven issue areas). The World Bank measure of PTA depth is relative and defined in relation to the World Trade Organization's (WTO's) legal texts: A PTA is deep if it includes provisions that

complement or go beyond the WTO mandate, i.e., provisions that are WTO-plus or WTO-extra. Preference in this paper is given to the absolute measure of deep to avoid any misspecification of deep-ness that may arise from reference to external (other than PTA) texts.

Key findings in this paper show that deep trade integration increases states' participation in GVCs. Furthermore, the size of this effect varies significantly across time, the content of PTAs, and states' level of development. More specifically, the study shows that deep PTAs on bilateral trade in GVCs are more pronounced over the long term, showing that deep PTAs are conducive to an effective institutional framework needed for bilateral trade in GVCs to develop. In addition, GVC-facilitating deep PTAs also support investment-related activities, especially when they include developing countries. Finally, the reformative long-term effect of deep PTAs on GVC relations persists when we compare it to bilateral investment treaties (BITs) and the World Trade Organization (WTO). These results emphasize that deep trade integration is a powerful and long-lasting policy tool that can facilitate trade in GVCs and contribute to development.

The rest of the paper is organized as follows. In the next section, I derive from the literature several hypotheses related to the expected effect of PTAs on trade in GVCs. The following three sections will explain the dataset, the empirical strategy, and the results. Finally, the concluding remarks will highlight the policy implications of this paper.

2.2 Literature and hypotheses

The expected effect of deep trade integration on GVCs

What is the expected effect of PTAs on trade in VA? As argued by others, trade in GVCs is more responsive to preferential than multilateral trade agreements. This is because PTAs are "more individualized" by design and, therefore, "can better reflect member-specific idiosyncratic needs" (Antràs and Staiger 2012, 3144). Furthermore, compared to shallow PTAs, i.e., PTAs with few provisions, deep PTAs are more effective in facilitating GVC trade because they go beyond "broadly applied" tariff cuts and foster deeper market integration (3144).

Stylized facts arising from the empirical assessments of the effect of deep PTAs on final export suggest that the effect of deep PTAs is stronger than the effect of shallow PTAs for several reasons. First, deep PTAs help to reduce the uncertainty associated not only with tariffs but also non-tariff barriers (NTBs) (Antràs and Staiger 2012; Limao 2016). This encourages buyers and suppliers to source or sell their products in those markets where the risk is predicted to be low because of lower costs of information and higher commitments of local governments bound by a comprehensive PTA (Kim 2021). In addition, because entering deeper agreements goes beyond tariffs, their ratification and implementation by members entail extensive reforms and harmonization in all member countries. For example, if under a deep PTA, the tax or customs codes have to be revised, or new national agencies need to be created, it will take more time for these changes to be implemented and take effect.

In contrast to shallow PTAs, the effect of deep PTAs is expected to materialize

over the long rather than short term and lead to more here-to-stay institutional and structural changes in member states, propelling more certainty in bilateral relations. Second, because deep PTAs go beyond tariff and customs issues, they have a more extensive spillover effect on the economy, fostering stronger production linkages among firms in member countries. When compared to shallow agreements, for example, deep PTAs have been more effective in increasing the flows of foreign direct investment (FDI) as well as stimulating firms' specialization upstream or downstream along the GVC, especially over the long run (WB and WTO 2017; Büthe and Milner 2014; Johnson and Noguera 2012; Orefice and Rocha 2014; Hofmann et al. 2017).

Finally, previous research comparing the effects of deep and shallow PTAs also shows that there are more variations in the effect of deep PTAs on trade across the design features of agreements, e.g. the number and the characteristics of provisions they cover, as well as countries' characteristics. When stratified by countries' income levels, for example, deep North-South (N-S) PTAs indicate a stronger effect on trade and investment flows between members than N-N and S-S PTAs (Baccini et al. 2015; Egger and Nigai 2015). Compared to other dyads, deep N-S PTAs exhibit a stronger effect because the N-S comparative advantages in terms of factors of production and resources are complementary rather than substituting for one another.

This complementarity encourages resource-seeking producers from developed countries to establish more backward linkages with suppliers from developing countries after deeper integration and buy more inputs from them (Harding and Javorcik 2011; Markusen and Maskus 2001). Suppliers in the South, similarly, are getting better access to producers from the North, and through customizing their production and improving their technology, increase their competitiveness against firms in other devel-

oping countries that are not in a deep PTA with the North (Amendolagine et al. 2013; Baldwin et al. 2014; Fernandez and Portes 1998). Therefore, deep PTAs are also expected to increase trade flow in GVCs, especially over the long term or when the trade is between a developed North and a developing South country. This discussion suggests that:

H1a: Deep PTAs increase bilateral VA trade more than shallow PTAs.
H1b: Deep PTAs increase bilateral VA trade over the long term more than shallow PTAs.
H1c: Deep PTAs increase bilateral VA trade more between N-S dyads than between other dyads.

The effect of deep PTAs may also depend on another design feature of PTAs: the number and characteristics of provisions that make the depth of an agreement. According to DESTA's classification, these provisions include standards and certification rules, government procurement rules, competition policies, intellectual property rights (IPRs), services (e.g. liberalization and national treatment) and investment (e.g. commitments to no restriction on transfers and payments, compensation in case of expropriation, investor-state dispute settlement mechanisms, and national treatment (Dür et al. 2014, 360).

While relying on the quantity (number) of these provisions included in a PTA is important to understanding and comparing the depth and coverage of agreements, not all seven provisions constituting the depth of PTAs may have an equal qualitative effect on production and the flow of bilateral VA trade. As stated by others, only "the role of specific provisions in shaping GVCs may be relevant" (WB and WTO 2017,

179). For example, while the flow of trade in final goods and services may be more directly influenced by the elimination of tariffs and market access rules, the flow of cross-border production may respond more directly to factors such as the promotion of investment, regulation and liberalization of services, and ease of technology transfers. In other words, production may respond more directly to those factors that directly impact domestic firms' productive capacities and their abilities to add more value to the national export.

Based on this characterization, I further identify and examine the effect of PTAs that contain specific provisions: PTAs containing investment-related (i.e. either investment, services or IPR) provisions, PTAs containing competition-related (i.e. either procurement or competition) provisions, and PTAs with other (i.e. either scope or standards) provisions. As previous research indicates, the primary mechanisms through which agreement may facilitate greater participation in GVCs are investment-related provisions because they directly affect domestic production capacity through FDI and production specialization. More specifically, including investment-related provisions in PTAs augments the effect of preferential liberalization on trade indirectly via multinationals' investment and resource-seeking strategies (Allee and Peinhardt 2014; Büthe and Milner 2014; Dixon and Haslam 2016; Boffa et al. 2019).

Likewise, service liberalization and service-related provisions have a greater impact on domestic production than liberalization of trade in goods because the service sector (e.g. finance or communications) is normally an upstream (closer to suppliers) sector that supports the development and operation of production relations. Service liberalization can further accelerate technological development and help upgrade the economy's overall productivity (Konan and Maskus 2006). IPR provisions also fa-

cilitate technology diffusion and knowledge transfer and support the efforts to increase production and development through FDI and licensing (Maskus and Fink 2005; Maskus and Penubarti 1995).

Competition-related provisions aim to liberalize national procurement markets and remove discrimination against foreign suppliers, changing how firms sell their products in the local markets. While including these provisions directly impacts the demand for more downstream imports into the country, their impact on the production linkages of local firms and their VA activities is effectuated indirectly over time and through FDI. This happens because preliminary reforms may be required in the first place to establish an open procurement market (Anderson et al. 2012; Anderson and Muller 2008). Similarly, while other provisions on standards and tariffs can potentially enable local suppliers to meet the regulatory requirements in foreign markets, their impact materializes only in the long run and after implementing extensive reforms (Piermartini and Budetta 2009; Vijil 2014; Brusick et al. 2005). Given this discussion, I test whether:

H2: Inclusion of investment-related provisions in PTAs increases trade in GVCs more than PTAs that do not include these provisions.

To further qualify deep PTAs as an effective institutional framework, I compare their effect with the effect of BITs and joint membership in the WTO for each dyad.[1] Standing alone, BITs improve the terms and environment of trade in goods between

1. While there has been little change in the WTO membership in the 2000s and afterward, there were still variations among developed and developing countries in the 1990s. The coefficient of WTO is not absorbed by FE, which means there are still variations in this variable that can be exploited.

two countries because they offer investment protection mechanisms, MFN, national treatment, and fair compensation mechanisms—among others (Bergstrand and Egger 2013). However, compared to deep PTAs, the effect of stand-alone BITs on bilateral export is often much smaller. Recent research shows that this is the case with trade in GVCs as well (Boffa et al. 2019).

There are several reasons for this difference. First, the mitigating effect of PTAs on the uncertainty associated with trade relations is higher than that of BITs. While BITs are always bilateral and time-limited, PTAs can be multilateral, and once in force, they will remain in force until members (new and old) decide to ratify and revise them. Second, the effect of PTAs is much greater than that of BITs. While BITs focus more on investment protection than investment liberalization, a feature already weakening in recent years (Kerner and Pelc 2022), PTAs with investment provisions focus on both. For example, PTAs with investment provisions may also stipulate national treatment rules for pre-establishment or entry phases of investment, specify performance requirements (e.g., local content, export, technology transfer), touch upon the corporate governance rules (e.g., the nationality of senior management), or extend the MFN clause to investors outside the PTA area (WB 2020b). PTAs are considered more comprehensive in their effect on investment than stand-alone BITs.

Compared to PTAs and BITs, the WTO is viewed as a low-impact institution in the context of trade in GVCs for two reasons. First, with the growing fragmentation of production, states find it increasingly difficult "to utilize traditional GATT/WTO concepts and rules" to discipline their trade relations under GVCs. This is because tariff cuts and trade liberalization through the WTO are small in those sectors that use highly customized inputs, i.e., sectors that rely on few but highly specialized sup-

pliers worldwide (Antràs and Staiger 2012, 3144-3177). Therefore, rules negotiated through the WTO may not interest those countries that seek more specific and customized integration and liberalization. In contrast, under preferential agreements, tariff cuts and trade liberalization can be not only more customized but also implemented faster, especially "for intermediate goods than for finished products", as shown in recent studies on the effect of tariff cuts on intermediate trade (Baccini et al. 2018, 1).

Second, liberalization of policies that directly impact production at the plant and factory-level activities, i.e., investment, services, and technology transfer, are outside the WTO mandate. As the evidence indicates, the WTO has made little progress in areas other than trade liberalization in goods (Francois and Hoekman 2010). Therefore, the effect of PTAs on trade in VA may be more salient than the effect of WTO membership. In other words:

H3: The dynamic effect of deep PTAs is higher on VA trade than the effect of BITs or joint WTO membership.

2.3 Data and variables

This paper puts together and uses a dyadic dataset.[2] Each observation is a unique *ijt* country dyad, where *i* is a source country *i (country 1)* that produces and exports VA to a destination country *j (country 2)* at year *t*. The measure of GVC trade is the estimation of bilateral VA trade flows from Eora-UNCTAD. The measure of the deepness of trade agreements is also different from the mentioned studies on the subject

2. The dataset created and used in this paper is available from the author via Harvard Dataverse.

and is an absolute index of PTAs' depth from DESTA. Depth index is based on direct coding and aggregation of over one hundred issue areas mentioned directly in the texts of PTAs into seven major provisions: scope of coverage, investment, services, procurement, intellectual property, competition, and standards. It ranges between zero (when a PTA is shallow and does not include any issue area) and seven (when a PTA is deep and includes all seven issue areas). The World Bank's measure of PTA depth is relative and defined in relation to the World Trade Organization's (WTO's) legal texts: A PTA is deep if it includes provisions that complement or go beyond the WTO mandate, i.e., provisions that are WTO-plus or WTO-extra. Preference in this paper is given to the absolute measure of deep to avoid any misspecification of deepness that may arise from reference to external (other than PTA) texts.

Outcome and predictor variables: The key outcome variable is the log-transformed dyadic VA trade (in 1000 constant USD, 2010=100) from country *i* to country *j* at year *t* ($ln(VAtrade_{ijt})$) and is derived from the Eora-UNCTAD dataset (Casella et al. 2019; Lenzen et al. 2013). Eora-UNCTAD dataset estimates GVC statistics from multi-region input-output tables (MRIO)[3] and System of National Accounts (SNA) (Aslam et al. 2017; Koopman et al. 2014). Compared to other datasets, Eora-UNCTAD data covers more developing countries and years.[4]

The main predictor is a dummy variable (PTA_{ijt}) that takes the value of one if the dyad is in a PTA and zero otherwise. As noted, this and other characteristics of

3. Eora-UNCTAD dataset is periodically updated and can be accessed here. This paper uses the 2019 version of the dataset where the latest nowcasted year is 2018 (Casella et al. 2019). See Table 2.4 in Appendix A for a simplified view of relations between GVCs indicators.

4. For a review of other datasets, see Casella et al. (2019, 117).

PTAs are based on DESTA dataset.[5] It also provides a straightforward additive index of depth (*Depth Index*) that ranges between 0 (very shallow) and 7 (very deep) and covers, as noted before, provisions on such issue areas as standards, investment, services, procurement policy, competition policy, IPRs, and whether a PTA is a partial or full agreement. The depth of a PTA in this paper is captured by *Depth* dummy that equals one if a PTA's *Depth Index* is above the sample's median, i.e., it includes two or more provisions, and zero otherwise. For robustness check, I also use the Rasch Index of depth *(DRI)* from DESTA, which is a continuous measure of depth, based on item response theory, and gives more weight to provisions that are more difficult to negotiate and agree upon, e.g., IPRs (Dür et al. 2014, 360).

The presence of *investment-related provisions* is measured by a dummy if a PTA covers investment, services, or IPRs areas. The presence of *market-access provisions* is measured by a dummy if a PTA covers procurement or competition policies. *Other provisions* are captured by a dummy if a PTA includes either a provision on standards or if it has a full rather than partial PTA. To benchmark the effect of PTAs on VA trade with final export, I use the log-transformed value of dyadic export in constant 2010 USD $ln(export_{ijt})$.[6] Finally, I use BIT_{ijt}, WTO_{ijt} dummies, and their lags to capture the effect of signing a *BITs* and *WTO membership*. Descriptive statistics are presented in Table 2.6 in Appendix A.

Time variable: Similar to Dür et al. (2014), the variable year in this paper shows the year of signature of a PTA and not the year when a PTA enters into force because "the large majority of agreements enter into force after a relatively short period [i.e.,

5. DESTA dataset can be accessed here.
6. Bilateral export data is from the Direction of Trade Statistics (DOTS), IMF, available here

within one or two years] where states seek domestic ratification" (p. 364). Although this dyadic dataset records observations consecutively by year (from 1985 to 2018), I use four-year interval data for estimations, i.e., 1990, 1994, 1998, 2002, 2006, 2010, 2014, and 2018. Using interval data in gravity estimation is proven important because trade volumes adjust to the changes in trade policy after a few years (Baier and Bergstrand 2007; Yotov et al. 2016). The choice of the length of intervals in gravity estimations is not clearly justified and can range from 3 to 5 years (Anderson and Yotov 2016; Baier and Bergstrand 2007; Olivero and Yotov 2012; Trefler 2004). It is, however, "recommended to experiment with alternative intervals while keeping estimation efficiency in mind" (Yotov et al. 2016, 24). This paper uses 4-year intervals because the effect of PTAs on VA trade stabilizes after three years of signing a PTA, as our experiments with two, three, and five-year intervals confirm (see Tables 2.7 and 2.8 in Appendix B).

Other key variables: Measure of income is a three-level categorical variable *(NS)* that encodes the income group of dyads, based on the World Bank Atlas data, as *S-S* if both partners are middle or low-income countries, *N-S* if one is high income and the second is middle or low income, and *N-N* if both partners are high-income countries. The key challenge in using *NS* variable is that it is time-invariant: developing countries rarely become developed over a few years, and the within-group variation for developed countries is even more invariant. To estimate the effect of PTAs, given income variations among dyads, I use *NS* to split the observations into *N-N, N-S,* and *S-S* sub-samples and estimate the effect of PTAs in separate models.[7]

7. Other economic data, such as US CPI, GDP, and GDP per capita, are from the World Development Indicators database, accessible here. Traditional gravity model's indicators are from CEPII, accessible here.

2.4 Empirical strategy

This paper implements a structural gravity model and estimates the effect of PTAs on VA trade between dyads. One issue that may seriously affect the reliability of estimations and lead to attenuation bias is that trade policy is endogenous to trade flows. Others argue that endogeneity bias has become the "gold medal mistake" in gravity estimations because the gravitational effects of unobserved characteristics at the country and dyad levels too often are not considered (Baldwin and Taglioni 2006, 793). No empirical strategy other than a lab-controlled experiment can, of course, fully account for the endogeneity issue; however, to minimize the issue, the accumulated best practices in gravity literature recommend to follow three steps: using directional dyadic panel data, using interval instead of consecutive periods, and including the full set of dyad *(ij)*, year *(t)*, and country-year *(it* and *jt)* FE (Baier and Bergstrand 2007; Yotov et al. 2016).

This paper implements all the recommended steps.[8] Applying the full set of FE is justified in this context: FE control for time-invariant (observable and unobservable) country-specific, dyad-specific, and time-specific characteristics, including various national policies, institutions, and exchange rates (Yotov et al. 2016, 19). The directed dyad FE controls for bilateral characteristics (e.g., distance, contiguity, and language) and the general level of trade costs between i and j. Country-specific time FE are necessary to control for multilateral trade resistance terms (MRT), which are unobserved trade barriers between a dyad and the rest of the world (Hummels et al. 2001; Olivero

8. One more recommendation is to implement Poisson Pseudo Maximum Likelihood (PPML) estimation when trade data take a lot of zero values. I do not implement a PPML model because the response variable does not take zero values after I removed 14 exporting countries with poor data reporting practices, which are flagged as problematic in Eora's documentation.

and Yotov 2012; Feenstra and Hanson 1996). Controlling for MRT with country-year FE for both partners is expected to produce more reliable results when the sample covers nearly the entire population, which is the case in this paper covering the entire universe of PTAs and a large number of countries.[9] Based on these details, I estimate the effect of PTAs given their depth and phased-in effect over the long term, with full and split by income groups samples, in the following log-linear form:

$$ln(VAtrade_{ijt}) = \beta_1(PTA_{ijt}) + \beta_2(X_{ijt}) + \gamma_{ij} + \delta_{it} + \tau_{jt} + \epsilon_{ijt},$$

where $ln(VAtrade_{ijt})$ is the volume of VA trade between country i and j at period t, i.e., 4-year interval; PTA_{ijt} is a dummy showing the year when a country-dyad signs a PTA; X_{ijt} represents other specifications such as the depth of PTAs $Depth_{ijt}$, income groups of country-dyad (*NS*), provisions included in a PTA, and one and two-period lagged effects of PTAs ((PTA_{ijt-1}), (PTA_{ijt-2})) and PTAs' depth ($(Depth_{ijt-1})$, $(Depth_{ijt-2})$). Full set of fixed effects are represented by $\gamma_{ij}, \delta_{it}, \tau_{jt}$, where γ_{ij} is directed dyad fixed effect, δ_{it} is country1-year and τ_{jt} is country2-year fixed effects.

As noted, for comparison, I also estimate the effect of PTAs on log-transformed dyadic export $ln(export_{ijt})$ as well as the effect of BITs (BIT_{ijt}) and WTO (WTO_{ijt}) membership on both log-transformed VA trade and dyadic export.

9. Scaling the left-hand side (LHS) variables by the product of GDPs, which is equivalent to restricting unitary income elasticities, could be an alternative solution; however, as Baier and Bergstrand (2007) indicate, imposing the unitary income elasticities has no impact on the PTA coefficient if we use the full set of FE.

2.5 Results and discussion

Table 2.1 presents the main and phased-in effects of shallow and deep PTAs.[10] Results of Model 1 show that countries that are in a PTA trade more in GVCs than countries that are not in a PTA: for every 1% increase in shallow or deep PTAs, bilateral VA trade increases by more than 3%.[11] These results only partially confirm (*H1a*). In other words, in the short term, there is no difference between dyads that are in a deep and dyads that are in a shallow PTA; bilateral GVC relations of both groups benefit from preferential liberalization in the same way. This observation is confirmed when I use the two other measures of depth provided in DESTA for robustness check: categorical *Depth index* and depth Rasch Index, *DRI*, (see Table 2.9 Appendix B). Coefficients for both alternative predictors are nearly zero (and even turning negative for *DRI* $(e^{0.003})$), suggesting that entering a deep PTA may even disrupt the flow of bilateral VA trade in the short term. The short-term (1 to 3 years) non-significant effect of deep PTAs is explained by the fact that in anticipation of a deep PTA and its associated reforms, firms may adjust the organization of their supply chains and switch to new suppliers from the PTA market in order to gain from the phased-in effect of deep PTAs later.

The devil, however, appears when we explore the details of PTAs across time and national income. Models 2 and 3 show the main and phased-in effect of shallow and

10. Because in the 2019 version of the Eora-GVC dataset that I use 2018 is nowcasted, I re-estimated all models in this paper after dropping the observations for 2018. The re-estimated results (not reported) were not different from those shown here with the 2018 data included, which shows that nowcasted data does not affect our results.

11. Unless otherwise stated, all coefficients that are expressed in percentage in this paper reflect the average percentage change in the exponentiated coefficients of the response variable per 1% change in the predictor variable, i.e., $(e^{\beta} - 1)100\%$.

Table 2.1: The main and long-term effect of PTAs

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(VA trade)			ln(VA trade)		
	Full sample			Split samples		
				N-N	N-S	S-S
Shallow	0.034***	0.031***	0.035***	0.020**	-0.008*	0.102***
	(0.004)	(0.003)	(0.004)	(0.008)	(0.005)	(0.008)
Shallow (medium term)		0.005**				
		(0.002)				
Shallow (long term)		-0.000				
		(0.002)				
Depth	0.033***	0.033***	0.022***	-0.002	0.022***	0.140***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.005)	(0.012)
Depth (medium term)			0.016***			
			(0.002)			
Depth (long term)			0.013***			
			(0.003)			
Constant	6.252***	6.252***	6.251***	9.027***	6.697***	5.012***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Observations	232,242	232,242	232,242	27,360	105,667	99,215
R-squared	0.998	0.998	0.998	0.999	0.998	0.995
rmse	0.152	0.152	0.152	0.117	0.144	0.156
Dyad FE	YES	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

deep PTAs over 4 (*t-1*) and then 8 (*t-2*) years. These results confirm (*H1b*): deep PTAs outperform shallow PTAs over the long term. If we follow Baier and Bergstrand (2007)'s suggestion and add up significant coefficients of the main and lagged effects of deep PTAs, for example, in Model 3, for every 1% increase in deep PTAs, trade in GVCs increases by 3.8% after 4 years and by 5.2% after 8 years. Under shallow PTAs, there is no difference in GVC trade after 4 and 8 years, although in the short term, the effect remains significant and above 3%.[12] These findings are consistent with previous research on final export that shows that trade policy and "terms-of-trade changes tend to have lagged effects on trade volumes" (90).

Models 4-6 stratify the dataset by income levels (by *NS* variable) and estimate the effect of deep and shallow PTAs with split samples. The results suggest that deep PTAs have a strong and positive effect on VA trade only when at least one partner is a developing country: signing deep PTAs accounts for 2.2% and 15% increase in bilateral VA trade between N-S and S-S dyads, respectively. These results confirm (*H1c*) and add that the effect on S-S GVC relations is even higher than N-S. The effect of shallow PTAs is also positive and significant for S-S, but the effect is nearly zero for N-S dyads.

Given that South often has a comparative advantage in terms of the cost of labour and raw inputs and hosts offshored tasks and operations along the supply chains, it is not unusual to see that trade liberalization is stronger if at least one country in the dyad is a developing country. What is novel, however, is that, unlike trade in finals,

12. In Table 2.8 Appendix B, I also estimate the effect of PTAs and their 1 to 10-year lags. This re-estimation confirms Model 3's result that the full effect of trade liberalization on VA trade materializes over the long term (after 4 to 9 years).

the effect of PTAs and their depth is stronger on S-S than on N-S VA trade. One explanation is that when we look at bilateral trade relations from a VA angle, S-S dyads trade more in GVCs because they perform most of the processing activities, exchanging more partially processed rather than fully finished items. Their bilateral trade, thus, carries more VA than N-S bilateral trade and, therefore, is more responsive to changes in the scope and coverage of trade liberalization.

For this reason, the development and strengthening of S-S trade integration and production relations may not only increase the participation of developing countries in GVCs, but it can also strengthen the development of specialized production hubs in the South. The presence of variations in the effect of the depth of PTAs across dyads and over time suggests that policy areas that constitute the depth of PTAs determine the effect of PTAs and their depth on bilateral VA trade, depending on the institutional and economic contexts of partners.

Table 2.2 estimates the effect of provisions (H2), using full and split samples stratified by income groups. While the effect of provisions varies across dyads stratified by income groups, PTAs that include investment-related provisions (investment, services, or IPRs) have a positive and significant effect on bilateral VA trade across all dyads. Model 1 with the full sample confirms H2 that investment-related provisions have a greater effect on bilateral VA trade than market-access provisions (procurement or competition) or other provisions (standards or full FTA). When I split the sample by income group in Models 2-4, the effect of investment-related provisions stays positive for all dyads but more strongly for N-N and S-S bilateral VA trade (more than 3% each) than for N-S. The effect of market-access provisions is also notable but only for S-S dyads (over 4%). Finally, the other two provisions have a strong

positive effect on both N-N and S-S dyads (about 8% and 3%, respectively), while the same effect is negative for N-S dyads.

Table 2.2: The effect of provisions

	(1) ln(VA trade)	(3) ln(VA trade)	(4) ln(VA trade)	(5) ln(VA trade)
	Full sample	Split samples		
		N-N	N-S	S-S
PTA	0.028***	-0.064***	0.020***	0.084***
	(0.006)	(0.015)	(0.007)	(0.012)
Investment-related provisions	0.015**	0.035**	0.020*	0.032**
	(0.007)	(0.016)	(0.011)	(0.014)
Market-access provisions	-0.018***	-0.051***	-0.004	0.046**
	(0.007)	(0.016)	(0.010)	(0.019)
Other provisions	0.009*	0.083***	-0.021***	0.038***
	(0.005)	(0.014)	(0.006)	(0.012)
Constant	6.250***	9.027***	6.695***	4.999***
	(0.001)	(0.002)	(0.001)	(0.002)
Observations	232,242	27,360	105,667	99,215
R-squared	0.998	0.999	0.998	0.995
rmse	0.152	0.116	0.144	0.156
Dyad FE	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

To check that these results are not driven by collinearity among provisions (although data diagnostics point to a variance inflation factor less than 5), I also test the effects of these provisions in separate models with split samples (see Table 2.10 in Appendix B). These robustness checks again confirm our observations in Model

2-4 in Table 2.2. It must be noted, however, that this paper looks only at bilateral relations and compares dyads that have a PTA with those dyads that do not share a PTA. Therefore, a positive and significant effect from all provisions on S-S VA trade does not suggest that S-S PTAs have a greater effect on GVC trade than N-N and N-S PTAs, or that S-S integration is better than N-S integration. I do not have evidence for such a suggestion. However, these results clearly show that signing PTAs with investment-related provisions helps S-S dyads more than others to trade bilaterally in VA, establish production linkages, and participate in GVCs.

Previous Models show that the depth of integration matters for trade in GVCs when PTAs cover investment-related provisions. Given that attracting foreign investment plays an important role in upgrading and competitiveness of production processes, the effect of PTAs on trade in GVCs may depend on the presence of other institutions such as BITs and WTO membership of both partners.

Table 2.3 compares the effect of PTAs, BITs, and joint WTO membership on bilateral VA trade over time. Overall, results of Models 1-3 suggest that countries with a joint PTA, BIT, and WTO membership trade more in VA than others. More precisely, Model 1 shows that the effect of a joint BIT (5 %) on bilateral VA trade is greater than the effect of a joint PTA (3 %) and joint WTO membership (1 %) across all dyads. This means that when compared to one another, a joint BIT explains more of the variations in bilateral VA trade than joint PTAs or WTO memberships. The coefficient of PTAs in Model 1 does not differ significantly from the coefficient of PTAs in Models 1–3 in Table 2.1. This means that, for all countries, signing BITs does not divert the impact of PTAs on GVCs. In contrast, BITs seem to only strengthen bilateral GVC integration because BITs can facilitate investment in production processes, causing

an increase in the quality and VA content of export.

Models 4-6 in Table 2.3 show the disaggregated effect of joint institutional memberships on GVC trade for different dyads. Joint memberships in PTAs, BITs, and WTO increases GVC integration of developing countries more than developed ones. This effect is particularly strong for S-S dyads (Model 6): S-S dyads engage more in GVCs when they share a PTA and a BIT. This means that signing BITs further supports preferential trade liberalization and strengthens GVC integration, providing developing countries with further opportunities for development. Since most processing facilities and plants producing parts and components are located in developing countries, a strong and complementary effect from BITs or PTAs with investment-related provisions on GVC trade (Table 2.2, Models 2–4) is expected. The implication is that for developing countries, signing PTAs with investment-related provisions is more important to trade more in GVCs than signing a shallow PTA or a stand-alone BIT.

The effect of joint membership in the WTO is also more important for bilateral GVCs relations between S-S than between N-N and N-S dyads. However, this effect is not as significant as the other two institutions. The low impact of joint WTO membership on bilateral trade in GVC is also expected because tariff cuts and trade liberalization through the WTO are small in those sectors that use highly customized inputs and are important for the durability of GVC relations.

Models 2 and 3 in Table 2.3 and Model 1 in Table 2.1 confirm H3: the long-term effect of stand-alone BITs or joint WTO membership on VA trade are smaller than the phased-in-effect of deep PTAs. Although the effect of BITs on GVCs declines

Table 2.3: The main and long-term effect of BITs and joint WTO membership

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(VA trade)			ln(VA trade)		
	Full sample			Split samples		
				N-N	N-S	S-S
PTA	0.030***			-0.001	0.010**	0.113***
	(0.003)			(0.006)	(0.004)	(0.008)
BIT	0.049***	0.043***		0.039***	0.026***	0.058***
	(0.004)	(0.004)		(0.007)	(0.005)	(0.011)
WTO	0.011**		0.012***	0.039	-0.010	0.029***
	(0.005)		(0.004)	(0.024)	(0.008)	(0.006)
BIT (medium term)		0.011***				
		(0.003)				
BIT (long term)		0.005*				
		(0.003)				
WTO (medium term)			0.001			
			(0.003)			
WTO (long term)			-0.008*			
			(0.004)			
Constant	6.241***	6.254***	6.256***	8.998***	6.697***	4.983***
	(0.002)	(0.000)	(0.003)	(0.015)	(0.004)	(0.004)
Observations	232,242	232,242	232,242	27,360	105,667	99,215
R-squared	0.998	0.998	0.998	0.999	0.998	0.995
rmse	0.152	0.152	0.152	0.117	0.144	0.156
Dyad FE	YES	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

gradually over time, it remains positive over the medium and long term. The effect of WTO, however, is positive and significant only over the short term, pointing again to the fact that shallow liberalization, through the removal of tariffs and customs-related barriers, does not have a long-term reformative effect on the development

and expansion of bilateral GVC trade among countries.

Comparing the significance of the dynamic effects of BITs and WTO with the effects of shallow and deep PTAs (Models 2 and 3, Table 2.1), we see that, indeed, the cumulative effect of WTO over time is similar to the effect of shallow PTAs, while the cumulative effect of deep PTAs is more important than BITs. To check that institutional complementarity does not drive these results, I separately estimate the individual effect of the three institutions with split samples. The results are similar to the results presented in Table 2.3.

Tables 1–3 indicate that while the overall effect of PTAs and their depth on GVCs is similar to their effect on final export, significant variation in the magnitude of this effect on the two outcome variables appears when we zoom in on specific design features of PTAs, such as the time effect, the content of depth, and the income levels of members. To ensure that the estimation approach taken in this paper is as robust as the state-of-the-art gravity models implemented with bilateral final export data, I re-estimate models in tables 1–3 with bilateral export in final goods as an outcome variable. Results with bilateral final export data confirm previous findings (Baier and Bergstrand, 2007) that deep trade integration between two countries significantly increases their bilateral trade in final export (by 28 %), especially if the trade involves a developed-developing dyad, which is not the case in the context of GVCs as table 1 shows.

In addition, BITs have a much smaller effect on trade in final export than the WTO membership, which is also consistent with results in Table 2.2, showing that GVC trade depends more on preferential investment facilitation than on multilateral trade liberalization. Benchmarking the results of Tables 2.1-2.3 with bilateral export

as an outcome variable confirms that trade in VA and trade in finals respond to a separate set of mechanisms (Tables 2.12 and 2.13 in Appendix C). While trade in final export responds well to deep integration, mostly through removing tariffs and non-tariff barriers, trade in GVCs depends on deep integration when investment and time effects are considered.

2.6 Conclusions and implications

The deepening and proliferation of PTAs and the rise of GVCs have become the defining features of global trade and the policy headlines of international organizations in the past few years. Despite the significant implications that the interplay of these two trends holds for trade and development policy, we know surprisingly very little about whether and how the change in the design features of trade agreements impacts the way countries, especially developing ones, can trade more in and benefit from GVCs. This paper used a comprehensive bilateral dataset on PTAs and trade in GVCs and assessed the effect of the deepening of trade agreements on bilateral trade in GVCs to address this gap, accounting for heterogeneous characteristics of PTAs and countries. In doing so, it improved on, and added to, the coverage and mechanisms of a limited and recent number of empirical works.

The main finding in this paper suggests that comprehensive (deep) trade agreements increase bilateral trade in GVCs. However, the devil of this effect is in its details: the significance and magnitude of deep PTAs on GVC integration vary by the design features of PTAs. Compared to shallow and multilateral trade agreements, deep PTAs that facilitate GVC trade have a strong cumulative effect over time. In addition, they are more effective when they involve developing countries and include

provisions that support investment and investment-related activities.

Several important policy implications follow from these findings. First, GVC-facilitating deep PTAs are an effective development policy instrument at the micro-level because an increase in the VA to export means an improvement in domestic firms' production processes and capabilities. By supporting countries in the process of design, negotiation, and accession of GVC-facilitating PTAs, intergovernmental development organizations and advanced economies can play a leading role in using the proliferation of deep PTAs and the fragmentation of international production for development.

Second, the significance of deep PTAs over the long- rather than short-term also indicates that deep PTAs are more conducive to institutional changes and to create an enabling environment for firms to produce and add more value to their export. This outcome is not surprising because deep trade integration involves more extensive industrial and institutional changes in the member countries that can increase the short-term costs of trade liberalization. Therefore, reference to a small (or even negative) short-term effect from deep trade integration on the economy may further strengthen economic-nationalistic and protectionist sentiments of the incumbent governments, as was the case with the withdrawals of India from the Regional Comprehensive Economic Partnership (RCEP) in 2020 and the United States from the Trans-Pacific Partnership (TPP) in 2017. In these situations, it is important to remember and weigh the long-term economic gains from deep integration against its short-term costs before outrightly rejecting a comprehensive deal that may benefit the economy a few years after the accession. In this context, developing countries may be more than developed countries in need of assistance to withstand the short-term costs of joining

and implementing.

Third, the significance of investment and investment-related provisions, especially for developing countries, underlines that the effect of trade policy on development depends on the effectiveness of investment policy and vice versa. While shallow trade liberalization, for example, may boost the export of upstream inputs from a resource-rich developing country, the prospect for its long-term growth and development will improve when the country can upgrade to higher VA tasks and processes along the GVCs. The primary sources of an increase in VA production are technology and knowledge transfer, which can be induced by the liberalization of services, and (or) investment in new and better products or production processes, which can be facilitated through investment liberalization. As the analysis results for developing countries in this paper showed, BITs combined with deep PTAs with investment-related provisions can achieve these goals more than shallow preferential and multilateral agreements.

Finally, the significant effect of deep PTAs on GVC trade of dyads that include a developing country, i.e. N-S and S-S dyads, point to developing countries' unparalleled comparative advantages in terms of low costs of production and resource endowment. At the same time, it also underlines the importance of an open international trade system, first and foremost for developing countries, most of which are upstream exporters, to access downstream buyers; therefore, it is important to acknowledge that any intentional (e.g. global trade wars) or unintentional (e.g. global pandemics) disruptions of supply chains, especially in the context of the current fragile economic and geo-political environment, will be more costly for developing rather than for developed countries.

It must be emphasized that the findings in this paper are based on a macro country-level analysis. For a more fine-grained micro-level analysis of the effect of comprehensive trade agreements on GVCs, future research should focus more on the variation across sectors and firms' responses to trade and development policy in the context of GVCs. After all, the evolving production patterns depend directly on firms' decisions and performances, as they are the ones that import, process, produce, add value, and trade internationally.

2.7 Bibliography

Allee, Todd, and Clint Peinhardt. 2014. "Evaluating Three Explanations for the Design of Bilateral Investment Treaties." *World Politics* 66, (1): 47–87.

Amendolagine, Vito, Amadou Boly, Nicola Daniele Coniglio, Francesco Prota, and Adnan Seric. 2013. "FDI and Local Linkages in Developing Countries: Evidence from Sub-Saharan Africa." *World Development* 50,41–56.

Anderson, James, and Yoto Yotov. 2016. "Terms of Trade and Global Efficiency Effects of Free Trade Agreements, 1990–2002." *Journal of International Economics* 99,279–298.

Anderson, Robert, Anna Mueller, Kodjo Osei-lah, Josefita de Leon, and Philippe Pelletier. 2012. "Government Procurement Provisions in Regional Trade Agreements: A Stepping Stone to GPA Accession?" In *The WTO Regime on Government Procurement,* edited by Sue Arrowsmith and Robert Anderson. Cambridge University Press Cambridge.

Anderson, Robert, and Anna Muller. 2008. "Market Access for Government Procurement of Services: Comparing Recent PTAs with WTO Achievements," edited by Martin Roy and Juan Marchetti. Cambridge University Press.

Antràs, Pol. 2020. "Conceptual Aspects of Global Value Chains." *The World Bank Economic Review* 34, (3): 551–574.

Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry. 2012. "Measuring the Upstreamness of Production and Trade Flows." *American Economic Review* 102, (3): 412–416.

Antràs, Pol, and Robert W. Staiger. 2012. "Offshoring and the Role of Trade Agreements." *American Economic Review* 102, (7): 3140–83.

Aslam, Aqib, Natalija Novta, and Fabiano Rodrigues-Bastos. 2017. *Calculating Trade in Value Added.* International Monetary Fund.

Baccini, Leonardo, Andreas Dür, and Manfred Elsig. 2015. "The Politics of Trade Agreement Design: Revisiting the Depth-Flexibility Nexus." *International Studies Quarterly* 59, (4): 765–775.

———. 2018. "Intra-Industry Trade, Global Value Chains, and Preferential Tariff Liberalization." *International Studies Quarterly* 62, (2): 329–340.

Baier, Scott, and Jeffrey Bergstrand. 2007. "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of international Economics* 71, (1): 72–95.

Baldwin, Richard, Masahiro Kawai, and Ganeshan Wignaraja, eds. 2014. *A World Trade Organization for the 21st Century: The Asian Perspective.* Edward Elgar Publishing.

Baldwin, Richard, and Daria Taglioni. 2006. "Gravity for Dummies and Dummies for Gravity Equations." In *Working Paper 12516.* National Bureau of Economic Research.

Bergstrand, Jeffrey H., and Peter Egger. 2013. "What Determines BITs?" *Journal of International Economics* 90, (1): 107–122.

Boffa, Mauro, Marion Jansen, and Olga Solleder. 2019. "Do We Need Deeper Trade Agreements for GVCs or Just a BIT?" *The World Economy* 42, (6): 1713–1739.

Brusick, Philippe, Ana Maria Alvarez, and Lucian Cernat. 2005. *Competition Provisions in Regional Trade Agreements: How to Assure Development Gains.* UNCTAD.

Büthe, Tim, and Helen V. Milner. 2014. "Foreign Direct Investment and Institutional Diversity in Trade Agreements: Credibility, Commitment, and Economic Flows in the Developing World, 1971-2007." *World Politics* 66, (1): 88–122.

Casella, Bruno, Richard Bolwijn, Daniel Moran, and Keiichiro Kanemoto. 2019. "Improving the Analysis of Global Value Chains: The UNCTAD-Eora Database." *Transnational Corporations* 26, (3): 28.

Dixon, Jay, and Paul Alexander Haslam. 2016. "Does the Quality of Investment Protection Affect FDI Flows to Developing Countries? Evidence from Latin America." *The World Economy* 39, (8): 1080–1108.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig. 2014. "The Design of International Trade Agreements: Introducing a New Dataset." *The Review of International Organizations* 9, (3): 353–375.

Egger, Peter, and Sergey Nigai. 2015. "Effects of Deep versus Shallow Trade Agreements in General Equilibrium." In *Trade Cooperation: The Purpose, Design and Effects of Preferential Trade Agreements,* edited by Andreas Dür and Manfred Elsig. Cambridge University Press.

Feenstra, Robert, and Gordon Hanson. 1996. "Globalization, Outsourcing and Wage Inequality." *American Economic Review* 86, (2): 240–245.

Fernandez, Raquel, and Jonathan Portes. 1998. "Returns to Regionalism: An Analysis of Non-traditional Gains Form Regional Trade Agreements." *World Bank Economic Review* 12, (2): 197–220.

Francois, Joseph, and Bernard Hoekman. 2010. "Services Trade and Policy." *Journal of Economic Literature* 48, (3): 642–92.

Gereffi, Gary. 2018. *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism.* Cambridge University Press.

Harding, Torfinn, and Beata Javorcik. 2011. "Roll out the Red Carpet and They Will Come: Investment Promotion and FDI Inflows." *Economic Journal* 121, (557): 1445–1476.

Hartman, Stephen W. 2013. "The WTO, the Doha Round Impasse, PTAs, and FTAs/RTAs." *The International Trade Journal* 27, (5): 411–430.

Hofmann, Claudia, Alberto Osnago, and Michele Ruta. 2017. *Horizontal Depth: A New Database on the Content of Preferential Trade Agreements. Policy Research Working.* World Bank Policy Research Working Paper No. 7981.

Hummels, David, Jun Ishii, and Kei-Mu Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 54, (1): 75–96.

Johnson, Robert, and Guillermo Noguera. 2012. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of International Economics* 86, (2): 224–236.

Kerner, Andrew, and Krzysztof J. Pelc. 2022. "Do Investor–State Disputes (Still) Harm FDI?" *British Journal of Political Science* 52, (2): 781–804.

Kim, Soo Yeon. 2021. "Investment Commitments in PTAs and MNCS in Partner Countries." *Economics & Politics* 33,415–442.

Konan, Denise, and Keith Maskus. 2006. "Quantifying the Impact of Services Liberalization in a Developing Country." *Journal of Development Economics* 81, (1): 142–162.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei. 2008. "How Much of Chinese Exports Is Really Made in China? Assessing Domestic Value-Added When Processing Trade Is Pervasive." National Bureau of Economic Research.

———. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104, (2): 459–494.

Laget, Edith, Alberto Osnago, Nadia Rocha, and Michele Ruta. 2020. "Deep Trade Agreements and Global Value Chains." *Review of Industrial Organization* 57, (2): 379–410.

Lenzen, Manfred, Daniel Moran, Keiichiro Kanemoto, and Arne Geschke. 2013. "Building Eora: A Global Multi-Region Input–Output Database at High Country and Sector Resolution." *Economic Systems Research* 25, (1): 20–49.

Limao, Nuno. 2016. "Preferential Trade Agreements." In *Handbook of Commercial Policy,* edited by Kyle Bagwell and Robert W. Staiger, 1:279–367. North-Holland.

Markusen, James, and Keith Maskus. 2001. "General-Equilibrium Approaches to the Multinational Firm: A Review of Theory and Evidence." National Bureau of Economic Research.

Maskus, Keith, and Carsten Fink. 2005. *Intellectual Property and Development: Lessons from Recent Economic Research.* The World Bank.

Maskus, Keith, and Mohan Penubarti. 1995. "How Trade-Related Are Intellectual Property Rights?" *Journal of International Economics* 39, (3-4): 227–248.

Olivero, Maria Pia, and Yoto Yotov. 2012. "Dynamic Gravity: Endogenous Country Size and Asset Accumulation." *Canadian Journal of Economics/Revue canadienne d'économique* 45, (1): 64–92.

Orefice, Gianluca, and Nadia Rocha. 2014. "Deep Integration and Production Networks: An Empirical Analysis." *The World Economy* 37, (1): 106–136.

Piermartini, Roberta, and Michele Budetta. 2009. "A mapping of regional rules on technical barriers to trade." In *Regional Rules in the Global Trading System,* edited by Antoni Estevadeordal, Kati Suominen, and Robert Teh, 250–315.

Rose, Andrew. 2004. "Do We Really Know That the WTO Increases Trade?" *American Economic Review* 94, (1): 98–114.

Spilker, Gabriele, Thomas Bernauer, In Song Kim, Helen Milner, Iain Osgood, and Dustin Tingley. 2018. "Trade at the Margin: Estimating the Economic Implications of Preferential Trade Agreements." *The Review of International Organizations* 13, (2): 189–242.

Trefler, Daniel. 2004. "The Long and Short of the Canada-US Free Trade Agreement." *American Economic Review* 94, (4): 870–895.

UN, ed. 2009. *System of National Accounts 2008.* New York: United Nations.

———, ed. 2013. *International Merchandise Trade Statistics: Compilers Manual, Revision 1 (IMTS 2010-CM).* Revision 1. [Studies in Methods] / United Nations, Department of Economic and Social Affairs, Statistics Division Ser. F, 87, Rev. 1. New York: United Nations.

UNCTAD. 2013a. *Global Value Chains and Development: Investment and Value Added Trade in the Global Economy.* United Nations New York.

———, ed. 2020. *International Production beyond the Pandemic.* 30th anniversary edition. World Investment Report 2020. Geneva New York: United Nations.

Vijil, Mariana. 2014. "Aid for Trade Effectiveness: Complementarities with Economic Integration." *The World Economy* 37, (4): 555–566.

Wang, Zhi, Shang-Jin Wei, and Kunfu Zhu. 2013. "Quantifying International Production Sharing at the Bilateral and Sector Levels." National Bureau of Economic Research.

WB. 2020a. *Handbook of Deep Trade Agreements.* Washington, DC: World Bank.

———. 2020b. *World Development Report 2020: Trading for Development in the Age of Global Value Chains.* Washington, DC: World Bank.

WB and WTO. 2017. *Measuring and Analyzing the Impact of GVCs on Economic Development: Global Value Chains Development Report 2017.* Washington, DC: World Bank Group.

Wooldridge, Jeffery. 2010. *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

Yotov, Yoto V., Roberta Piermartini, José-Antonio Monteiro, and Mario Larch. 2016. *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model.* World Trade Organization.

2.8 Appendix to Chapter 2

Appendix A

In Table 2.4, I simplify and demonstrate the relations between different components of GVC trade, bilateral VA trade, and monadic GVC variables, i.e. foreign VA to export (FVA), domestic VA to export (DVA), indirect VA to export (DVX) and their compositions: (a) total monadic GVC trade, which is the sum of FVA and DVX and visualized in this table as the sum of grey-shaded vertical and horizontal columns; and (b) total monadic VA to export (VAX), which is the sum of FVA and DVA, and visualized here as the sum of the grey-shaded vertical column and diagonal cells.

Table 2.4: MRIO tables and the relations between commonly used value added (VA) variables

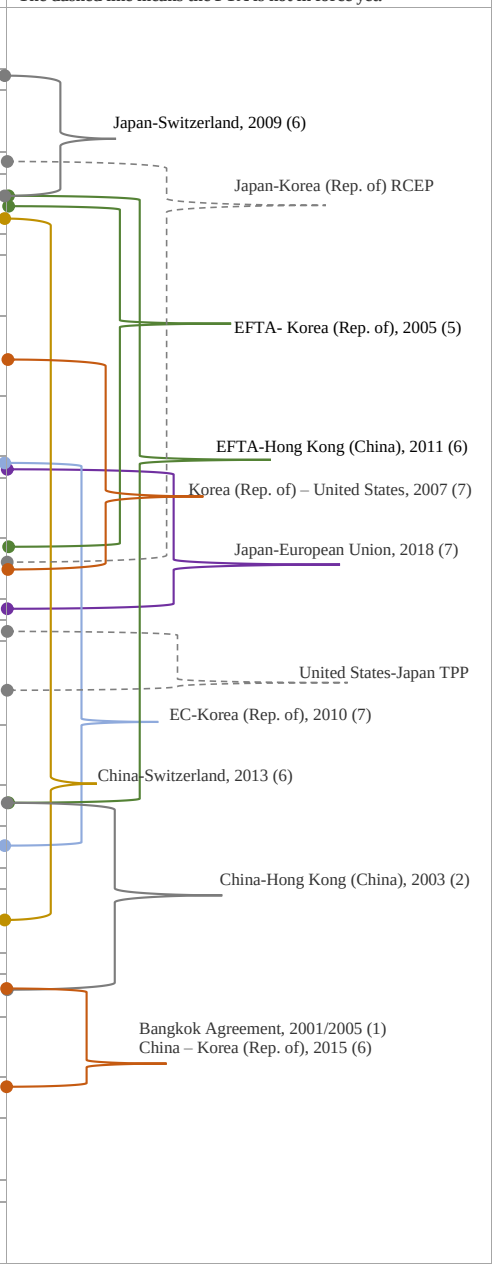
		downstream countries (j)						
		country1	country2	country3	countryk	…	countryN	
upstream countries (i)	country1	DVA country1	bilateral VA trade country1, country2	bilateral VA trade country1, country3	bilateral VA trade country1, countryk	…	bilateral VA trade country1, countryN	FVA for country1 = sum of row – DVA country1
	country2	bilateral VA trade country2, country1	DVA country2	bilateral VA trade country2, country3	bilateral VA trade country2, countryk	…	bilateral VA trade country2, countryN	FVA for country2 = sum of row – DVA country2
	country3	bilateral VA trade country3, country1	bilateral VA trade country3, country2	DVA country3	bilateral VA trade country3, countryk	…	bilateral VA trade country3, countryN	FVA for country3 = sum of row – DVA country3
	country k	bilateral VA trade countryk, country1	bilateral VA trade countryk, country2	bilateral VA trade countryk, country3	DVA countryk	…	bilateral VA trade countryk, countryN	FVA for countryk = sum of row – DVA countryk
	…	…	…	…	…	…	…	…
	country N	bilateral VA trade countryN, country1	bilateral VA trade countryN, country2	bilateral VA trade countryN, country3	bilateral VA trade countryN, countryk	…	DVA countryN	FVA for countryN = sum of row – DVA countryN
		DVX for country1 = sum of column – DVA country1	DVX for country2 = sum of column – DVA country2	DVX for country3 = sum of column – DVA country3	DVX for countryk = sum of column – DVA countryk	…	DVX for countryN = sum of column – DVA countryN	

Source: Author's elaborations, based on (Koopman et al. 2014).

Note: For more on the derivation of these GVC indicators from MRIO tables, see (Aslam et al. 2017), (Casella et al. 2019) and (Wang et al. 2013).

Table 2.5: Companies, countries, and PTAs involved in iPhone X GVC

Major parts	Minor parts	Company	Economy	PTA and year signed (depth index indicated in the bracket) The dashed line means the PTA is not in force yet.
Dual camera	Lens	Largan Precision	Taiwan, Province of China	
		Genius Electronic Optical		
	CMOS image sensors	Sony	Japan	
True depth 3D-sensing camera	Receiver	Largan Precision	Taiwan, Province of China	
		Genius Electronic Optical		
		Kantatsu	Japan	
	Sensor	STMicroelectronics	Switzerland	
	Infrared filter	Viavi	United States	
	Sensor assembly	Tong Hsing	Taiwan, Province of China	
Projector	Vertical-cavity surface-emitted laser (VCSEL)	Lumentum	United States	
		Finisar		
		II-VI		
	Wafer-level lens	Himax	Taiwan, Province of China	
		Ams	Austria	
	Laser manufacturer	Win Semi	Taiwan, Province of China	
	Laser tester	Chorma		
	3D camera module assembly	LG innotek Sharp (Japan-based unit of Taiwan's Foxconn)	Korea (Rep. of)	
	Ceramic substrate	Kyocera	Japan	
NAND flash memory chips		Toshiba	Japan	
		Western Digital/SanDisk	United States	
Modem chips		Qualcomm		
		Intel		
Bionic Core Processors (A11)		TSMC	Taiwan, Province of China	
Casing	Glass back, cover glass	Biel Crystal	Hong Kong, China	
DRAM chips		Samsung Electronics	Korea (Rep. of)	
		SK Hynix		
		Micron	United States	
Batteries		Desay Battery	China	
		Sunwoda		
		Simplo Technology		
Audio	Microphones, speakers	Knowles	United States	
		AAC Technologies	China	
		GoerTek		
		Merry Electronics	Taiwan Province of China	
Display	OLED panels	Samsung Electronics	Korea (Rep. of)	
	3D force touch module	TPK Holding	Taiwan, Province of China	
		General Interface Solution (Foxconn)		
		Lens Technology	China	
	Stainless steel frames, casing assembly	Foxconn Technology	Taiwan, Province of China	
Assembly	Final product	Foxconn		



Note: Information about major parts, subparts, companies producing them, and locations are from *Nikkei Asian Review's* staff article: *How the iPhone reshaped Asian tech, 2017*, available here. PTA data are from DESTA.

Table 2.6: Descriptive statistics
(N=232,242)

	Mean	Std. Dev.	Min	Max
ln(VA trade)	6.259636	2.912212	-2.109828	18.41957
ln(dyadic export)	14.89593	4.078903	-0.141129	26.75736
PTA	0.2801862	0.449091	0	1
Depth	0.0870902	0.2819678	0	1
Depth index	.5635372	1.343551	0	7
Depth Rasch Index	-0.030068	.6101734	-1.433347	2.26725
BIT	0.1058207	0.3076086	0	1
WTO	0.4838272	0.4997394	0	1
NS	2.309397	0.6702901	1	3
Investment-related provisions	0.0825088	0.2751389	0	1
Market-access provisions	0.0746463	0.2628203	0	1
General provisions	0.1978023	0.3983431	0	1

Note: All financial values are in constant USD prices (2010=100).

Appendix B

Table 2.7: Comparing the main effect of PTAs with 3-, 4-, 5-, and 6-year interval data

	(1)	(2)	(3)	(4)	(5)
			ln(VA trade)		
	Consecutive years	3-year interval	4-year interval	5-year interval	6-year interval
PTA	0.017***	0.007***	0.035***	0.006***	-0.005*
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	6.240***	6.231***	6.250***	6.312***	6.337***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	841,037	289,640	232,242	174,236	145,083
R-squared	0.998	0.998	0.998	0.998	0.998
rmse	0.140	0.145	0.152	0.135	0.148
Dyad FE	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2.8: The phased-in and anticipatory effect of PTAs and BITs on VA trade with consecutive years

The results in the following table point to the differences (and some similarities) between the long-term and anticipatory effects of PTAs and BITs: (1) both PTAs and BITs are endogenous to VA trade flows; (2) while in anticipation of PTAs, firms indeed withhold their decisions (consistent with previous research on the anticipatory effect of PTAs (Baier and Bergstrand 2007; Dür et al. 2014)), in anticipation of a BIT, firms fast-track their activities in the BIT-covered market, which can eventually lead to an increase in trade; and (3) the total effect of PTAs diminishes after 9 years, while the total and main effects of BITs only solidify over time.

	PTAs				BITs			
	Models	Lag /lead effect	Agreement's effect	Total effect	Models	Lag /lead effect	Agreement's effect	Total effect
t-1	(1)	0.026***	-0.006**	0.020	(16)	0.016***	0.025***	0.041
t-2	(2)	0.026***	-0.002*	0.024	(17)	0.015***	0.028***	0.043
t-3	(3)	0.028***	-0.000	0.028	(18)	0.013***	0.031***	0.044
t-4	(4)	0.029***	0.001	0.029	(19)	0.012***	0.033***	0.045
t-5	(5)	0.031***	0.003***	0.034	(20)	0.011***	0.034***	0.045
t-6	(6)	0.028***	0.007***	0.035	(21)	0.010***	0.035***	0.045
t-7	(7)	0.028***	0.009***	0.037	(22)	0.009***	0.036***	0.045
t-8	(8)	0.027***	0.011***	0.038	(23)	0.008***	0.037***	0.045
t-9	(9)	0.025***	0.014***	0.039	(24)	0.008***	0.038***	0.046
t-10	(10)	0.023***	0.015***	0.038	(25)	0.008***	0.038***	0.046
t+1	(11)	-0.013***	0.028***	0.015	(26)	0.010***	0.032***	0.042
t+2	(12)	-0.009***	0.023***	0.014	(27)	0.009***	0.035***	0.044
t+3	(13)	-0.010***	0.022***	0.012	(28)	0.008***	0.037***	0.045
t+4	(14)	-0.013***	0.022***	0.009	(29)	0.007***	0.038***	0.045
t+5	(15)	-0.011***	0.020***	0.009	(30)	0.008***	0.040***	0.048
Constant		6.23***	6.23***	6.23***		6.240***	6.240***	6.240***
Observations		841,037	841,037	841,037		841,037	841,037	841,037
R-squared		0.998	0.998	0.998		0.998	0.998	0.998
rmse		0.140	0.140	0.140		0.140	0.140	0.140
Dyad FE		YES	YES	YES		YES	YES	YES
Country1-year FE		YES	YES	YES		YES	YES	YES
Country2-year FE		YES	YES	YES		YES	YES	YES

All clustered standard errors are =< 0.002 (not shown here). *** p<0.01, ** p<0.05, * p<0.1.

Table 2.9: Strict exogeneity test

To test the strict exogeneity assumption, i.e., that there is no feedback effect from the changes in trade flows to the changes in trade policy, I add one-period lead dummies for PTA and depth variables in Models 1 and 2 in Table 3 below (Baier and Bergstrand 2007, 88; Wooldridge 2010, 285). A negative and statistically significant coefficient of the PTA lead confirms previous findings that PTAs are endogenous to trade policy. In the context of GVC trade, too, firms "delay trade temporarily in anticipation of an impending agreement" (Baier and Bergstrand 2007, 90). With the full set of FE and interval data, the total effect of PTAs on VA trade remains positive and significant (5.4 %), as model 1 shows.

	(1) ln(VA trade)	(2) ln(VA trade)	(3) ln(VA trade)
PTAs	0.019***	0.036***	0.061***
	(0.002)	(0.003)	(0.005)
PTAs (medium term)	0.024***		
	(0.002)		
PTAs (long term)	0.018***		
	(0.002)		
PTAs (anticipatory)	-0.008***		
	(0.002)		
Depth		-0.014***	
		(0.003)	
Depth (medium term)		0.017***	
		(0.002)	
Depth (long term)		0.016***	
		(0.003)	
Depth (anticipatory)		0.005**	
		(0.002)	
DRI			-0.015***
			(0.002)
Constant	6.246***	6.249***	6.248***
	(0.001)	(0.001)	(0.001)
Observations	232,242	232,242	232,242
R-squared	0.998	0.998	0.998
rmse	0.152	0.152	0.152
Dyad FE	YES	YES	YES
Country1-year FE	YES	YES	YES
Country2-year FE	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2.10: Characteristics of depth

	(1) ln(VA trade)	(3) ln(VA trade)	(4) ln(VA trade)	(5) ln(VA trade)	(6) ln(VA trade)	(7) ln(VA trade)	(8) ln(VA trade)	(9) ln(VA trade)	(10) ln(VA trade)	(11) ln(VA trade)
	Full sample	Spit samples								
		N-N	N-S	S-S	N-N	N-S	S-S	N-N	N-S	S-S
PTA	0.028***	0.006	0.001	0.114***	0.014*	0.003	0.116***	-0.076***	0.033***	0.080***
	(0.006)	(0.007)	(0.005)	(0.008)	(0.007)	(0.005)	(0.008)	(0.014)	(0.006)	(0.012)
Investment-related provisions	0.015**	-0.009	0.023***	0.058***						
	(0.007)	(0.007)	(0.005)	(0.012)						
Market-access provisions	-0.018***				-0.021***	0.020***	0.082***			
	(0.007)				(0.007)	(0.005)	(0.017)			
Other provisions	0.009*							0.085***	-0.027***	0.052***
	(0.005)							(0.014)	(0.006)	(0.011)
Constant	6.250***	9.028***	6.695***	4.997***	9.028***	6.695***	4.997***	9.027***	6.694***	4.999***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Observations	232,242	27,360	105,667	99,215	27,360	105,667	99,215	27,360	105,667	99,215
R-squared	0.998	0.999	0.998	0.995	0.999	0.998	0.995	0.999	0.998	0.995
rmse	0.152	0.117	0.144	0.156	0.117	0.144	0.156	0.116	0.144	0.156
Dyad FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2.11: The effect of PTAs and BITs on dyadic VA trade by income group

	(1) ln(VA trade)	(2) ln(VA trade)	(3) ln(VA trade)	(4) ln(VA trade)	(5) ln(VA trade)	(6) ln(VA trade)	(7) ln(VA trade)	(8) ln(VA trade)	(9) ln(VA trade)
	Split samples								
	N-N	N-S	S-S	N-N	N-S	S-S	N-N	N-S	S-S
PTA	0.001	0.012***	0.121***						
	(0.006)	(0.004)	(0.008)						
BIT				0.039***	0.027***	0.076***			
				(0.007)	(0.005)	(0.011)			
WTO							0.040	-0.010	0.035***
							(0.025)	(0.008)	(0.006)
Constant	9.027***	6.695***	4.996***	9.021***	6.694***	5.026***	9.004***	6.703***	5.015***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.014)	(0.004)	(0.003)
Observations	27,360	105,667	99,215	27,360	105,667	99,215	27,360	105,667	99,215
R-squared	0.999	0.998	0.995	0.999	0.998	0.995	0.999	0.998	0.995
rmse	0.117	0.144	0.156	0.117	0.144	0.157	0.117	0.144	0.157
Dyad FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix C

Table 2.12: The effect of provisions on dyadic export

	(1) ln(dyadic export)	(2) ln(dyadic export)	(3) ln(dyadic export)	(4) ln(dyadic export)	(5) ln(dyadic export)	(6) ln(dyadic export)	(7) ln(dyadic export)	(8) ln(dyadic export)	(9) ln(dyadic export)	(10) ln(dyadic export)
	Full sample	Split samples								
		N-N	N-S	S-S	N-N	N-S	S-S	N-N	N-S	S-S
PTA	0.046	0.027	-0.040	0.202***	0.037	-0.055	0.184**	0.263**	0.138***	0.112
	(0.041)	(0.063)	(0.045)	(0.073)	(0.065)	(0.046)	(0.073)	(0.118)	(0.053)	(0.085)
Investment-related provisions	0.090*	0.019	0.141***	-0.131						
	(0.049)	(0.058)	(0.042)	(0.083)						
Market-access provisions	0.168***				0.003	0.170***	-0.001			
	(0.051)				(0.062)	(0.044)	(0.090)			
Other provisions	-0.141***							-0.251**	-0.148***	0.101
	(0.033)							(0.118)	(0.051)	(0.073)
Constant	15.031***	17.398***	15.116***	13.729***	17.399***	15.118***	13.730***	17.403***	15.110***	13.735***
	(0.010)	(0.022)	(0.014)	(0.030)	(0.022)	(0.014)	(0.030)	(0.022)	(0.013)	(0.030)
Observations	142,379	21,892	73,749	46,731	21,892	73,749	46,731	21,892	73,749	46,731
R-squared	0.892	0.942	0.888	0.858	0.942	0.888	0.858	0.942	0.888	0.858
rmse	1.458	1.055	1.414	1.653	1.055	1.414	1.653	1.055	1.415	1.653
Dyad FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2.13: The effect of deep PTAs on dyadic export

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(dyadic export)	ln(dyadic export)	ln(dyadic export)	ln(dyadic export)	ln(dyadic export)	ln(dyadic export)
	Full sample			Split samples		
				N-N	N-S	S-S
PTA	0.052**	0.055**	-0.074**	0.017	-0.067	0.205***
	(0.025)	(0.025)	(0.031)	(0.066)	(0.046)	(0.073)
Depth			0.252***	0.033	0.181***	-0.127
			(0.028)	(0.062)	(0.041)	(0.079)
BIT	0.028					
	(0.025)					
WTO	0.146**					
	(0.074)					
Constant	14.930***	15.021***	15.036***	17.398***	15.119***	13.727***
	(0.045)	(0.010)	(0.010)	(0.022)	(0.014)	(0.030)
Observations	142,379	142,379	142,379	21,892	73,749	46,731
R-squared	0.892	0.892	0.892	0.942	0.888	0.858
rmse	1.459	1.459	1.458	1.055	1.414	1.653
Dyad FE	YES	YES	YES	YES	YES	YES
Country1-year FE	YES	YES	YES	YES	YES	YES
Country2-year FE	YES	YES	YES	YES	YES	YES

Clustered standard errors at dyad level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Bridging text

The previous paper examined whether and how the change in the design features of trade agreements impacts how countries, especially developing ones, can trade more in and benefit from GVCs. The paper used a comprehensive bilateral dataset on PTAs and trade in GVCs and assessed the effect of the deepening of trade agreements on bilateral trade in GVCs to answer the question, accounting for heterogeneous characteristics of PTAs and countries. In doing so, it improved and added to the coverage and mechanisms of a scant and recent number of empirical works on the subject.

The main finding in this paper suggests that comprehensive (deep) trade agreements increase bilateral trade in GVCs. However, the devil of this effect is in its details. First, the significance and magnitude of deep PTAs on GVC integration vary by the design features of PTAs. Compared to shallow and multilateral trade agreements, deep PTAs that facilitate GVC trade have a strong cumulative long-term effect. This finding implies that deep agreements are more conducive to institutional changes as they enable firms to produce and add more value to their export.

Furthermore, deep PTAs' effect on countries' GVC participation is strong when PTAs involve at least one developing (South) country. This outcome points to developing countries' unparalleled comparative advantages in terms of low costs of production and resource endowment. Finally, deep PTAs' effect on countries' GVC participation is also strong when they include provisions that support investment and investment-related activities. This outcome underlines that the effect of trade policy on development depends on the effectiveness of investment policy and vice versa.

However, this paper's findings are based on a macro country-level analysis. For a more fine-grained micro-level analysis of the effect of comprehensive trade agreements on GVCs, future research should focus more on the variation across sectors and firms' responses to trade and development policy in the context of GVCs. After all, the evolving production patterns depend directly on firms' decisions and performances, as they are the ones that import, process, produce, add value, and trade internationally.

This task is undertaken in the following paper. The following article uses firm-level data and proposes a novel measure of GVCs integration at the firm level, examines the effect of deep integration on firms' GVC linkages, and brings the question of the quality of the domestic institutions into the discussion.

Chapter 3

Deep trade integration, domestic institutions, and GVC integration: firm-level evidence

Abstract

There is considerable evidence that the deepening of trade integration has uneven distributional consequences for local firms, depending on their productivity. It is also well-established that institutional differences across countries are an important source of comparative advantage in global trade and production. What has received less attention is the interplay between these two at the firm level in the context of the recent rise in GVCs. In order to fill this gap, this paper asks whether (and why) the differences in the quality of domestic institutions across countries mediate the distributional effect of deep integration on firms' integration in GVCs. To answer this question, I measure GVC integration at the micro- (firms) and the deepening of preferential integration at the macro- (country) levels and combine these with conventional measures of the quality of domestic institutions for 124 countries between 2006 and 2020. Leveraging the differential effect of trade integration on firms with different levels of productivity across different institutional environments, I find that when the regulatory quality of domestic institutions is high, the deepening of trade integration increases productive firms' participation in GVCs. By bringing the question of local institutions into the discussion of participation in GVCs and the distributional consequences of deep integration, the paper shows that the effect of trade liberalization on firms is conditioned not only on the heterogeneous characteristics of firms, such as productivity but also on the quality of local institutions.

Keywords: GVCs, institutions, trade integration, firms
JEL codes: F02, F14, L23, O14, D22

3.1 Introduction

There is considerable evidence that country-level trade integration has uneven distributional consequences for local firms: productive firms win and export more while unproductive lose and leave (Melitz 2003; Bernard et al. 2003; Baccini, Pinto, et al. 2017; Topalova and Khandelwal 2011). There is also strong evidence that the quality of domestic institutions is an important determinant of nations' comparative advantage in trade (Acemoglu et al. 2001; Hall and Jones 1999; Coase 1992; North 1990). What has received little attention is the interplay between these two (firm- and country-level) advantages in the context of GVCs.

This gap exists for several reasons. In the GVC literature, theoretical study of GVCs (Gereffi et al. 2005; Gereffi 2018) and empirical analysis of trade in GVCs (Taglioni and Winkler 2016; WB 2020a; Laget et al. 2020) have been institutional-free and focused on developed countries because of the limitation in the cross-country firm-level data (Johnson 2018; Baccini and Dür 2018). In the main trade models, firms' decisions and behaviour are analyzed under frictionless market conditions, where institutional differences across countries, in terms of contracts enforcement, regulations and laws related to manufacturing and enterprises development, do not determine the outcome of trade integration for firms. The key determinant in this context is the firms' characteristics, such as size and productivity. In practice, however, the quality of the institutional environment is an important source of comparative advantage (Nunn 2007; Levchenko 2007) that can change when and how firms with various characteristics are gaining from liberalization.

In the context of GVCs, the role of domestic institutions and local government

is even more important because GVCs involve not only cross-border trade (export-import) but also production and supply chains. A more constructive institutional environment can help local firms to specialize in producing high value-added (VA) inputs and products and establish more production linkages with foreign suppliers and buyers. As research indicates (Eckhardt and Poletti 2018), while the role of government in the development of global commodity chains (GCCs) has always been viewed as central, the effect of various configurations of domestic institutions on GVC integration of countries (and their firms) "remains surprisingly under-researched" (3).

Additionally, while the joint effect of trade integration and firm productivity may explain many variations in firms' participation in GVCs (Amiti and Konings 2007; Antràs and Helpman 2004; Goldberg et al. 2010; Baccini et al. 2018), bringing the "institutions back into the study of GVCs" (Eckhardt and Poletti 2018, 3) (De Marchi et al. 2018; Gereffi 2018), is also necessary for a better understanding of how and why more trade integration may lead to more participation of firms (and their countries) in GVCs.

In order to fill the gap, this paper asks whether the differences in the quality of domestic institutions across countries mediate the distributional effect of deep integration on firms' participation in GVCs. It shows that deepening trade integration increases GVC participation of productive firms in countries with good quality domestic institutions more than productive firms in countries with weak institutions. In other words, compared to low-quality institutions, a high-quality institutional environment has a stronger reallocation effect on firms after trade liberalization. In this context, firms in countries with an above-average score in terms of the quality of governance and regulatory institutions tend to integrate more with GVCs than firms

in countries with weaker institutions, even after firm-level productivity is considered. This effect remains robust to the adjustment for several country and firm-level factors and additional tests.

I further show that the effect of regulatory institutions, which backs up the stability of supply chain relations, is important for firms to participate more in GVCs. Because trade in GVCs can be characterized as more customized, relationship-specific (i.e., dependent on the durability of supplier-buyer relations), and contract-intensive, firms' success depends on the certainty and clarity of rules and regulations. A higher degree of certainty can guarantee the stability of supplier-buyer relations and eliminate the costs (and risks) associated with frequently switching to new suppliers of inputs without prolonged interruption in their supply chains. As trade integration gets deeper, firms in countries where the quality of contract enforcement and regulations is higher than average can establish more production linkages with GVCs than firms with a similar level of productivity in other countries.

The key implication is that the reallocation effect of deep integration on firms is conditioned not only on the heterogeneous characteristics of firms (e.g., their productivity) but also on the quality of domestic institutions, which has received little attention in GVC and trade literature. Furthermore, the positive effect of high-quality institutions on the national economy cuts two-way. On the one hand, their presence works as a positive natural selection mechanism on the private sector development, filtering out unproductive firms who fail to adapt to the new environment created by more comprehensive trade liberalization. In this context, good institutions help countries gain from trade liberalization and GVCs. However, on the other hand, the effect of good institutions rewards productive firms more than unproductive firms after

trade liberalization becomes more comprehensive, petting losing firms and workers against more GVC and trade integration. In this context, the debates and discussions of reshoring and backlash against globalization may create political and economic divisions and undermine national and international development efforts.

The paper uses a repeated cross-section dataset to test these claims. It brings together macro (country-level) data on deep PTAs from the Design of Trade Agreements (DESTA), the quality of domestic institutions from the World Governance Indicators (WGI), micro (firm-level) indicators from the World Bank Enterprise Surveys (WBES), and other variables for 124 countries between 2006 and 2020. I measure the GVC integration of firms by calculating their GVC participation indicator, which is the sum of backward and forward linkages in constant USD, following the input-output approach developed by Koopman et al. 2014 (see Chapter 2, Appendix A).

I measure deep integration at the country level as the average cumulative index of depth (comprehensiveness) of all PTAs signed by each country in the dataset. This monadic variable captures a single country's engagement in preferential trade liberalization. For the baseline models, I measure the quality of domestic institutions as the simple average of the WGI. I also estimate the effect of each dimension individually and use the firm-level assessment of domestic institutions as alternative measures of regulatory quality. The empirical approach is a difference-in-difference (DID) strategy that exploits the variations in the effect of deep integration across different levels of firm productivity and the quality of domestic institutions. The main results of double interaction with split samples remain robust to the inclusion of alternative measures of institutions, covariates, and in the framework of a triple difference strategy and sensitivity test.

The paper makes several contributions. First, it empirically brings the question of domestic institutions into the discussion of firms' participation in GVCs and the distributional consequences of trade integration in this context. Second, it uses firm-level (micro) survey data that includes many developing countries to measure GVC participation and productivity indicators. Third, it derives a cumulative measure of the depth of integration from dyadic PTA data to measure the average monadic "deepness" of preferential trade liberalization. Furthermore, given that macro-level data on GVC still lag behind traditional trade statistics, despite recent improvements in GVC data and statistical methods (Koopman et al. 2014; UN 2018, 2009), undertaking micro-level analysis of GVCs and trade is extremely important to understand how and when firms (and their countries) participate in GVCs. To the best of my knowledge, at the stage of implementation of this analysis, no other similar studies address similar questions.

Conceptually, this paper builds on several streams of the literature that show: a) that trade liberalization has important distributional consequences for the economy (Baccini, Pinto, et al. 2017; Baccini et al. 2022); b) that the quality of domestic institutions is an important source of countries' comparative advantage in trade and development (Nunn 2007; Levchenko 2007; Acemoglu et al. 2001; La Porta et al. 2008); c) that supplier-buyer relations in GVCs under incomplete contracts are more sticky, because trade in GVCs requires customized inputs or processes that specific firms can provide (Grossman and Helpman 2005; Antràs 2003; Antras and Chor 2021); and most importantly on few published studies, d) that put forward the question of the link between the quality of domestic institutions and participation in GVCs theoretically (Eckhardt and Poletti 2018) and empirically for firms in one country (Ge

et al. 2020; Boehm 2022) and for countries in one region (Dollar and Kidder 2017).

The structure of the paper is as follows. The next section will present the conceptual framework and hypotheses. The second section will describe the data, variables, and empirical approach. The final two sections will present and discuss the results, followed by a concluding section.

3.2 Literature and hypotheses

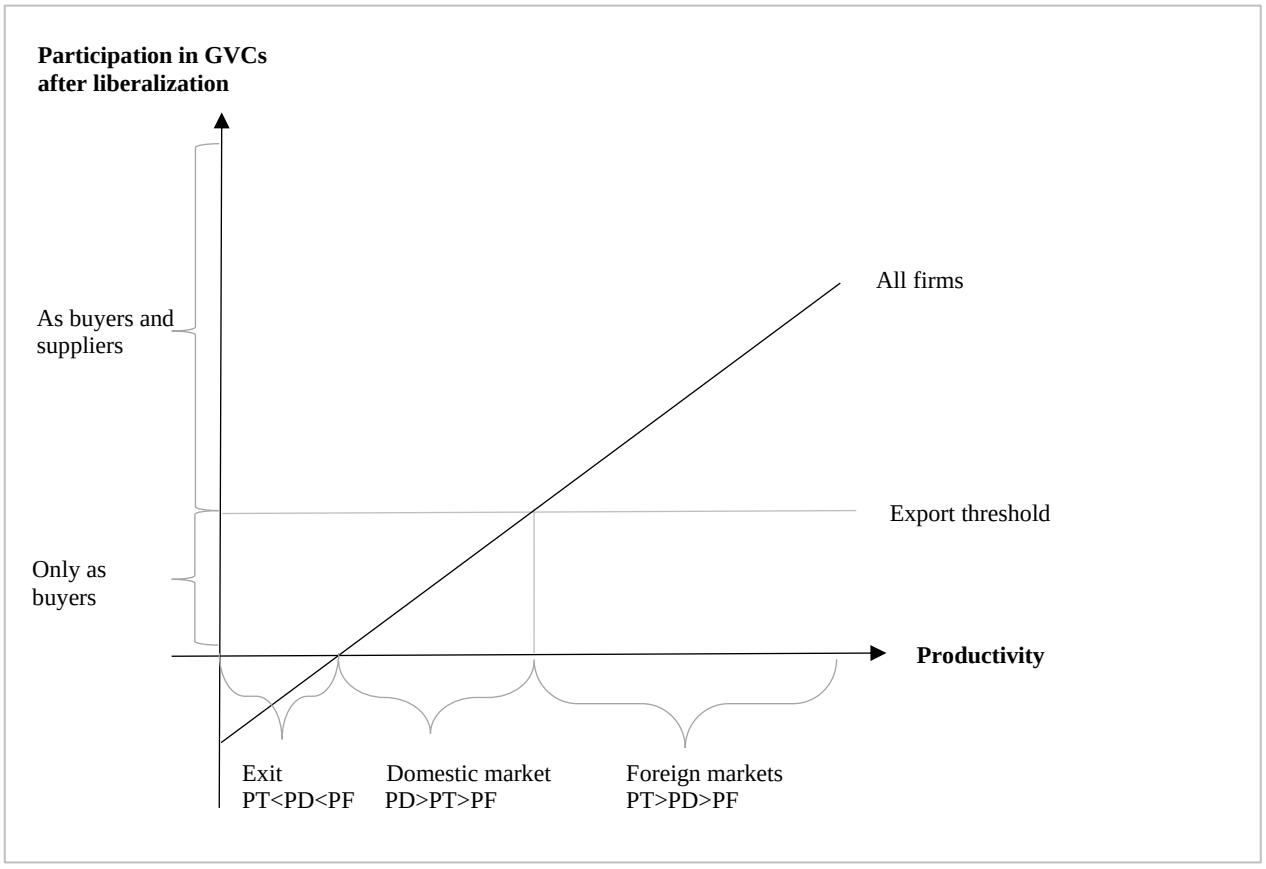
The reallocation effect of deep integration on firms in GVCs

Trade integration has an uneven reallocation effect on firms: it creates winners and losers among firms, depending on their productivity levels (Melitz 2003; Bernard and Jensen 1999). Previous works based on Melitz 2003 model of trade show that the differences in productivity across firms are the key determinant of participation in and gain from trade integration for two reasons. First, compared to non-exporters, firms that want to export face higher fixed costs, i.e., sunk and irrecoverable costs after the initial investment and do not change as the scale of production increases. As a result, only fast-growing, efficient, and productive firms can afford to meet the initial competition pressure from trade integration and remain above the productivity line required for survival in the foreign market. Second, after trade liberalization, removing barriers reduces the variable costs (e.g., wages and inputs) due to increased competition. Since marginal (per unit increase in) fixed costs remain constant and marginal variable costs decrease with more production, the effect of the economies of scale kicks in for more efficient and productive producers that aim to engage with new suppliers and buyers after the signing of new PTAs (Baccini, Osgood, et al. 2017).

Therefore, after states enter comprehensive trade integration, only firms with total productivity (PT) higher than the minimum threshold required for survival in foreign (PF) and domestic markets (PD) can expand their production and supply chain relations beyond borders. These firms participate in GVCs as buyers of foreign inputs and suppliers of domestic inputs for foreign buyers (PT>PD>PF). Therefore, they are the winners of trade integration as they can take advantage of lower tariff and non-tariff barriers and not only import from upstream countries but also add value to the production of downstream countries through export.

Less productive firms that do not meet the competitive productivity threshold in the foreign market but meet the minimum productivity level at home remain focused only on the domestic market and do not export after trade integration (PF>PT>PD). They may still import foreign parts for assembly and domestic consumption and benefit from cheaper inputs through backward production linkages. However, they do not add value to the production and export of other countries. Less productive firms that do not meet domestic or foreign productivity thresholds (PF>PD>PT) do not survive after trade liberalization and are forced to close production altogether. These firms are the losers of trade integration (see Figure 3.1).

Figure 3.1: GVC participation after trade liberalization



Note: Based on the interpretation of Melitz (2003).

The relationship between firms' productivity and integration in GVCs through establishing more backward and forward linkages as buyers of other firms' inputs and suppliers of inputs for other firms follows the same logic outlined by Melitz 2003 in the context of traditional export. In other words, more productive firms win from trade integration and participate more in GVCs. In contrast, less productive firms fail to do so and lose. While winning and losing in new (new) trade theories (NNTT) is measured in terms of revenue, here we define winning and losing as more and less participation in GVCs as buyers and suppliers. When countries sign more compre-

hensive (deeper) trade agreements, trade barriers and production costs decline; the minimum productivity threshold required for survival in the foreign market reduces as a result. Productive and already exporting firms find more opportunities to connect to GVCs. Once they enter a GVC, they can grow and invest more in upgrading their production processes, specialize in higher VA activities, and customize their products according to the demands of their buyer firms, effectively establishing long-term production linkages.[1]

Therefore, the effect of trade integration on productive firms' gains and participation in GVCs will increase as trade integration gets deeper, i.e., deep integration has a greater reallocation effect than shallow integration on the participation of more productive firms in GVCs.

Institutional differences as a source of comparative advantage in GVCs

The distributional effect of international institutions is one key factor determining firms' participation in GVCs. The other is the quality of the institutional environment within which firms operate and make decisions. As new institutionalism argues, nations' comparative advantage and economic development are the direct consequences of the quality of their institutions. Countries with low-quality institutions (LQI), i.e., the weak rule of law and regulations, political instability, high corruption, and low contract enforcement, show much less economic progress and experience more underdevelopment than countries that have high-quality institutions (HQI) (Acemoglu et al. 2001; Hall and Jones 1999; Coase 1992).

1. As shown in Razeq (2022), unlike traditional trade, trade in GVCs increases more in the long rather than in the short run under deeper trade integration.

In international trade, the differences in the export pattern across countries have empirically been linked to the differences in the overall quality of domestic institutions (Nunn and Trefler 2014; Chor 2010). High quality of various dimensions of domestic institutions that are geared toward the development of the private sector, i.e., financial regulations (Beck et al. 2003; Manova 2013), labour regulations (Costinot 2009; Cunat and Melitz 2012; Baccini et al. 2022), regulatory and judicial institutions (Long 2010), intellectual property rights institutions (Ang et al. 2014), and legal and contractual enforcement institutions (Ottaviano 2008) among others, have consistently shown a strong and positive effect on the gain from trade than LQI.

In the context of GVCs, the same strong mediating effect of the domestic institution is expected. With the globalization of production and the rise of GVCs, the role of local institutions supporting domestic production and trade has not become obsolete. In contrast, domestic institutions are more important for GVC integration because they can be relied on to improve production quality and determine the intensity and size of firms' participation in export and GVCs. Therefore, the differences in the quality of domestic institutions across countries are a source of comparative advantage that can significantly mediate the joint effect of deep PTAs and productivity and lead to uneven distribution of gains from trade in GVCs among firms.

H1: deep PTAs increase productive firms' participation in GVCs if the overall quality of domestic institutions is high.

The regulatory quality of domestic institutions and GVCs

Regulatory quality of formal institutions geared toward the private sector, i.e., the "quality of contract enforcement, property rights, shareholder protection, and the like," are important determinants of trade and development (Levchenko 2007, 791). As North (1990) argues, "the inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and contemporary underdevelopment" (p. 54). In common law countries, for example, where these regulations are more rigid than civil law countries, more rapid growth in trade and market relations are observed (Chong and Zanforlin 2000; La Porta et al. 2008; Knack and Keefer 1995). As Levchenko (2007) and others (Nunn 2007; Acemoglu et al. 2005) show, the differences in the pattern of trade among countries can be explained more by the presence of strong legal and regulatory institutions than traditional economic factors such as physical capital and skilled labour combined.

More recent works with firm-level data show that in countries where prices and wages are coordinated rather than determined by the markets, i.e., the regulatory quality and the effect of market institutions are weak, firms' revenue does not change after trade liberalization. In contrast, where the regulatory quality of institutions that foster competition and market-based exchange is high, trade liberalization brings more opportunities (and revenue) for those firms that are productive (Baccini et al. 2022).

The same general logic applies to trade in GVCs. Without a strong legal and regulatory environment in an upstream (supplier) country B, for example, even the most productive downstream (buyer) firms from country A may find it costly to establish production linkages with firms from B. If firms in country C, where the regulatory

obstacles to labour, customs, contracts, and others are low, can produce the required parts and components, buyers from country A may prefer to invest more in GVC relations with firms from C rather than B and secure long-term and stable supply chain for themselves. One recent example is the opening of Volkswagen's assembly plant and its joint investment with Siemens to produce and test its first African electric cars in Rwanda, a country that scores high in WGI in the region and has been on a steady growth path in recent years.[2]

In the context of GVCs, three more characteristics of supplier-buyer relations explain why the mediating effect of good quality of the domestic regulatory environment may be important for the integration of firms in GVC. These characteristics include product (relationships) specificity, high inventory costs, and contract intensity. First, under trade in GVCs, products require a specific set of technologies, resources, and features that only particular upstream producers can deliver. Product specificity leads to relationship specificity when downstream buyers cannot "rely on spot markets" for immediate fulfillment of their contracts (Levchenko 2007, 791). The specificity of supplier-buyer relationships or, to use Antras and Chor (2021) term, the "stickiness" of contracts in GVCs, makes it costly (if not impossible) for buyers to change their suppliers swiftly when needed to preserve the steady flows of their supply chains. The higher the specificity of products and relationships, the more good institutions affect firms' participation in GVCs with more trade liberalization.

Furthermore, more reliance on just-in-time (JIT) logistics as an inventory cost-reduction strategy (Pisch 2020), a defining feature of international supply chains,

2. Volkswagen press release available here.

also makes firms' decisions within GVCs more sensitive to the uncertainty associated with low regulatory and institutional quality. Finally, trade in GVCs is also more contract-intensive than traditional trade. GVCs involve a set of fragmented production processes involving trade in multiple customized parts and components, i.e., in making one item in GVCs, several transactions (and contracts) may be involved (Dollar and Kidder 2017; Nunn 2007). Thus, a higher degree of contract intensity increases the importance of good regulations for firms aiming to participate in GVCs as trade barriers decrease.

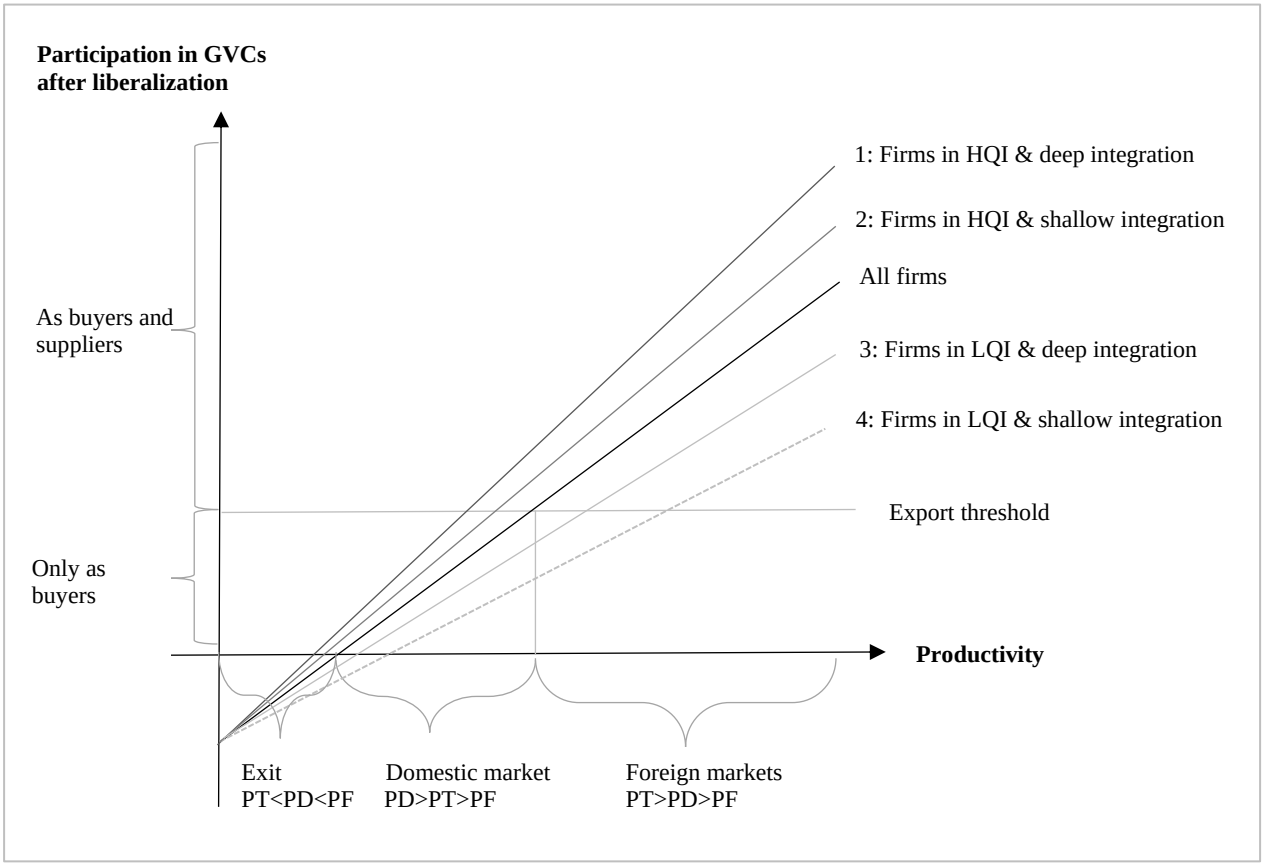
These features of GVC amplify the significance of good regulatory environments for the stability and resilience of supply chains through a decrease in uncertainty and costs. Conversely, the risk and costs associated with under-fulfillment or non-enforcement of contracts increase for buyers when the quality of the regulatory environment in the supplier's country decreases.

H2: deep PTAs increase productive firms' participation in GVCs if the quality of regulatory institutions and contract enforcement is high.

Figure 3.2 summarizes the expected effect of deep integration on the GVC participation of firms across different levels of productivity and quality of institutions. As integration becomes deep and trade barriers get lower, more productive firms in countries with good regulatory institutions (HQI) will be more propelled to integrate with GVCs than unproductive firms (line 1 $>$ line 2). Firms in LQI environments will always be slower in integrating with GVCs than firms in the HQI environment (lines 4 and 5 $<$ lines 1 and 2). Therefore, while more productive firms integrate faster in GVCs than unproductive firms after trade liberalization in both HQI and LQI, I ex-

pect that the effect of deep integration will always be higher in HQI than in LQI.

Figure 3.2: The hypothetical effect of deep integration on GVC participation of firms across different levels of productivity and quality of institutions



3.3 Data and variables

Dataset

The dataset is based on survey responses from firms operating in 124 developing and developed countries between 2006 and 2020.[3] The key advantage of using the WBES is that it covers many firms in developing countries, which are rarely covered by commercial firm-level datasets. WBES contains information on firms' characteristics (location, size, ownership), operation (capacity utilization, export, sales), and inputs (origin of resources, labour, assets).[4] To these data, I calculate and add annual monadic variables for PTAs (based on DESTA), the quality of institutions (based on WGI, Polity V, and Ease of Doing Business (EODB)), country-level characteristics (from World Development Indicators (WDI)), average tariffs (from Trade Analysis Information System (TRAINS) and World Integrated Trade Solution (WITS)), and the concordance between 2-digit ISIC 3.1 reported in WBES, 4-digit ISIC 3.1, HS 2017, and BEC 5 at the 4-digit level (from UN Comtrade) for the calculation of GVC participation. Together this compiled dataset makes it possible to measure firm-level GVC integration, the depth of country-level preferential trade integration, and the quality of local institutions, as well as to exploit the differences across firms, industries, countries, and time.

Thus, this paper's unit of observation is firm-industry-country-year (*fict*). The in-

3. The current methodological standards and questionnaires were introduced in 2006, which makes a few surveys conducted before 2006 incomparable.

4. WBES also contain questions on firm-level perception of the local and institutional environment, which allow measuring the stringency of issues they face. These questions can provide a firm-level alternative to the WB's Ease of Doing Business (EODB) dataset, which has been suspended because of external concerns over the transparency and accuracy of estimation. See here.

dustry is defined at the ISIC 3.1 4-digit level. The structure of the dataset is repeated cross-sections (not longitudinal). Two characteristics of the WBES determine this structure. First, the number of surveys across country and year is unbalanced, i.e., it varies across countries and time in the sample. At various years throughout the 2006–2020 period, the World Bank (WB) conducted four waves of surveys. Although most countries have two or three waves conducted, a few countries in the dataset have one wave and two countries with a fourth wave. Furthermore, each wave is implemented on a new representative sample of firms, which means that firms are not identifiable across the waves.

Note that since approximately 60% of firms in the dataset report 0% when asked about the percentage of annual sales that are exported directly or indirectly, the measures of GVC that I calculate from the WBES are only for less than 40% of firms that participate in exporting. Among these exporting firms, not all report on the key variables needed for calculating the GVC participation variable. For this reason, I can calculate the outcome variable for 17,748 observations. I can use 9,719 observations in the full model because of the lack of PTAs and/or productivity values. Note also that firms include those that are operating in the formal sector. Since the WBES collects all financial variables in local currency units (LCUs), financial variables, such as sales, are in different currencies. To deal with this, I converted all financial variables into USD, using the International Monetary Fund's (IMF) official exchange rates (annual average), and then deflated them to 2010 prices, using the WB's annual gross domestic product (GDP) deflator for the United States (US).

Dependent variable

The outcome variable, $log(GVC_{fict})$, is the log of GVC participation in constant USD (2010=100) and is calculated for each firm in a specific country, industry, and year, using the WBES. GVC participation is the sum of foreign value added in the export of country A and domestic value added of country A in the export of other countries. This variable, therefore, captures both forward and backward production linkages and is a trade-specific measure of GVC integration. I follow the input-output approach to calculate GVC statistics at the country level (Koopman et al. 2014) and take the following steps to calculate this variable.

First, I calculate the total value of export (in constant USD, 2010=100) for each firm, using the WBES information on the percentage of total sales that are exported directly or indirectly, i.e., through an intermediary. Second, I rely on WBES information about the origin of inputs (i.e., foreign or domestic origin) to distinguish between domestic VA (DVA) and foreign VA (FVA) to export for each firm. More specifically, DVA is the share of material inputs of domestic origin in firms' export, and FVA is the share of material inputs of foreign origin in firms' export (both in constant USD, 2010=100). Third, I use the concordance tables between ISIC 3.1 and HS 2017 at the 4-digit level (UN Statistics) and manual matching to identify BEC 5 class at the 3-digit level for each firm main export. It allows for identifying the end-use classification (i.e., intermediate products, final consumption, or capital goods) of firms' DVA. Of interest here is the intermediate designation of products. Fourth, that part of DVA exported for intermediate consumption gives us the DVX value. Finally, the sum of FVA and DVX gives us the GVC participation measure.

Main interaction terms

The main independent variable is the interaction between the deepness of trade integration at the country level and firm productivity at the firm level: $Depth_{ct} \times Productivity_{fict}$. More specifically, the $Depth_{ct}$ of trade integration for a single country is based on a continuous measure of the depth of PTAs from the DESTA dataset: Depth Rasch Index – DRI (Dür et al. 2014). DRI captures the extent to which a PTA covers beyond-tariffs trade issues and rarely negotiated trade areas (e.g., property rights, investment, services, procurement policies): the more extensive the coverage, the deeper a PTA. In DESTA, this measure is specific to each PTA and does not vary across countries and years: a country may sign several PTAs of various depths in one year and not sign any in the next few years. To capture the depth of preferential trade integration for each country across time, I use DRI to calculate an average annual cumulative measure of the deepness of preferential integration for each country in DESTA. In other words, the $Depth_{ct}$ in this paper is the annual cumulative sum of the depth of all PTAs a country has entered annually since the 1980s divided by the cumulative sum of PTA numbers.

$Productivity_{fict}$ is measured as the log of total labour productivity, i.e., total sales per unit of labour cost (in constant USD, 2010=100). This partial measure of productivity is used here instead of total factor productivity (TFP) for two reasons.[5] First, not all variables required for the calculation of TFP, i.e., the cost of raw material, finished products, and capital, are not available for many exporting firms. Second,

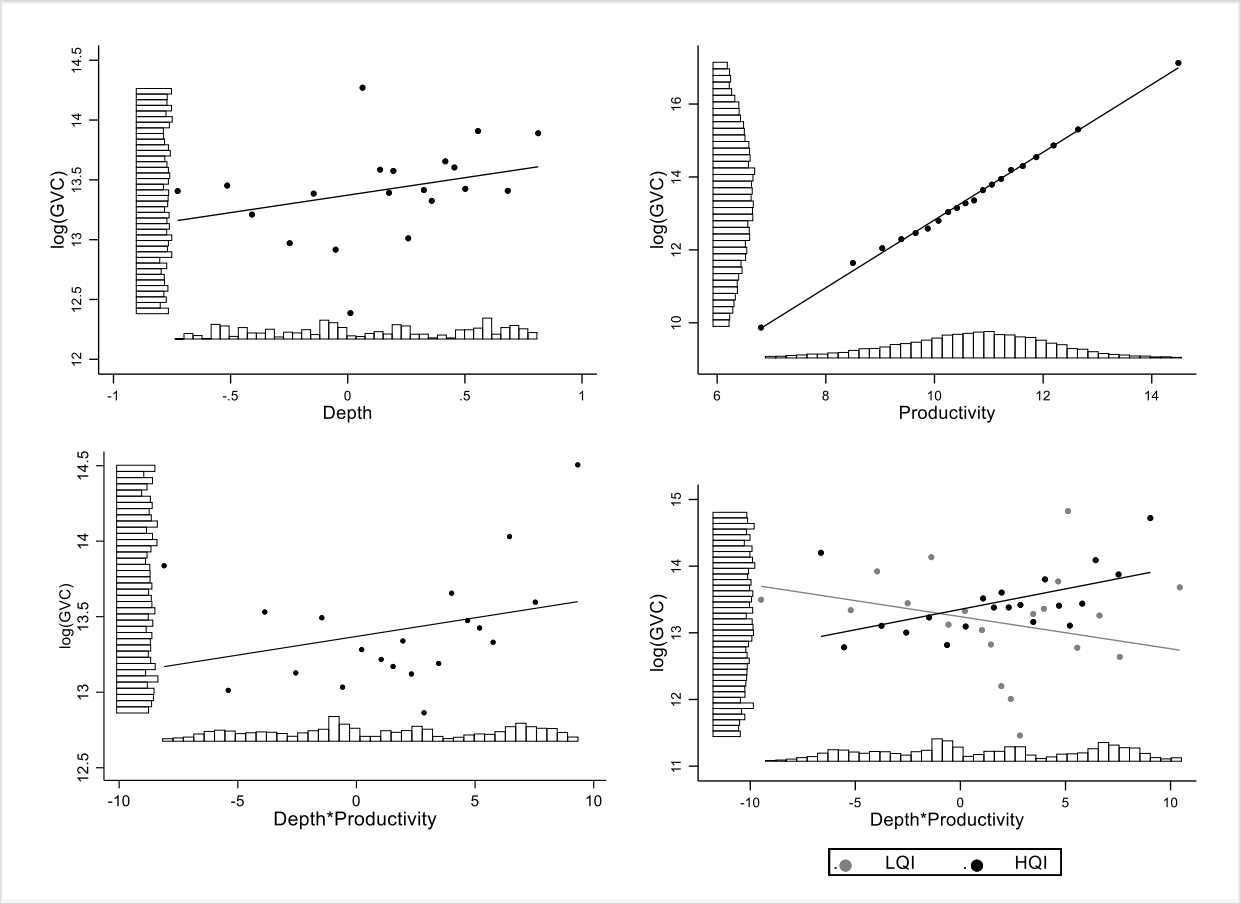
5. TFP for firm-industry level is calculated and provided by the WB in a separate dataset for less than 30% of observations. Using this variable produces inconsistent results because GVC variables cannot be calculated because of missing values for other indicators. For more on the method of calculation of TFP, see the WBES documentation, available here.

although TFP is theoretically argued to be a more comprehensive measure of productivity than labour productivity, the two measures are highly and positively correlated in practice. In addition, the latter is less sensitive to certain methodological choices and provides a more straightforward measure and interpretation of firm-level cost-growth relations.[6]

The measure of the quality of domestic institutions *Institutions* is based on the average of WGI estimates. It captures several dimensions of the quality of domestic institutions, such as Voice and Accountability, Political Stability (VA), Political Stability and Absence of Violence/Terrorism (PV), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption (CC). As an alternative measure of institutions that is theoretically more important in the context of GVCs, I use the quality of contract enforcement from the EODB dataset, which is also a continuous measure. Both continuous measures are then used to derive dummies that identify countries with low (below the median) and high (above the median) institutions and contract enforcement quality, i.e., LQI and HQI. To make sure that there is no reverse feedback from other variables on the quality of institutions, I use the 2005-year values for all institutional variables to "fix" them at the year before the time span of our data begins (Wooldridge 2010, 73-75), and then calculate their averages and dummies. In order words, variable *Institutions* remains constant. Figure 3.3 plots the relations between the main variables. Summary statistics and correlation matrix are presented in Tables 3.4 and 3.5 in Appendix A.

6. Furthermore, as argued by others, since TFP depends on the level of capital accumulation, it is not a more fundamental measure of productivity and growth than labour or capital productivity, and its construction and interpretation are subject to several strong assumptions (Lipsey and Carlaw 2004; Murray 2016). For a more in-depth discussion of the differences between labour, capital, and total productivity, see Altomonte and di Mauro (2022, 8-35).

Figure 3.3: Binned scatter plots of main variables



Note: binned scatter plots implemented by reghdfe with robust SE and country-level controls. Histograms of frequencies for each variable are along the respective axes. The height of histograms is not related to the scales of plotted axes. Binned scatterplots are scatterplots with reduced visual noise (through binning of the independent variable) and have the capacity to include covariates, FE, clustering method, and the distribution of scattered variables. *binscatterhist* (Stepner 2013; Pinna 2020) used here performs high-dimension FE regression (*reghdfe*) to calculate residuals before plotting the scatter. See also *binsreg* (Cattaneo et al. 2021).

Controls

I control for standard firm-level characteristics that are not highly correlated with the outcome and the main interaction terms but are important in determining GVC participation. Firm-level controls specified in the Tables include *Age* (the log of the total number of years since the establishment has been in operation),[7] *Assets* (proxied by the cost for the firm to re-purchase all of its machinery),[8] *Foreign Technology* (a dummy for the use of technology licensed from a foreign firm), and *Innovation* (a dummy if the firm reported new products, new processes, or any R&D spending over the past three years). I do not include other variables highly correlated with the main interaction terms and the outcome, such as *Size, Ownership, and Skills*; the differences in the levels of these variables are captured by firm-level controls that are included.

At the country level, I control for traditional controls such as the overall size of the economy *(log(GDP))*, trade *(log(Export))*, and the level of development of physical infrastructure (*Infrastructure*), proxied by the number of fixed telephone subscriptions per 100 people of population. Controlling the level of physical infrastructure in the context of GVC is important because countries with better logistics provide better supply chain conditions for firms.[9] All these three indicators are from the WDI.

7. Adding the square of age variable, in addition to the log of age, in the right-hand side of the equation is often recommended to model the effect of age more accurately, which may have a non-linear relationship with the outcome. For instance, the effect of age could be negative until, say, the age of 10 and then turn positive after that. Because we have only four waves at maximum, this issue is not of serious concern here, and including the squared value of age does not change the results. Some firms report an unrealistically high number of years (over 500 years) in the market; these values are turned into missing values. The frequency of these high values is less than 1% in the distribution of age measure.

8. Note that the WB uses this variable as a proxy for capital in the calculation of TFP (see WBES documentations online).

9. In terms of firm- and country-level control variables, as Pietrobelli et al. 2021 show in Table 1 of

To control for the level of multilateral liberalization, I also include the average MFN rates *(log(MFN Av.))* at the 4-digit ISIC 3.1 level (UN TRAINS, 2021).[10]

Adjusting controls: In models like the one implemented in this paper, potential country- and firm-level characteristics may influence the main independent and dependent variables and cause the detected interaction effect. Simply including these controls by themselves will lead to incorrect and false-positive results. As suggested by others (Keller 2014; Yzerbyt et al. 2004; Baccini et al. 2022), these control variables also need to be adjusted for the main interaction terms and included in the right-hand side of the model in addition to the main interaction variables. To meet this requirement, I interact firm-level controls with the country-level term, i.e., $Depth_{ct}$, and country-level controls with the firms-level term, i.e., $Productivity_{fict}$. It will allow us to confidently conclude that added control variables drive the outcome only in the presence of the effect of the main interaction terms.

3.4 Empirical strategy

This paper is concerned with the effect of deep integration on the GVC participation of firms, given firm productivity and the institutional environment within which firms operate and participate in GVC. To assess this conditional effect, I take a difference-in-differences (DID) approach and implement a double interaction model with country-year and industry FE (Angrist and Pischke 2009, 48-51). Using double interaction is a way to capture the DID effect. However, since the argument states

their paper, GVC participation is affected primarily by policies related to the creation of an enabling business environment (i.e., institutions), elimination of trade obstacles (i.e., integration), improvement of transport and digital infrastructures (i.e., infrastructure), and others.

10. World MFN weighted average (%) tariffs are from WITS, UNCTAD TRAINS dataset. Since this variable is at the industry level, it is interacted with both terms of interaction.

that the domestic environment may still change the way Depth and Productivity influence GVCs over time, I stratify the sample across a third variable, *Institutions*, which distinguishes between LQI and HQI at the country level, as described in the previous section.

Using a double interaction with stratification across a third variable is equivalent to a triple differences (TD) strategy (or a DIDID), which could be established as a triple interaction that looks for the change in GVC participation given the differences across the levels of deep integration, productivity, and institutions in the same model. However, for the simplicity of interpretation, we can achieve the same goal in capturing these differences through double interaction with split samples based on different levels of a third variable, i.e., the quality of institutions. As noted in other fields such as corporate finance (Atanasov and Black 2016), health science (Wing et al. 2018), and economics (Olden and Møen 2022), a powerful alternative to TD "is to limit the sample in a way that makes the third difference unnecessary" (Atanasov and Black 2016, 256). It is also advised that "researchers almost always present triple difference specification results as a supplement to a main DID specification" (Wing et al. 2018, 461). This paper follows this advice: the main strategy is a double DID with split samples based on the levels of institutional quality dummies. The results of TD estimates are presented for robustness check (see Appendix C).

I run ordinary least squares (OLS) regressions with standard errors clustered at the country-year level and split samples for LQI and HQI. In its most detailed form, the OLS model used in this paper is:

$$
\begin{aligned}
log(GVC_{fict}) = &\beta_0 + \beta_1 Productivity_{fict} + \beta_2 (Productivity_{fict} \times Depth_{ct}) + \\
&\gamma Z_{fict} + \nu (Z_{fict} \times Depth_{ct}) + \eta (M_{ct} \times Productivity_{fict}) + \\
&\delta_{ct} + \tau_i + \epsilon_{fict},
\end{aligned} \tag{3.1}
$$

where $log(GVC_{fict})$ is the log of dependent variable at the firm-industry-country-year level. $Productivity_{fict}, Depth_{ct}$, and their interaction are the main independent variables. $\beta_0, \beta_1, \beta_2, \gamma, \nu$, and η are the coefficients. The key coefficient of interest is β_2, which I expect to be positive because both variables theoretically have a positive effect on the dependent variable. δ_{ct} and τ_i are country-year and is industry fixed effects. Country-year fixed effects absorb time-variant differences across countries, whereas industry fixed effects absorb time-invariant differences across industries. Since we include δ_{ct}, I cannot estimate the coefficient of $Depth_{ct}$, i.e., it is absorbed by the country-year fixed effects. ϵ_{ict} accounts for all residual determinants of the outcome variable. The matrices of Z_{fict} (in interaction with the country-level main interaction term $Depth_{ct}$) and M_{ct} (in interaction with firm-level main interaction term $Productivity_{fict}$) include standard firm- and country-level controls, respectively.

Concerns about the identification strategy and remedies

I discuss several possible questions related to the empirical strategy used in this paper below.

The main interaction terms: Variable $Depth_{ct}$ strongly varies across countries but weakly across country-year. The variable $Productivity_{fict}$, in contrast, varies across firms, industries, and years; in addition, the correlation between the two variables is weak (0.17; see Table 3.6 in Appendix A). For this reason, $Depth_{ct}$ is not the predictor

of $Productivity_{fict}$, which is further confirmed if we regress the latter on the former with the main covariates and country, year, and industry FE.[11] The interaction of these two variables results in a term that varies significantly at the lowest level of observations, i.e., firm, industry, country, and year.

Multicollinearity: Overfitting and multicollinearity are the usual concerns about adding too many terms in models when adjusting for covariates. A classic response to these concerns is not to interact controls with covariates or to mean-center all variables before implementing the analysis. Regarding the first solution, as described above, omitting the interaction between control and the main interaction terms will lead to incorrect specification, and the second one is argued to be an overstated concern. Recent works show that "the problem of multicollinearity in interaction models has been overstated" (Brambor et al. 2006, 70) because an increase in multicollinearity among the interaction terms is expected. The main goal of "including covariate interaction terms is not to estimate their effects per se, but rather to control for their effects" on the main interaction term and rule out alternative explanations arising from those controls (Keller 2014, 8). The only way to do this is to look at the changes in the effect of the main interaction term when we vary it by controls through interaction. If the main effect from the interaction term does not change, we can be confident that alternative explanations arising from the identified controls do not affect the estimations.

Regarding the second solution, while mean-centring variables decrease the VIF of some variables, it increases the correlation among other variables, making the matter worse. In light of the previous discussion in this paragraph, mean-centring is

11. Results are available upon request.

unnecessary.[12] As Hayes et al. 2012 notes, an improvement to the "model coefficients and standard errors have nothing to do with reduced multicollinearity that results from mean centring" (p. 289). This conclusion is also supported by other advanced methodological works on the subject (Iacobucci et al. 2016; Shieh 2011).

Sampling: Theoretically, firms from countries that engage more in deep preferential integration export and participate more in GVCs. For this reason, GVC participation may be driven mostly by firms in deeply integrated countries. Two pieces of evidence address this concern. First, the WBES draws a new representative sample of firms for each new wave of surveys. Firms are not selected for their size, sales, or export, which could bias their selection for the purpose of this paper. Second, the correlation between GVC and Depth variables is low (see Table 3.5 in Appendix A). Because firms from developing countries are not overrepresented in the dataset, the GVC participation of firms from deeply integrated countries does not drive the results.

Pre-trends: Deep integration differentially affects industries across countries because tariff reduction is heterogeneous across industries and countries. For this reason, some industries in some countries might have already been on a steeper upward trend regarding trade liberalization and firm participation. These differential trends can potentially bias the outcome toward firms in deeply integrated countries and industries. To account for different trends across industries within the same country (and for different trends between industries with the same ISIC 3.1 code across different countries), I follow others on this issue (Antràs and Chor 2018, 187, Levine et al. 2018). I test for country-industry-specific time trends by including country-industry dummies with linear time variables in the main models with double and

12. Results are available upon request.

triple interactions. If the results remain unchanged by this inclusion, the possibility of bias arising from differential trends can be ruled out, providing support for the parallel-trend assumption at the country-industry level.

Additional country-level controls: While all models include key firm- and country-level controls, it is impossible to completely address the omitted variable problem (Baccini et al. 2022). However, to check for the robustness of our finding against the omission of important covariates, I take two additional steps. First, I identify and include in the main models with double (and for robustness check, also in the triple) interactions several other country-level characteristics that are conceptually and statistically correlated with both *Depth* and *Institutions* and could potentially explain away the differences in the effect of the main interaction terms across different levels of institutions on GVC participation. If adding additional covariates does not absorb the direction and significance of the effect of interaction terms in the main models, then we can be confident that these covariates do not confound the effect observed in the main models.

For example, high *economic globalization and informational globalization* scores, such as access to the internet, television, and free press, could be the key mechanism mediating the effect of interaction terms on GVC participation. The other potential mechanism could be the *historical origin of the national judicial and legal system*. Higher costs, the uncertainty of business decisions, and weaker contract and property rights regulations are associated with countries whose legal and judicial institutions have civil rather than common law origin (Levchenko 2007; La Porta et al. 2008; Pistor 2005). Countries that score high in expert-opinion indices, such as the *EODB* indicator, or attract more *foreign capital (FDI)*, or have a higher *GDP per capita* may

also be overly represented in HQI and drive the results. Therefore, I include these additional covariates in the main models of interaction with and besides the main interaction terms to see if they can provide a more powerful explanation than the quality of institution measures. Second, I also implement a sensitivity analysis (Cinelli et al. 2020) of the specified models to omit unobserved confounds that could be as strong as *Productivity*, which is the main independent variable. Again, the expectation is that our results will not dramatically change if the identification strategy taken in this paper is indeed causal.

Negative weights: OLS with fixed effects (FE) is a common tool for DID analysis. When the treatment effect is homogenous across treated units, the common trends assumption is satisfied, and the FE estimator is just a linear combination of the treatment effects across all treated units. Since the treatment is homogenous, the relationship between the residualized outcome and residualized treatment will remain linear even after removing the FE.

However, when a treatment is applied heterogeneously across units in different countries and years, and analysts control for location- and time-specific periods FE, OLS with FE may no longer be "a consistent estimator of the average treatment effect" (Gibbons et al. 2019, 1; Roth et al. 2021). This is because the FE estimator places more negative weights[13] on observations that are treated in a later period because of the expectation that the effect of the treatment is less prominent in the later than in earlier treated units, i.e. when a unit is treated in an earlier period, it remains treated in the later periods. While negative weights are a natural consequence of correctly

13. Negative weights are proportional to the residuals from a regression of treatment on country and year fixed effects, scaled by the sum of the squared residuals across all observations.

specified FE and are not in and of themselves a cause for concern when treatment is homogenous, they can severely bias the estimation when treatment timing is staggered for a large number of observations, such as in this study. One way to check for the severity of the issue is to omit late-treated observations. For example, if we implement a triple interaction model with data for only two years, the results should be similar to those obtained with all years included.

3.5 Results and discussion

Table 3.1 shows the main results with firm- and country-level controls. Models 1–3 include all firms, regardless of their institutional environment. These models show the effect of double interaction terms among Depth and Productivity on the GVC participation of firms. More specifically, Model 1 assesses this effect with country, year, and industry FE, and Model 2 includes country-year and industry FE. In all these models, the coefficient of Depth is not shown. As explained before, because of collinearity, Depth gets absorbed by FE. Model 3, in addition, includes country-industry-specific time trends. Models 1–3 show that the coefficient of double interaction among *Depth* and *Productivity* is always positive and significant. These results imply that the effect of deeper integration on GVC participation is positive when conditioned on firm-level productivity, i.e., the conditional effect of both variables is positive.

These models show that productive firms participate more in GVCs when their countries enter deeper trade agreements. In other words, deep trade agreements significantly distribute gains from GVC integration at the firm level because it enables more productive firms to stay and less productive firms to exit from GVC trade. These results remain positive and significant when Model 3 includes country-industry time

trends, i.e., linear time trends for each country-industry. The coefficient of interaction term does not change in sign and significance, suggesting that these trends do not explain a substantial portion of the variation in the outcome.

To test if the quality of formal domestic institutions mediates the effect of deep PTAs on GVCs integration across different levels of productivity (H1), Models 4 and 5 split the full sample into LQI (below the median level) and HQI (at or above the median level) environments, using the average WGI variable at 2005 baseline as described in the Data section. While for LQI, the coefficient of $Depth \times Productivity$ does not show any significant effect on GVC participation, there is a strong and positive effect on the participation of firms located in HQI countries. In other words, HQI does make a significant difference in the reallocation effect of deep PTAs among productive and unproductive firms.[14]

To ease the interpretation of results, Figure 3.4 plots the average marginal effect of shallow and deep integration on GVC participation of firms at different levels of productivity for HQI (Model 5, Table 3.1). Overall, the plot suggests that the effect of deep integration on firms' participation in GVCs increases as firms' productivity increases. Moreover, an elastic marginal effect with double interaction for HQI means that productive firms participate more in GVCs after trade liberalization when the quality of institutions is good.

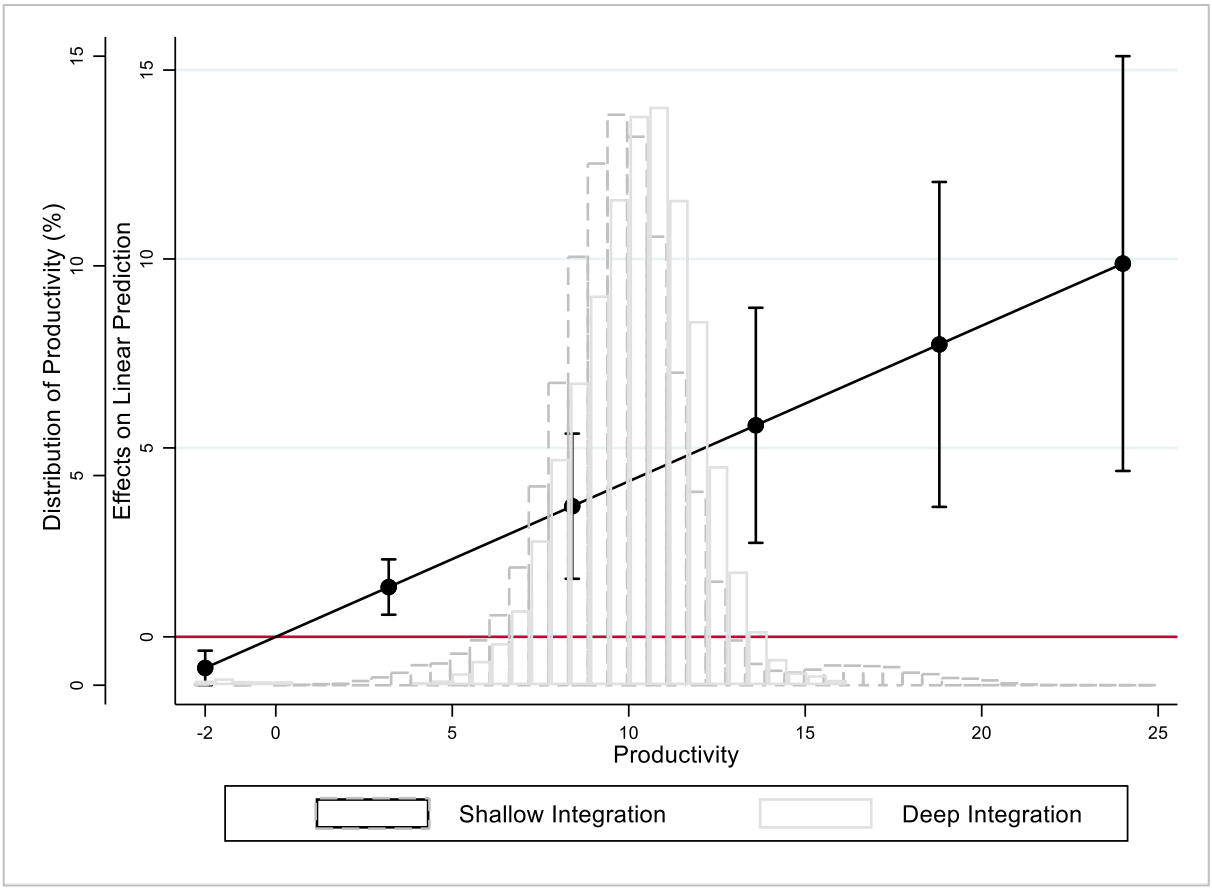
14. While the small sample size is the main suspect in yielding insignificant results, a simple power test for LQI shows that a much smaller sample size of $<$320 observations would be enough to obtain statistically significant results (at 5%). In addition, a two-tailed test of equal means between LQI and HQI for the response variable confirms that the difference between the two groups is not equal to zero and is highly significant. The overall F-statistics for Model 4 is also significant at the 1% level. Therefore, the insignificant result for LQI is not because of the power and sample size. Results are available on request.

Table 3.1: The reallocation effect of deep PTAs on GVC integration of firms for different levels of firm productivity and the quality of domestic institutions

	(1)	(2)	(3)	(4)	(5)
	logGVC)				
	Full sample			Split sample by the quality of domestic institutions	
				Low Quality	High Quality
Depth	- 6.247***				
	(1.147)				
Productivity	-0.1478	0.450	0.751	-0.125	1.633
	(0.656)	(0.865)	(0.898)	(1.020)	(1.087)
Depth*Productivity	**0.368*** **	**0.323*** **	**0.408*** **	**0.282**	**0.412*** **
	(0.082)	**(0.094)**	**(0.101)**	**(0.200)**	**(0.117)**
Constant	-21.401*	-1.862***	-25.449	-0.400	-2.675***
	(12.50)	(0.479)	(19.835)	(0.585)	(0.605)
Observations	9,719	9,719	9,719	3,296	6,423
R-squared	0.626	0.636	0.681	0.709	0.589
Firm-level controls	✓	✓	✓	✓	✓
Country-level controls	✓	✓	✓	✓	✓
Country-year FE		✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Country FE	✓				
Year FE	✓				
Country-industry time trends			✓		

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

Figure 3.4: Average marginal effect of deep PTAs on GVC integration of firms for different levels of firm productivity in countries with HQI



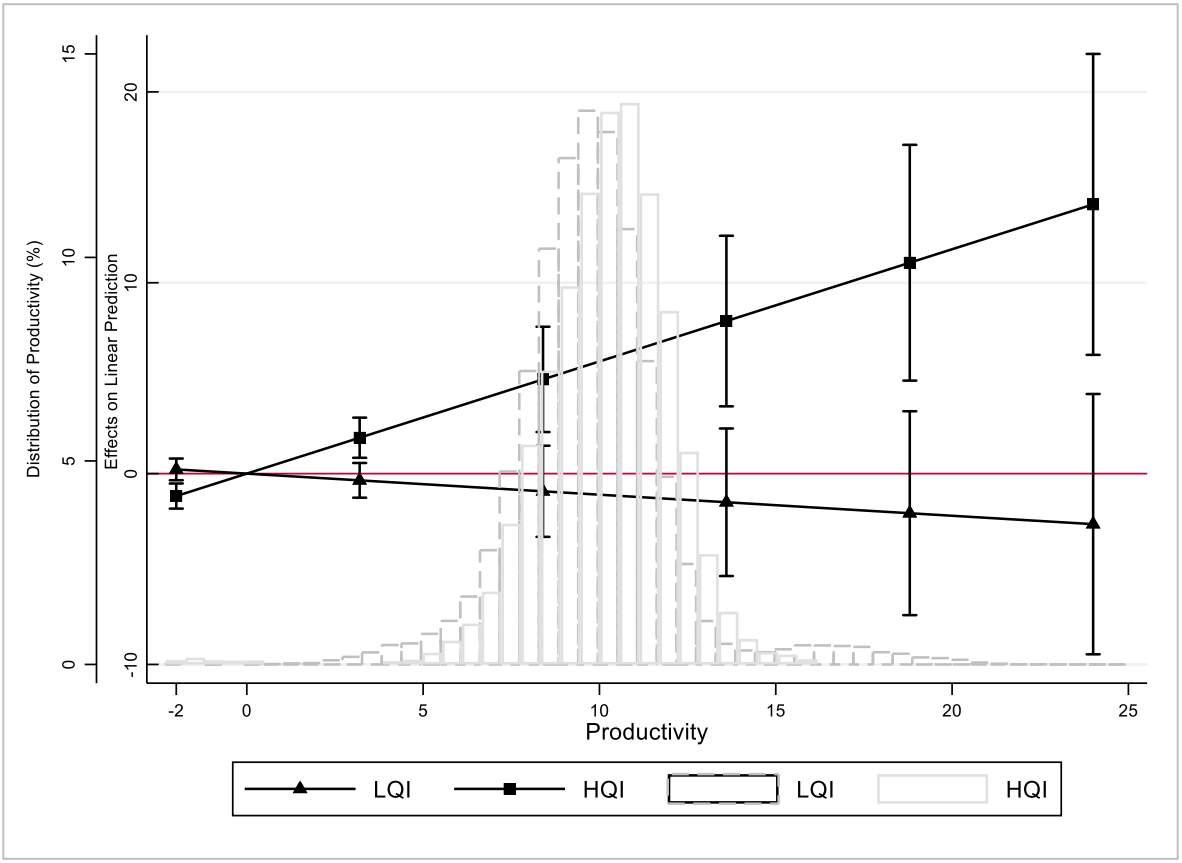
Note: Marginal prediction for HQI sub-sample is based on Model 5, Table 3.1. The histogram shows the distribution of Productivity for countries with shallow and deep preferential trade liberalization; 95% confidence interval.

As noted, double interaction with the split sample across a third variable is equivalent (and preferable due to the ease of interpretation) to a triple interaction strategy. To check if the robustness of the results from Models 4 and 5 are confirmed when we look at the differences between the effects of deep integration across different levels of institutions and productivity in the same model, I also implement a triple differ-

ence by interacting directly the continuous average WGI variable at 2005 baseline with *Depth*×*Productivity* (see Table 3.8 Appendix C). The strong mediating effect of institutions on GVC participation of firms across different levels of depth and productivity is confirmed and in line with Models 4 and 5 in Table 3.1. The coefficients of the double interaction term (Model 2, Table 3.1) and the triple interaction term (Model 2, Table 3.8 Appendix C) also remain robust with the inclusion of additional country-level covariates (see Tables 3.7 and 3.8 in Appendix C).

Figure 3.5 shows the average marginal effect of triple interaction at 95% CI (see also Table 3.8 in Appendix C). The marginal effect of trade liberalization for different levels of productivity and the institutional quality shows a strong and positive effect on HQI. The CIs for HQI remains above the zero line and do not overlap with LQI, i.e., the means of these two groups are different. LQI has a downward trend but covers the zero line, too, indicating that the environment may have no and even a negative effect on firms' participation in GVCs after trade integration. On the other hand, more productive firms in LQI may disintegrate from GVCs after trade liberalization. In other words, the distributional effect of trade liberalization, given firms' productivity, works in the HQI environment.

Figure 3.5: Average marginal effect of deep PTAs on GVC integration of firms for different levels of firm productivity and quality of domestic institutions



Note: Marginal prediction based on using Model 2 in Table 3.8 Appendix C. The histogram shows the distribution of Productivity for LQI and HQI countries; 95% confidence interval.

Another way to simplify the interpretation of the results of a three-way continuous interaction term is the analysis of simple slopes. An analysis and pair-wise comparison of simple slopes for GVC participation of firms show significant (at 1%) within-group differences for productive and unproductive firms across different institutional environments and across-group differences for productive and unproductive firms in HQI environments. This comparison confirms that HQI enables productive firms to integrate more completely in GVCs after deepening trade integration.

Because the main variable that captures the quality of institutions is an average of all six dimensions of WGI (2005), it may be that consistently robust results for HQI described above are driven by only one or a few strong dimensions of WGI estimates. Table 3.2 deals with this concern. Models 1–6 estimate the joint effect of Depth and Productivity conditioned on different dimensions of institutional quality. They split the full sample into low (below the median level) and high (at or above the median level) institutional environments, using VA, PV, GE, RQ, RL, and CC at the 2005 baseline. Since each dimension captures different aspects of political, regulatory, and judicial institutions, some are more directly related to the private sector development than others.

For example, by definition, those most directly dealing with firms and production are RQ, which captures the quality of policies and regulations geared toward private sector agents and their development, and RL, which captures confidence in the quality of regulations, quality of contract enforcement, property rights, and the courts. Results show that productive firms in countries that score high in these dimensions integrate more in GVCs after trade liberalization than other firms. Results consistently show that the mediating effect of HQI across all six constitutive dimensions of the WGI indicator remains significant for productive firms in HQI countries.

For each dimension of institutions, Figure 3.6, plots the marginal effects of deep integration across different productivity levels for firms in HQI, using Table 3.2, i.e., Models 2, 4, 6, 8, 10, 12. The slope for RQ plot is slightly more elastic than other dimensions, especially when firms' productivity increases.

Table 3.2: The reallocation effect of deep PTAs on firms' GVC integration for different levels of firm productivity across different institutional dimensions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	log(GVC)											
	WGI indicators (2005)											
	Voice/Accountability (VA)		Political Stability/ Absence of Violence (PV)		Government Effectiveness (GE)		Regulatory Quality (RQ)		Rule of Law (RL)		Control of Corruption (CC)	
	LQI	HQI	LQI	HQI	LQI	HQI	LQI	HQI	LQI	HQI	LQI	HQI
Productivity	-0.946	2.195	0.554	0.663	0.145	1.278	-1.134	1.786*	0.190	0.897	-0.846	2.092**
	(0.932)	(1.348)	(1.163)	(0.918)	(0.912)	(1.104)	(1.084)	(0.981)	(1.008)	(1.204)	(0.980)	(1.056)
Depth* Productivity	**0.313****	**0.408*****	**0.282***	**0.431*****	**0.368****	**0.409*****	**0.280**	**0.446*****	**0.115**	**0.388*****	**0.287**	**0.383*****
	(0.143)	**(0.143)**	**(0.151)**	**(0.109)**	**(0.146)**	**(0.123)**	**(0.194)**	**(0.114)**	**(0.167)**	**(0.121)**	**(0.189)**	**(0.110)**
Constant	0.182	-2.667***	-0.581	-2.805***	-0.485	-2.528***	-0.053	-2.85***	-1.758***	-2.457***	0.228	-2.617***
	(0.567)	(0.655)	(0.564)	(0.602)	(0.527)	(0.690)	(0.595)	(0.642)	(0.613)	(0.668)	(0.574)	(0.591)
Observations	3,502	6,217	3,782	5,921	3,248	6,471	3,370	6,349	3,847	5,872	3,333	6,386
R-squared	0.688	0.601	0.648	0.634	0.703	0.590	0.686	0.602	0.695	0.581	0.697	0.601
Firm-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country-year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

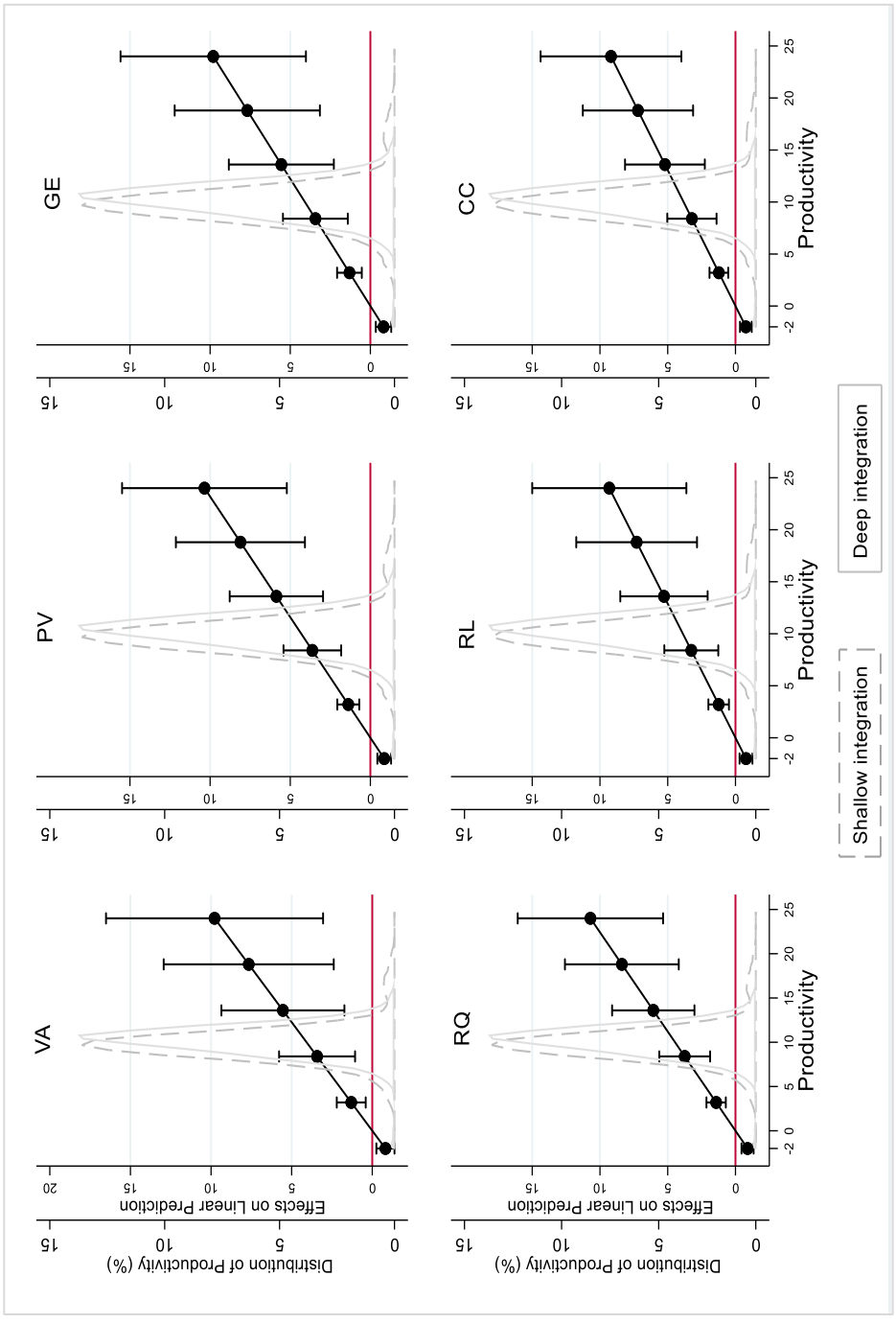


Figure 3.6: Average marginal effect of deep PTAs on firms' GVC integration for different levels of firm productivity across different dimensions of HQI

Table 3.3 presents the results from an interaction between Depth and Productivity given the quality of contract enforcement and regulations in several important-for-production areas (H2). The measure of contract enforcement is from the EODB (Models 9 and 10). Other measures are firm-level assessments from WBES (Models 1–8). In magnitude, the reallocation effect of HQI on GVC integrations after the deepening of trade integration for productive firms is twice that of LQI.

Since the effects for LQI across all areas are significant at least a 10% level of significance, we can estimate the marginal effects for both institutional environments. Figure 3.7 plots the marginal effects of deep integration for both LQI and HQI. Note that all plots in this paper are within 95% CI. In line with previous results, more elastic marginal effect lines for HQI show that the distributional effect of trade integration is higher in HQI environments across different productivity levels than in LQI.

Other measures of GVCs: Other outcome variables also confirm the importance of good regulations and contracts for GVC integration after trade liberalization. I estimate the effect of triple interaction among Depth, Productivity, and Institutions on other indicators of GVC activities, i.e., DVX, FVA, and forward (DVX>FVA) and backward (DVX<FVA) linkages (Table 3.10 Appendix C). The mediating effect of institutions is positive and significant. Results are similar to our main findings with GVC participation variables for both components of the GVC participation index: FVA and DVX, with a larger effect on downstream than upstream GVC trade represented by FVA and DVX, respectively. From the perspective of production linkages, the effect on backward (downstream/buyers/final producers) is positive as well.

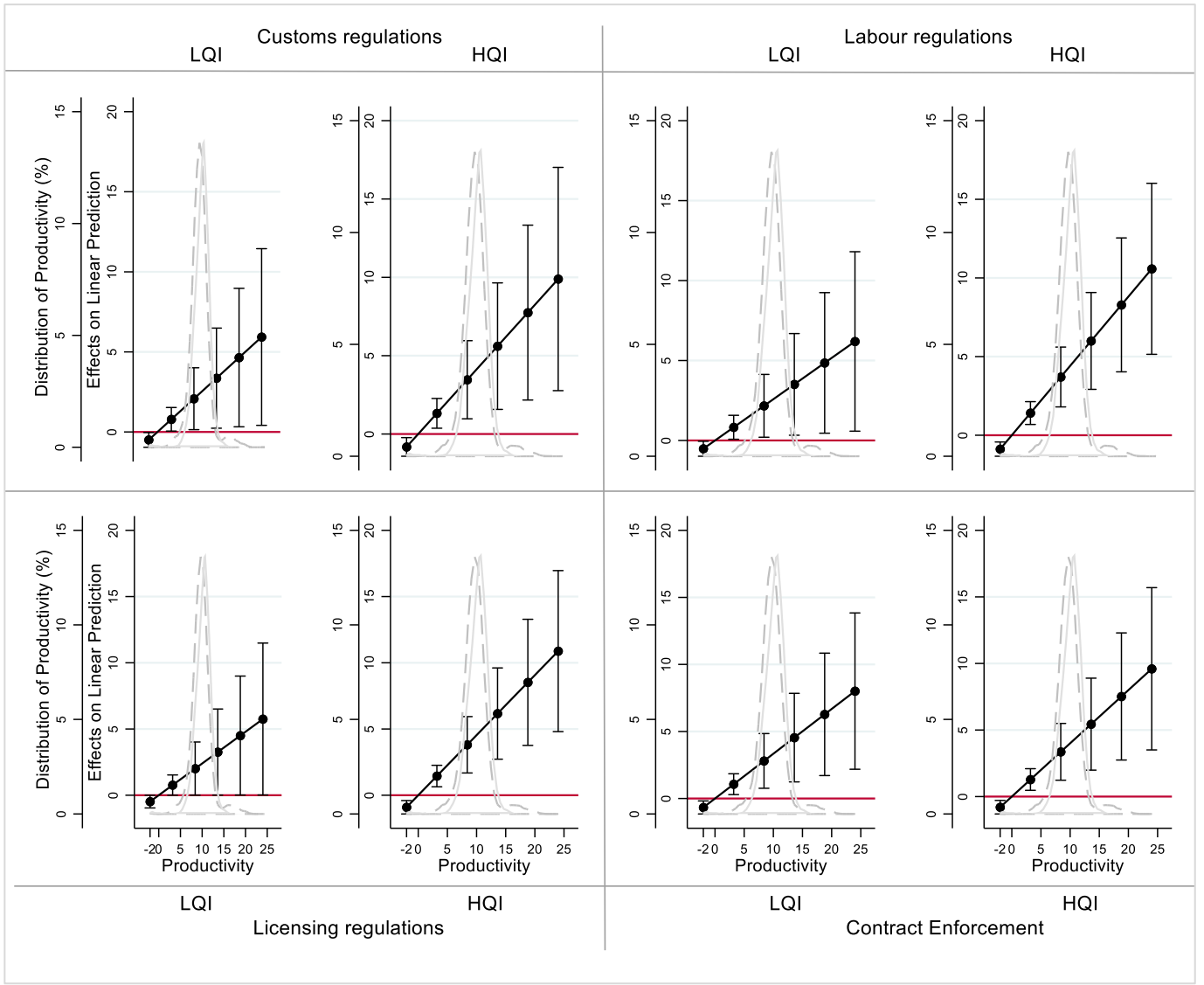
Table 3.3: The reallocation effect of deep PTAs on GVC integration of firms for different levels of firm productivity and regulatory quality of institutions and contract enforcement

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Customs regulations		Labour regulations		Licensing regulations		Contract Enforcement	
	LQI	HQI	LQI	HQI	LQI	HQI	LQI	HQI
Productivity	0.729	-0.237	0.791	-0.012	1.336	-0.655	-0.311	1.356
	(0.906)	(1.278)	(1.013)	(1.049)	(0.853)	(1.238)	(0.923)	(1.259)
Depth*Productivity	**0.247****	**0.412*****	**0.258****	**0.441*****	**0.240***	**0.453*****	**0.334*****	**0.400*****
	(0.117)	**(0.151)**	**(0.119)**	**(0.116)**	**(0.122)**	**(0.129)**	**(0.124)**	**(0.130)**
Constant	-1.395**	-2.708***	-2.027***	-1.457*	-1.951***	-2.093**	-1.709***	-2.051***
	(0.550)	(0.781)	(0.557)	(0.772)	(0.509)	(0.813)	(0.547)	(0.689)
Observations	6,070	3,615	6,006	3,469	5,282	4,105	3,933	5,629
R-squared	0.662	0.617	0.648	0.637	0.660	0.628	0.665	0.624
Firm-level controls	✓	✓	✓	✓	✓	✓	✓	✓
Country-level controls	✓	✓	✓	✓	✓	✓	✓	✓
Country-year FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

Note: The computation of the indicator is based on the rating of the obstacle as a potential constraint to the current operations of the establishment.

Figure 3.7: Average marginal effect of deep PTAs on GVC integration of firms for different levels of firm productivity and regulatory quality of institutions and contract enforcement



These outcomes are reasonable because downstream firms import inputs and components tailored to their specification from abroad to process, assemble, and export, e.g., furniture or semi-finished parts for furniture assembly. Since downstream products are more differentiated and customized, and supplier-buyer relations are more relationship-specific and sensitive to JIT delivery and contract intensity, the reallocation effect of deep integration on productive firms increases as the regulatory quality of institutions increases. These results provide additional support for H2.

For forward-oriented (upstream/supplier) firms, i.e., firms with forward linkages, the effect of interaction is negative and small. Since upstream firms export less customized inputs and more raw materials, e.g., lumber used by other countries to make furniture, they involve supplier-buyer relations that are less relationship-specific and less sensitive to JIT delivery and contract intensity. For this reason, we observe that the effect of deep integration on productive firms decreases when the regulatory quality of institutions increases. The mediating effect of a strong regulatory environment may cause firms' disintegration from forward GVC linkages as they become more productive. I cannot say that these firms switch from forward to backward GVC integration as they become more productive because firms are not identified across time in the dataset. Future research must elaborate more on the differential effect of integration on upstream and downstream firms and their change in position.

Additional tests

As noted in the empirical strategy section, pre-trends and other confounders may seriously affect the validity of the results. Because tariffs are reduced heterogeneously across industries and countries, some industries in some countries and years may be on a steeper growth curve. To account for different trends across industries within

the same country (and for different trends between industries with the same ISIC 3.1 code across different countries), I include country-industry dummies with a linear time variable in the main double interaction as well as in triple interaction models for a robustness check (Model 3 in Table 3.1 and Model 3 in Table 3.8 Appendix C). The main results remain unchanged for this inclusion, which indicates that differential trends within the specified group are not driving the results.

Although all models include many firm- and country-level controls, other unaccounted country-level observed confounders could potentially explain away the effect of double and triple differences described above. To address this concern, I take a more conservative approach (Baccini et al. 2022) and include in the main models several other potential country-level characteristics (i.e., globalization, the historical foundation of institutions, business climate, capital inflows, and income) in interaction with (and in addition to) Depth and Productivity. Including confounders does not absorb the direction and significance of the effect of the main interaction terms (see Tables 3.7 and 3.8 Appendix C). This means that the effect observed in the main models is not confounded by additional country-level factors associated with integration and institutions. I test these other covariates to see if they are more powerful mechanisms than the overall quality of institutions that explain the differences in the conditional effect of deep integration and productivity on firms' participation in GVCs.

In addition, I also implement a sensitivity analysis (Cinelli et al. 2020) of the specified models to the omission of *unobserved* confounders that I define to be at least as strong as *Productivity*, which is the main independent variable, in their explanatory power. Results show (see Table 3.11 and Figure 3.9 Appendix D) that point estimates for an unobserved confounding that could be twice or even three times stronger than

the benchmark variable *Productivity* remain significant and within the limits of positive effect boundaries. This test also suggests that the identification strategy with the specified variables in this paper is indeed causal.

3.6 Conclusions and implications

This paper used micro- and macro-level data to measure GVC participation at the firm and deep PTAs at the country levels. It examined the distributional consequences of deep PTAs for firms' integration in GVCs across different levels of institutional quality and firm productivity. The main findings are threefold. First, the paper showed that firm productivity explains most (but not all) of the differences in firms' participation in GVCs, as preferential liberalization becomes comprehensive. Second, it showed that the reallocation effect of deep integration is stronger in HQI than in LQI. As trade integration gets deeper at the country level and trade and non-trade barriers are removed, firms in HQI environments integrate and participate more in GVCs than firms in LQI environments. Third, among other dimensions of domestic institutions, the regulatory quality of institutions and the low cost of contract enforcement may be more important for GVC integration because of the specialized and contract-dependent nature of GVCs.

These findings imply that the effect of deep liberalization on firms is conditioned not only by the heterogeneous characteristics of firms (such as productivity) but also by the quality of local institutions. Under the globalization of production and proliferation of trade integration, the role of domestic institutions has not become obsolete. In contrast, as results in this paper show, the quality of domestic institutions continues to exert influence over new and more globalized patterns of trade and production

that are assumed to be exogenously imposed on countries, especially in the developing world. While countries interested in increasing their welfare gains from the globalization of production and the deepening of trade relations may not have control over all success mechanisms, they very much have control over improving the quality of their domestic institutions, i.e., as a strong source of comparative advantage for GVCs. The case of Vietnam and its successful participation in GVCs (not just export) can be explained by its ability to have better institutions than other countries in its income group. The other emerging case is Rwanda and its effort to attract and maintain global producers by improving its institutions' regulatory and bureaucratic quality. Therefore, the proliferation of deep integration and trade in GVCs cannot be a useful development tool unless the local regulatory and governance conditions are improved.

Furthermore, the positive effect of high-quality institutions on the national economy cuts two-way. On the one hand, their presence works as a positive natural selection mechanism on the private sector development, filtering out unproductive firms who fail to adapt to the new environment created by more comprehensive trade liberalization. In this context, good institutions help countries gain from trade liberalization and GVCs. However, on the other hand, the effect of good institutions rewards productive firms more than unproductive firms after trade liberalization becomes more comprehensive, petting losing firms and workers against more GVC and trade integration. In this context, the debates and discussions of reshoring and backlash against globalization may create political and economic divisions and undermine national and international development efforts.

A strong reallocation effect from trade integration on firms' participation in GVCs in HQI may also suggest that firms (and the public) in HQI may be more divided

on the benefits from more GVC integration and trade than firms (and the public) in LQI. In broader terms, the backlash against globalization and offshoring may be a more developed-country phenomenon, while developing countries' private and public interests remain interested in an open trade system. Since I do not find negative (and significant) effects on firms' participation in GVCs in LQI, we cannot conclude that most losers are concentrated in LQI environments, mostly developing and emerging economies. However, it is clear that the quality of domestic institutions is a source of comparative advantage for GVCs' integration under trade liberalization, and their improvement must be an essential element of policies geared toward GVC integration. The key implication is that the proliferation of deep integration and trade in GVCs will not yield significant economic welfare locally unless the local regulatory and governance conditions are improved.

3.7 Bibliography

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91, (5): 1369–1401.

———. 2005. "Institutions as a Fundamental Cause of Long-Run Growth." *Handbook of economic growth* 1,385–472.

Altomonte, Carlo, and Filippo di Mauro. 2022. *The Economics of Firm Productivity: Concepts, Tools and Evidence.* Cambridge: Cambridge University Press.

Amiti, Mary, and Jozef Konings. 2007. "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia." *American Economic Review* 97, (5): 1611–1638.

Ang, James S., Yingmei Cheng, and Chaopeng Wu. 2014. "Does Enforcement of Intellectual Property Rights Matter in China? Evidence from Financing and Investment Choices in the High-Tech Industry." *Review of Economics and Statistics* 96, (2): 332–348.

Angrist, Joshua, and Jorn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, Princeton.

Antràs, Pol. 2003. "Firms, Contracts, and Trade Structure." *The Quarterly Journal of Economics* 118, (4): 1375–1418.

Antras, Pol, and Davin Chor. 2021. "Global Value Chains." In *National Bureau of Economic Research.* Working Paper. National Bureau of Economic Research.

Antràs, Pol, and Davin Chor. 2018. "On the Measurement of Upstreamness and Downstreamness in Global Value Chains." In *World Trade Evolution,* edited by Pol Antras and Davin Chor. Routledge.

Antràs, Pol, and Elhanan Helpman. 2004. "Global Sourcing." *Journal of Political Economy* 112, (3): 552–580.

Aslam, Aqib, Natalija Novta, and Fabiano Rodrigues-Bastos. 2017. *Calculating Trade in Value Added.* International Monetary Fund.

Atanasov, Vladimir, and Bernard Black. 2016. "Shock-Based Causal Inference in Corporate Finance and Accounting Research." *Critical Finance Review* 5, (2): 207–304.

Baccini, Leonardo, and Andreas Dür. 2018. "Global Value Chains and Product Differentiation: Changing the Politics of Trade." *Global Policy* 9,49–57.

Baccini, Leonardo, Andreas Dür, and Manfred Elsig. 2018. "Intra-Industry Trade, Global Value Chains, and Preferential Tariff Liberalization." *International Studies Quarterly* 62, (2): 329–340.

Baccini, Leonardo, Mattia Guidi, Arlo Poletti, and Aydin B. Yildirim. 2022. "Trade Liberalization and Labor Market Institutions." *International Organization* 76, (1): 70–104.

Baccini, Leonardo, Ian Osgood, and Stephen Weymouth. 2017. *The Service Economy: Understanding Sectoral Differences in Patterns of Lobbying for Trade in the United States.* Mimeo.

Baccini, Leonardo, Pablo Pinto, and Stephen Weymouth. 2017. "The Distributional Consequences of Preferential Trade Liberalization: Firm-Level Evidence." *International Organization* 71, (2): 373–395.

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 2003. "Law and Finance: Why Does Legal Origin Matter?" *Journal of Comparative Economics* 31, (4): 653–675.

Bernard, Andrew B., and J. Bradford Jensen. 1999. "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics* 47, (1): 1–25.

Bernard, Andrew, Jonathan Eaton, Bradford Jensen, and Samuel Kortum. 2003. "Plants and Productivity in International Trade." *American Economic Review* 93, (4): 1268–1290.

Boehm, Johannes. 2022. "The Impact of Contract Enforcement Costs on Value Chains and Aggregate Productivity." *The Review of Economics and Statistics* 104, (1): 34–50.

Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. "Understanding Interaction Models: Improving Empirical Analyses." *Political Analysis* 14, (1): 63–82.

Cattaneo, Matias D., Richard K. Crump, Max H. Farrell, and Yingjie Feng. 2021. "Binscatter Regressions."

Chong, Alberto, and Luisa Zanforlin. 2000. "Law Tradition and Institutional Quality: Some Empirical Evidence." *Journal of International Development: The Journal of the Development Studies Association* 12, (8): 1057–1068.

Chor, Davin. 2010. "Unpacking Sources of Comparative Advantage: A Quantitative Approach." *Journal of International Economics* 82, (2): 152–167.

Cinelli, Carlos, Jeremy Ferwerda, and Chad Hazlett. 2020. "Sensemakr: Sensitivity Analysis Tools for OLS in R and Stata." *Available at SSRN 3588978.*

Cinelli, Carlos, and Chad Hazlett. 2020. "Making Sense of Sensitivity: Extending Omitted Variable Bias." *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 82, (1): 39–67.

Coase, Ronald H. 1992. "The Institutional Structure of Production." In *Handbook of New Institutional Economics,* 31–39. Springer.

Costinot, Arnaud. 2009. "On the Origins of Comparative Advantage." *Journal of International Economics* 77, (2): 255–264.

Cunat, Alejandro, and Marc J. Melitz. 2012. "Volatility, Labor Market Flexibility, and the Pattern of Comparative Advantage." *Journal of the European Economic Association* 10, (2): 225–254.

De Marchi, Valentina, Elisa Giuliani, and Roberta Rabellotti. 2018. "Do Global Value Chains Offer Developing Countries Learning and Innovation Opportunities?" *The European Journal of Development Research* 30, (3): 1–19.

Dollar, David, and Matthew Kidder. 2017. *Institutional Quality and Participation in Global Value Chains.* The World Bank.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig. 2014. "The Design of International Trade Agreements: Introducing a New Dataset." *The Review of International Organizations* 9, (3): 353–375.

Eckhardt, Jappe, and Arlo Poletti. 2018. "Introduction: Bringing Institutions Back in the Study of Global Value Chains." *Global Policy* 9,5–11.

Freund, Caroline, and Martha Denisse Pierola. 2015. "Export Superstars." *Review of Economics and Statistics* 97, (5): 1023–1032.

Ge, Ying, David Dollar, and Xinding Yu. 2020. "Institutions and Participation in Global Value Chains: Evidence from Belt and Road Initiative." *China Economic Review* 61, (101447).

Gereffi, Gary. 2018. *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism.* Cambridge University Press.

Gereffi, Gereffi, John Humphrey, and Timothy Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy* 12, (1): 78–104.

Gibbons, Charles E., Juan Carlos Suarez Serrato, and Michael B. Urbancic. 2019. "Broken or Fixed Effects?" *Journal of Econometric Methods* 8, (1): 1–12.

Goldberg, Pinelopi, Amit Khandelwal, Nina Pavcnik, and Petia Topalova. 2010. "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India." *The Quarterly Journal of Economics* 125, (4): 1727–1767.

Grossman, Gene M., and Elhanan Helpman. 2005. "Outsourcing in a Global Economy." *The Review of Economic Studies* 72, (1): 135–159.

Hall, Robert E., and Charles I. Jones. 1999. "Why Do Some Countries Produce so Much More Output per Worker than Others?" *The Quarterly Journal of Economics* 114, (1): 83–116.

Hayes, Andrew F., Carroll J. Glynn, and Michael E. Huge. 2012. "Cautions Regarding the Interpretation of Regression Coefficients and Hypothesis Tests in Linear Models with Interactions." *Communication Methods and Measures* 6, (1): 1–11.

Hummels, David, Jun Ishii, and Kei-Mu Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 54, (1): 75–96.

Iacobucci, Dawn, Matthew J. Schneider, Deidre L. Popovich, and Georgios A. Bakamitsos. 2016. "Mean Centering Helps Alleviate "Micro" but Not "Macro" Multicollinearity." *Behavior Research Methods* 48, (4): 1308–1317.

Johnson, Robert. 2018. "Measuring Global Value Chains." *Annual Review of Economics* 10, (1): 207–236.

Johnson, Robert, and Guillermo Noguera. 2012. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of International Economics* 86, (2): 224–236.

Keller, Matthew C. 2014. "Gene-by-Environment Interaction Studies Have Not Properly Controlled for Potential Confounders: The Problem and the (Simple) Solution." *Biological Psychiatry* 75, (1).

Knack, Stephen, and Philip Keefer. 1995. "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." *Economics & Politics* 7, (3): 207–227.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104, (2): 459–494.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2008. "The Economic Consequences of Legal Origins." *Journal of Economic Literature* 46, (2): 285–332.

Laget, Edith, Alberto Osnago, Nadia Rocha, and Michele Ruta. 2020. "Deep Trade Agreements and Global Value Chains." *Review of Industrial Organization* 57, (2): 379–410.

Levchenko, Andrei A. 2007. "Institutional Quality and International Trade." *The Review of Economic Studies* 74, (3): 791–819.

Levine, Ross, Chen Lin, and Wensi Xie. 2018. "Corporate Resilience to Banking Crises: The Roles of Trust and Trade Credit." *Journal of Financial and Quantitative Analysis* 53, (4): 1441–1477.

Lipsey, Richard G., and Kenneth I. Carlaw. 2004. "Total Factor Productivity and the Measurement of Technological Change." *Canadian Journal of Economics/Revue canadienne d'économique* 37, (4): 1118–1150.

Long, Cheryl Xiaoning. 2010. "Does the Rights Hypothesis Apply to China?" *The Journal of Law and Economics* 53, (4): 629–650.

Manova, Kalina. 2013. "Credit Constraints, Heterogeneous Firms, and International Trade." *Review of Economic Studies* 80, (2): 711–744.

Melitz, Marc. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71, (6): 1695–1725.

Montalbano, Pierluigi, Silvia Nenci, and Carlo Pietrobelli. 2018. "Opening and Linking up: Firms, GVCs, and Productivity in Latin." *America. Small Business Economics* 50, (4): 917–935.

Murray, Alexander. 2016. "Partial versus Total Factor Productivity Measures: An Assessment of Their Strengths and Weaknesses." *International Productivity Monitor,* no. 31: 113.

North, Douglas. 1990. *Institutions, Institutional Change and Economic Performance.* Cambridge.

Nunn, Nathan. 2007. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *The Quarterly Journal of Economics* 122, (2): 569–600.

Nunn, Nathan, and Daniel Trefler. 2014. "Domestic Institutions as a Source of Comparative Advantage." In *Handbook of International Economics,* 4:263–315. Elsevier.

Olden, Andreas, and Jarle Møen. 2022. "The Triple Difference Estimator." *The Econometrics Journal* 25, (3): 531–553.

Ottaviano, Gianmarco IP. 2008. "Contract Enforcement, Comparative Advantage and Long-Run Growth." In *In Elhanan Helpman, Dalia Marin, and Thierry Verdier, Eds. "The Organization of Firms in a Global Economy".* Harvard University Press.

Pietrobelli, Carlo, Roberta Rabellotti, and Ari Van Assche. 2021. "Making Sense of Global Value Chain-Oriented Policies: The Trifecta of Tasks, Linkages, and Firms." *Journal of International Business Policy* 4, (3): 327–346.

Pinna, Matteo. 2020. *Binned Scatterplots With Marginal Histograms: Binscatterhist.* SSRN Scholarly Paper ID 3719940. Rochester, NY: Social Science Research Network.

Pisch, Frank. 2020. "Managing Global Production: Theory and Evidence from Just-in-Time Supply Chains." University of St. Gallen Discussion Paper No. 2020-08.

Pistor, Katharina. 2005. “Legal Ground Rules in Coordinated and Liberal Market Economies.” SSRN Scholarly Paper, Rochester, NY.

Razeq, Zarlasht. 2022. “Deep Trade Integration and North-South Participation in GVCs.” *Transnational Corporations Journal* 29, (3): 1–40.

Roth, Jonathan, Pedro H C SantAnna, Alyssa Bilinski, and John Poe. 2021. “What’s Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature.”

Shieh, Gwowen. 2011. “Clarifying the Role of Mean Centring in Multicollinearity of Interaction Effects.” *British Journal of Mathematical and Statistical Psychology* 64, (3): 462–477.

Stepner, Michael. 2013. “BINSCATTER: Stata Module to Generate Binned Scatterplots.”

Taglioni, Daria, and Deborah Winkler. 2016. *Making Global Value Chains Work for Development.* World Bank Publications.

Topalova, Petia, and Amit Khandelwal. 2011. “Trade Liberalization and Firm Productivity: The Case of India.” *Review of Economics and Statistics* 93, (3): 995–1009.

UN, ed. 2009. *System of National Accounts 2008.* New York: United Nations.

———. 2018. *Classification by Broad Economic Categories, Rev.5: Defined in Terms of the Harmonized Commodity Description and Coding System (2012) and the Central Product Classification, 2.1* ST/ESA/STAT/SER.M/53/Rev.5. UN.

Van Biesebroeck, Johannes, and Emmanuel Buadi Mensah. 2019. “The Extent of GVC Engagement in Sub-Saharan Africa.” Policy Research Working Paper 8937, World Bank.

WB. 2020a. *Handbook of Deep Trade Agreements.* Washington, DC: World Bank.

Wing, Coady, Kosali Simon, and Ricardo A. Bello-Gomez. 2018. "Designing Difference in Difference Studies: Best Practices for Public Health Policy Research." *Annual Review of Public Health* 39,453–469.

Winkler, Deborah Elisabeth, and Thomas Farole. 2015. *Global Value Chain Integration and Productivity: Evidence from Enterprise Surveys in Namibia, South Africa, and Swaziland.* The World Bank.

Wooldridge, Jeffery. 2010. *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

Yzerbyt, Vincent Y., Dominique Muller, and Charles M. Judd. 2004. "Adjusting Researchers' Approach to Adjustment: On the Use of Covariates When Testing Interactions." *Journal of Experimental Social Psychology* 40, (3): 424–431.

3.8 Appendix to Chapter 3

Appendix A

Table 3.4: Summary statistics

	N	Mean	St.Dev	min	max	skewness
log(GVC)	9719	13.536	2.485	3.202	25.365	.038
Depth	9719	.131	.468	-1.433	.922	-.089
Productivity	9719	10.626	1.672	1.613	20.485	.132
Institutions (WGI Av.), 2005	9719	-.025	.755	-1.664	1.691	.612
Institutions (WGI Av.) dummy, 2005	9719	.661	.473	0	1	-.68
Voice/Accountability, 2005	9719	1.64	.48	1	2	-.582
Political Stability, 2005	9703	1.61	.488	1	2	-.452
Government Effectiveness, 2005	9719	1.666	.472	1	2	-.703
Regulatory Quality, 2005	9719	1.653	.476	1	2	-.644
Rule of Law, 2005	9719	1.604	.489	1	2	-.426
Control of Corruption, 2005	9719	1.657	.475	1	2	-.662
Contract Enforcement, 2005	9576	1.599	.49	1	2	-.405
Age	9719	2.993	.779	0	5.394	-.359
Assets	9719	13.487	2.535	-6.48	26.142	-.376
Innovation	9719	.559	.496	0	1	-.239
License	9719	1.75	.433	1	2	-1.158
Av. MFN	9719	1.511	.92	-2.659	3.787	-.733
log(GDP)	9719	25.892	1.652	20.339	29.604	-.152
log(Export)	9719	10.559	1.747	2.441	14.482	-.366
Infrastructure	9719	17.924	12.135	.058	58.362	.649
Depth*Productivity	9719	1.563	5.152	-15.877	15.3	.023
Depth*Age	9719	.401	1.485	-5.391	4.743	.053
Depth*Assets	9719	1.859	6.526	-25.095	19.716	-.016
Depth*Innovation	9719	.085	.371	-1.433	.922	.343
Depth*License	9719	.23	.851	-2.867	1.845	-.04
Depth*Av. MFN	9719	.03	.761	-3.3	1.956	-.501
Productivity*Av. MFN	9719	15.762	9.786	-33.348	58.422	-.517
Productivity*log(GDP)	9719	275.626	48.763	44.534	533.957	-.117
Productivity*log(Export)	9719	112.835	27.646	19.234	243.119	-.082
Productivity*Infrastructure	9719	196.454	143.809	.218	965.485	.9

Table 3.5: Correlation of main variables

	log(GVC)	Depth	Productivity	Institutions (av. 2005)	Age	Assets	Innovation	License	Av. MFN	log(GDP)	log(Export)
log(GVC)											
Depth	0.12										
Productivity	0.63	0.17									
Institutions (av. 2005)	0.2	0.6	0.3								
Age	0.18	0.08	0.10	0.18							
Assets	0.61	0.13	0.66	0.27	0.20						
Innovation	0.06	0.10	0.03	0.07	0.12	0.08					
License	-0.14	-0.06	-0.09	-0.04	-0.03	-0.17	-0.13				
Av. MFN	-0.09	-0.31	-0.15	-0.26	-0.08	-0.16	-0.03	0.06			
log(GDP)	0.16	0.01	0.10	0.14	0.10	0.11	0.11	0.03	-0.03		
log(Export)	0.18	0.10	0.14	0.21	0.09	0.11	0.11	0.03	-0.09	0.94	
Infrastructure	0.13	0.34	0.32	0.51	0.10	0.25	-0.04	-0.01	-0.24	0.19	0.28

Table 3.6: Correlation of covariates

	Depth	Institutions (av. 2005)
Depth	1	
Institutions (av. 2005)	0.58	1
Economic Globalization	0.59	0.71
Common Law	-0.32	-0.04
Ease of Doing Business Av. Score (2005)	0.46	0.56
log(GDPpc)	0.41	0.70
log(Inward FDI)	0.01	0.23
Informational Globalization	0.38	0.63

Appendix B

Measuring GVC participation

As discussed in Razeq (2022), thanks to advancements in accounting and statistical methods related to multi-regional (global) input-output (MRIO) tables (Aslam et al. 2017; Koopman et al. 2014; Johnson and Noguera 2012), there are now several macro datasets that capture key aspects of GVC trade at the country level.

The three key continuous monadic GVCs indicators that can be derived from MRIO tables and the SNA include: 1) foreign VA to export (FVA), i.e., the annual amount of foreign-produced VA that is imported for further processing or assembly; 2) domestic VA to export (DVA), i.e., the annual amount of VA that is generated domestically in the process of production of final or intermediate products for export; and 3) indirect VA by this country contained in the export of other countries where items are exported for further processing and subsequent export (DVX). These three indicators can be used to derive two aggregate indicators: 1) a measure of the overall GVC participation of a country, which is the sum of FVA and DVX and is a GVC-specific measure of trade integration (Hummels et al. 2001); and 2) a highly correlated to the first one measure of the overall VA to export (VAX) regardless of its origin, which is the sum of FVA and DVA. In other words, to estimate the overall GVC participation at the country level, one needs first to calculate 1-3 indicators.

At the micro (firm) level, estimating GVC integration has not been as straightforward and successful as at the macro level, mostly because of data and methodological challenges. Traditionally, size and foreign ownership of firms have been used to ar-

gue that large foreign (with 10% or more of ownership held by foreign nationals) firms participate more in GVCs than small and domestic firms just because the former is also more productive and can afford to export (Freund and Pierola 2015).[15] This sheer focus on large foreign firms in GVC trade overlooks the integral role played by a range of other small local firms that import foreign inputs and add value to exported items. As a result, we know very little under what conditions and how all exporting firms in a single country (regardless of their size and ownership) participate in GVCs after trade liberalization.

One advantage of measuring GVC at the micro-level with WBES data is that this dataset carries rich information on production, inputs, export share, sales, labour, and other statistics of small, large, domestic, and foreign firms. As WB's research on the subject, using regional sub-samples (Van Biesebroeck and Mensah 2019, 9; Taglioni and Winkler 2016, 101-116), demonstrate, firms' participation in GVCs can be estimated with WBES data.[16]. I build upon these studies to calculate the indicator of interest in this study: the GVC participation variable, an aggregate measure that captures both forward and backward production relations that accordingly link an exporting firm to its foreign buyers and suppliers within GVCs.

I take several steps to calculate the GVC participation variable at the firm level. First, I calculate the total value of export (in constant USD, 2010=100) for each firm, using the WBES information on the percentage of total sales that are exported directly or indirectly (through an intermediary). Second, I rely on WBES information

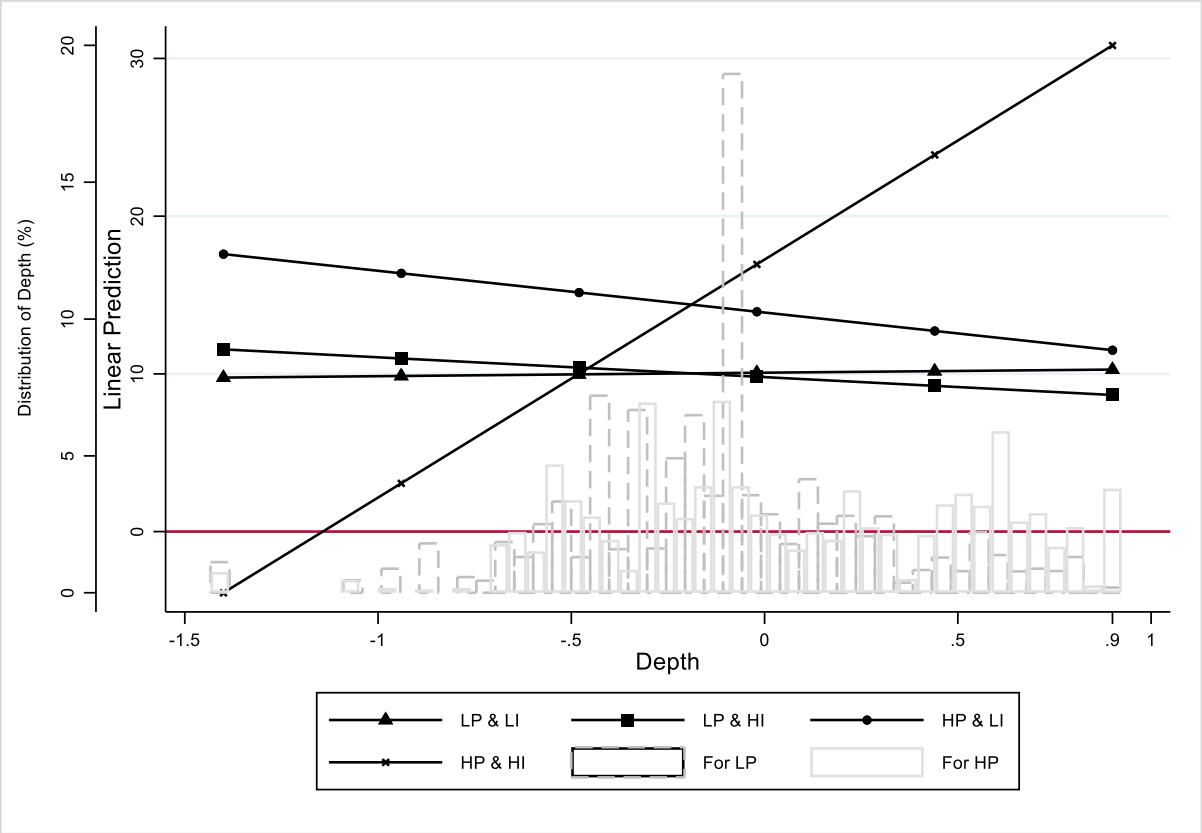
15. Freund and Pierola (2015), for example, found that the top five firms make up 30% of total exports on average in each country.

16. The two other works on this topic use firms' productivity as a proxy for their GVCs participation; see Montalbano et al. (2018) and Winkler and Farole (2015).

about the origin of inputs (i.e., foreign or domestic origin) to distinguish between domestic VA (DVA) and foreign VA (FVA) to export for each firm. More specifically, DVA is the share of material inputs of domestic origin in firms' export, and FVA is the share of material inputs of foreign origin in firms' export (both in constant USD, 2010=100). Third, I use the concordance tables between ISIC 3.1 and HS 2017 at the 4-digit level (UN STATS) and manual matching to identify each firm's BEC5 class at the 3-digit level. It allows for identifying the end-use classification (i.e., intermediate products, final consumption, or capital goods) of firms' DVA. Of interest here is the intermediate designation of products. Fourth, that part of DVA that is exported for intermediate consumption gives us the DVX value. Taglioni and Winkler (2016) suggest using the indirect export of intermediate material by local firms as a proxy for the size of DVX because inputs exported indirectly show the indirect contribution of the exporting country in the subsequent export of other countries. The problem with this approach to DVX is that it does not tell us why we must exclude directly exported inputs. For this reason, I focus on the total (direct and indirect) export to calculate DVX. In addition, with more details added and improvements made to the structure of BEC in its 4th and 5th revisions, I can distinguish between the share of intermediate and final consumption in the structure of total export. Finally, the sum of FVA and DVX gives us the GVC participation measure (GVC_{fict}) in constant USD (2010=100).

Appendix C

Figure 3.8: Average marginal effect of a triple difference test



Pairwise comparison of lines

I further implement a pair-wise comparison of simple slopes. It confirms a strong and significant effect for HQI. The comparison of the following groups is statistically and highly significant (at 1%), which are also robust and statistically significant (at 5%) after applying Bonferroni's adjustment:

- Unproductive firms in HQI and LQI (LP & HI line vs LP & LI line)

- Productive firms in HQI and unproductive firms in LQI (HP & HI line vs LP & LI line)
- Productive and unproductive in HQI (HP & HI line vs LP & HI line)
- Productive firms in HQI and LQI (HP & HI line vs HP & LI line)

The differences in means of the following lines are not significant, i.e., we cannot compare the marginal effect of the following groups with confidence:

- Productive and unproductive firms in LQI (HP & LI line vs LP & LI line)
- Productive firms in LQI and unproductive firms in HQI (HP & LI line vs LP & HI line)

Table 3.7: Double difference with covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(GVC)							
Productivity	0.450	-0.173	0.533	0.078	-0.037	0.360	0.336	1.520
	(0.865)	(1.154)	(0.842)	(0.971)	(0.954)	(1.097)	(0.899)	(1.125)
Depth*Productivity	**0.323*** **	**0.288*** **	**0.332*** **	**0.302*** **	**0.237*** **	**0.297*** **	**0.324*** **	**0.218** **
	(0.094)	**(0.092)**	**(0.094)**	**(0.097)**	**(0.091)**	**(0.098)**	**(0.094)**	**(0.101)**
Constant	-1.862***	-1.775***	-1.859***	-1.856***	-1.714***	-1.754***	-1.830***	-1.732***
	(0.479)	(0.487)	(0.478)	(0.487)	(0.479)	(0.495)	(0.473)	(0.5317)
Observations	9,719	9,719	9,719	9,576	9,719	9,061	9,719	8922
R-squared	0.636	0.636	0.636	0.635	0.637	0.637	0.636	0.637
Firm-level controls	✓	✓	✓	✓	✓	✓	✓	✓
Country-level controls	✓	✓	✓	✓	✓	✓	✓	✓
Economic Globalization		✓						
Common Law origin			✓					
EODB				✓				
log(GDPpc)					✓			
log(Inward FDI)						✓		
Informational Globalization							✓	
All								✓
Country-year FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.8: Triple difference with covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	log(GVC)								
Depth	-5.522***								
	(1.282)								
Productivity	-0.363	0.213	0.531	0.244	0.358	-0.134	-0.257	0.207	0.554
	(0.641)	(0.819)	(0.832)	(1.196)	(0.791)	(0.888)	(0.902)	(0.895)	(1.024)
Depth*Productivity	0.284***	0.239***	0.349***	0.296	0.247***	0.789*	1.079	0.397	1.051
	(0.084)	(0.089)	(0.099)	(0.363)	(0.090)	(0.419)	(0.856)	(0.680)	(0.968)
Depth*Institutions	-2.719**								
	(1.211)								
Productivity*Institutions	0.039	0.039	-0.009	0.041	0.040	0.050	-0.038	0.033	0.017
	(0.038)	(0.045)	(0.049)	(0.052)	(0.044)	(0.053)	(0.053)	(0.047)	(0.053)
Depth*Productivity*Institutions	**0.191*** **	**0.205*** **	**0.203*** **	**0.219** **	**0.233*** **	**0.291*** **	**0.324** **	**0.227** **	**0.349** **
	(0.070)	**(0.076)**	**(0.075)**	**(0.095)**	**(0.072)**	**(0.091)**	**(0.141)**	**(0.110)**	**(0.139)**
Constant	-19.621	-1.924***	-26.159	-1.928***	-1.913***	-1.975***	-1.880***	-1.922***	-1.984***
	(12.927)	(0.443)	(19.824)	(0.461)	(0.443)	(0.451)	(0.434)	(0.434)	(0.448)
Observations	9,724	9,719	9,719	9,719	9,719	9,576	9,719	9,719	9,576
R-squared	0.628	0.637	0.682	0.637	0.637	0.636	0.638	0.637	0.638
Firm-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country-level controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Economic Globalization				✓					
Common Law origin					✓				
Ease of Doing Business Av. Score						✓			
log(GDPpc)							✓		
Informational Globalization								✓	
All									✓
Country-year FE		✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓								
Year FE	✓								
Country-industry time trends			✓						

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.9: Triple difference with all WGI indicators

	(1)	(2)	(3)	(4)	(5)	(6)
	log(GVC)					
	Voice/ Accountability	Political Stability	Government effectiveness	Regulatory quality	Rule of Law	Control of Corruption
Productivity	0.422	0.284	0.276	0.214	0.235	0.334
	(0.769)	(0.804)	(0.828)	(0.809)	(0.831)	(0.830)
Depth*Productivity	0.165*	0.305***	0.247***	0.190**	0.273***	0.263***
	(0.094)	(0.092)	(0.088)	(0.088)	(0.087)	(0.092)
Productivity*Institutions	0.085**	0.000	0.030	0.028	-0.017	0.055
	(0.037)	(0.038)	(0.045)	(0.050)	(0.041)	(0.046)
Depth*Productivity*Institutions	**0.163*** **	**0.113***	**0.205*** **	**0.256*** **	**0.236*** **	**0.161*** **
	(0.055)	**(0.067)**	**(0.074)**	**(0.087)**	**(0.075)**	**(0.068)**
Constant	-1.767***	-1.909***	-1.954***	-1.935***	-2.017***	-1.948***
	(0.446)	(0.452)	(0.443)	(0.444)	(0.443)	(0.449)
Observations	9,719	9,703	9,719	9,719	9,719	9,719
R-squared	0.638	0.637	0.637	0.637	0.637	0.637
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE	No	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.10: Triple difference with other GVC variables

	(1)	(2)	(3)	(4)	(5)
	log(GVC)	log(DVX)	log(FVA)	Forward	Backward
Productivity	0.213	0.255	0.318	0.092	-0.092
	(0.819)	(0.854)	(0.978)	(0.101)	(0.101)
Depth*Productivity	0.239***	0.278***	0.184*	0.012	-0.012
	(0.089)	(0.104)	(0.106)	(0.019)	(0.019)
Productivity*Institutions	0.039	-0.019	0.066	0.001	-0.001
	(0.045)	(0.050)	(0.060)	(0.007)	(0.007)
Depth*Productivity*Institutions	**0.205*** **	**0.155***	**0.201*** **	**-0.021*** **	**0.021*** **
	(0.076)	**(0.083)**	**(0.095)**	**(0.010)**	**(0.010)**
Constant	-1.924***	-2.250***	-3.710***	0.696***	0.304***
	(0.443)	(0.483)	(0.511)	(0.069)	(0.069)
Observations	9,719	8,966	7,711	9,719	9,719
R-squared	0.637	0.582	0.584	0.287	0.287
Firm-level controls	Yes	Yes	Yes	Yes	Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes
Country-year FE	No	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Note: OLS with standard errors clustered at the country-year level in parentheses. The unit of observation is firm-industry-country-year. Industry is defined at ISIC3.1 4-digit level. *** p<0.01, ** p<0.05, * p<0.1

Appendix D

Sensitivity analysis

In experimental (full models) settings, where all factors are accounted for, the bias is zero, and the estimated value of the outcome Y is equal to the effect (u) of Treatment D given other observable covariates X. In observation studies (restricted models) such as this one, where it is not possible to measure and account for all factors, there is at least one unobserved confounded Z, an omitted variable (OV), which makes the estimated value of Y biased (b). The gap between b and u, i.e., "the discrepancy of what we wish to know and what we actually have" (Cinelli et al. 2020, 3), creates the OV bias (OVB) that is the major threat to the identification strategy in all observation studies.

While it is impossible to identify and account for all OV (observables or not), several statistical tools exist that help answer how the restricted models' point estimates and standard errors compare to the full models. One such test is sensitivity analysis with R and Stata sensmakr packages that I implement here to assess the severity of OVB and its threat to nullify the research conclusions (Cinelli et al. 2020; Cinelli and Hazlett 2020). Results are listed in Table 3.11. In addition to point estimates and standard errors for both partial and full models, sensitivity analysis produces four additional statistics used to assess the severity of the threat coming from the association of a hypothetical unobserved confounding with the residual variances of both the treatment and the outcome.

Table 3.11: Sensitivity analysis

Panel A

Estimates with partial model (Model 2, Table X):						
Treatment:	Est.	S.E.	t-value (H0 =0)	R^2 Y~ D|X	$RV_{q=1}$	$RV_{q=1, \alpha=0.05}$
Interaction term	0.205	0.0496	4.1370	0.18%	4.17%	2.21%

Panel B

Estimates with full model and bounds on OVB:					
Bounds	Est.	S.E.	t-value (H0 =0)	R^2 Y ~Z|X,D	R^2 D ~Z|X
Twice as strong as Productivity	0.199	0.05	3.97	0.01%	2.47%
Three-times as strong as Productivity	0.196	0.05	3.89	0.01%	3.7%

Note: df=9449.

Panel A includes partial R^2 of the treatment D with the outcome Y, given covariates X (R^2 Y~D|X) and associated with its robustness value (RVq=1) and its statistical significance (RVq=1, α =0.05) for R^2 Y~D|X, using the observed partial model. Panel B shows the partial R^2 of residual variance of the treatment D explained by the omitted variable Z, given covariates X (R^2D~Z|X), partial $R^2$of residual variance of the outcome Y explained by the omitted variable Z, given X and D (R^2Y~Z|D, X), and bounds on OVB statistics, which benchmark the maximum strength of unobserved confounders by several multiples (two and three here) of the explanatory power of a strongly observed covariate, which is *Productivity* in our case.

In our context, the sensitivity analysis notations are as follows: Y is the outcome variable (log(GVC)), D is the treatment variable *(Depth*$\times$*Productivity*$\times$*Institutions)*, X is the matrix of observed covariates (firm- and country-level controls and country-year and industry dummies), Z is the unobserved confounding (the source of OVB), and the benchmark variable for a bound on the strength of Z is Productivity, i.e., we want to know the power of an unobserved confounding x-time as strong as our benchmark variable to explain away our estimated effect of Model 2, Table 3.8 Appendix C.

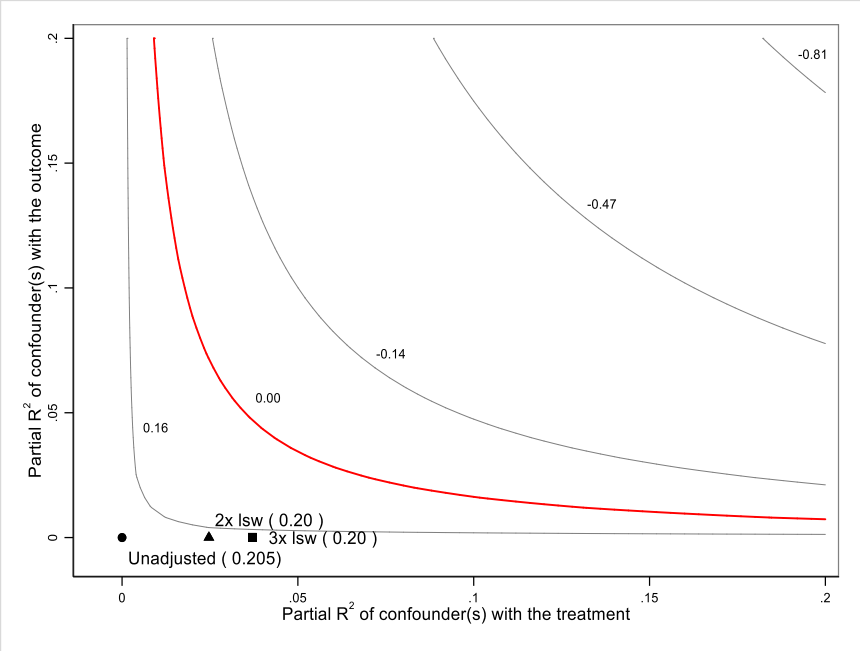
Given this information and result, the verbose interpretation of sensitivity statistics is as follows:

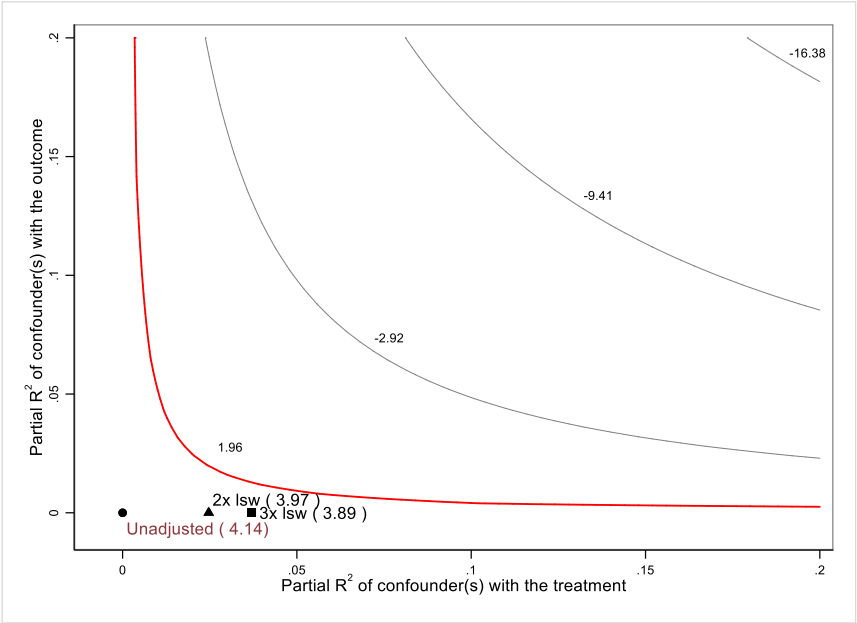
- R^2 Y~D|X: An extreme confounder (Z) that explains 100% of the residual variance of the log(GVC) would need to explain at least 0.18% of the residual variance of the Treatment to fully account for the estimated effect observed.
- RVq=1: Unobserved confounders (Zs) that explain more than 4.17% of the residual variance of both the Treatment and the log(GVC) are strong enough to bring the point estimate 0.2053 to 0 (a bias of 100% of the original estimate).
- RVq=1, α=0.05: Unobserved confounders (Zs) that explain more than 2.21% of the residual variance of both the Treatment and the log(GVC) are strong enough to bring the estimate to a range where it is no longer "statistically different" from 0 (a bias of 100% of the original estimate), at the significance level of α = 0.05.
- Bounds statistics show the maximum strength of unobserved confounders, bounded by a multiple (twice or three times) of the observed explanatory power of the chosen benchmark covariate, i.e., *Productivity*, with the Treatment and the *log(GVC)*.

The general rule of thumb is that the partial R^2 of the unobserved confounding with the outcome (R^2 Y~Z|X,D) and the partial R^2 of the unobserved confounding with the Treatment (R^2D~Z|X) should be a less than robustness value (RVq=1) of the partial R2 of treatment with the outcome (R^2Y~D|X). Since both statistics (0.01% and 2.47%) are below the required threshold (4.17%), an unobserved confounding that may be twice and even three times as strong as Productivity does not explain away the observed estimate in Model 2 Table 3.8 Appendix C. Theoretically, identifying

observed variables two or three times stronger than the variable *Productivity* while meeting other statistical criteria for inclusion is difficult, if not impossible. For this reason, I conclude that our results hold the sensitivity to a strong OV test. However, since the R^2D ~Z|X is not less than R^2 Y ~D|X (2.47% and 3.7% are more than 0.18%), I cannot say that an extreme confounder explaining all residual variation of the outcome and as strongly associated with the treatment as Productivity will not be able to overturn this paper's conclusions.

Figure 3.9: Plotting sensitivity of results to unobserved confounding: point estimate (first plot) and t-value (second plot)





Sensitivity plots are based on Table 3.11. The horizontal axes show the treat-

ment's residual share of variation hypothetically explained by unobserved confounding, R^2D~Z|X. The vertical axes show the hypothetical partial R^2 of unobserved confounding with the outcome variable, R^2Y ~Z|D,X. The contours show what estimate for outcome would have been obtained in the full regression model, including unobserved confounders. Accordingly, these charts plot the coefficients and their associated t-values from such regression. The circle markers indicate the coefficient (first plot) and t-value (second plot) of the unadjusted interaction coefficient from Table 3.8, Model 2, that I have estimated based on our empirical strategy. The triangle and square markers indicate adjusted estimates with different hypothetical degrees of confounding bound to 2-times and 3-times multiples of degrees of association that the strongest covariate, i.e., Productivity, maintains with the treatment and the outcome. As we can see, point estimates for an unobserved confounding that could be twice and three times stronger than the benchmark variable Productivity remain positive and below the zero-effect (bold red) line, meaning that a confounding with 2-times and 3-times multiples of strength would not be able to turn the estimation of our models to zero or turn it negative.

Bridging text

The previous paper used micro- and macro-level data to measure GVC participation at the firm and deep PTAs at the country levels. It examined the distributional consequences of deep PTAs for firms' integration in GVCs across different levels of institutional quality and firm productivity. In doing so, it brought the question of domestic institutions into the discussion of GVC analysis and firm-level performance and proposed a new measure of GVC integration at the firm level. It showed that firm productivity explains most (but not all) of the differences in firms' participation in GVCs, as preferential liberalization becomes more and more comprehensive. Findings in the previous paper also suggested that the reallocation effect of deep integration is stronger in countries where the quality of domestic institutions is strong in the first place. As trade integration becomes deep at the country level and trade and non-trade barriers are removed, firms in high-quality institutional environments participate more in GVCs.

These findings imply that the effect of deep PTAs on firms depends not only on the heterogeneous characteristics of firms (as trade theory argues) but also on the quality of local institutions. The quality of domestic institutions is a source of comparative advantage for firms' integration with GVCs under trade liberalization. The key implication is that in normal times, the proliferation of deep integration and trade in GVCs will not contribute to local development unless the regulatory and governance conditions are improved.

As papers one and two suggest, in normal times, deep trade agreements help countries and firms to increase their global production linkages and integrate more with

GVCs. A major question raised from the recent global supply chain crisis episode during COVID-19 is the sustainability and resilience of GVC participation of countries and firms in the face of major supply chain disruption. Development progress is vulnerable to unexpected external shocks. As COVID-19 showed, there is a mounting need to understand better how the negative effect of supply chain disruptions may be minimized on firms (and countries).

Using the recently released COVID-19 firm-level survey data, the following paper argues that deep PTAs help GVC integration of firms in normal and hard times. Institutions of deep PTAs, namely deep PTAs, increase SC resilience and help firms maintain their production linkages to GVCs during a major supply chain disruption.

Chapter 4

Deep trade integration and the resilience of GVC participation in uncertain times: firm-level evidence

Abstract

Do deep trade agreements increase the resilience of firms' GVCs linkages against supply chain disruptions? Using the COVID-19 episode as a test case, this paper examines whether deep preferential trade agreements (PTAs) reduce the negative effect of supply chain disruptions on firms' trade and GVC linkages. The paper argues that because institutionalized trade integration reduces trade costs and increases the certainty and continuity of trade relations, firms in countries committed more to deep trade integration experience less decline in their export after a major disruption in supply chains. In assessing this argument, the paper uses a quarterly dataset that includes micro and macro data on firm-level export, levels of GVC integration, depth of PTAs, COVID-19 measures, and other country and firm characteristics. Results show that the depth of trade agreement reduces the disruptive impact of lockdowns and closures on firms' export, especially for firms that were more integrated with GVCs before the pandemic. The implication is that more comprehensive trade integration increases the resilience of supply chains in times of major shocks. This paper contributes to the micro-study of GVC integration and trade institutions in uncertain times.

JEL codes: F02, F14, L23, O19, D22
Keywords: International business resilience, Global disruptions, Covid-19 pandemic, GVCs, institutions, trade integration, firms

4.1 Introduction

Supply chain resilience is a new buzzword in trade politics. Following the declaration of Coronavirus disease (COVID-19), a global pandemic in March 2020, stringent lockdown measures across countries halted trade flows, causing major disruptions in supply chains (SC) and trade in GVCs. The shortages of consumer and industrial products that ensued affected consumers and producers, weighing down the progress towards global economic development since the 2008 financial crisis.

The extent of SC's vulnerability to external shocks has drawn states' attention to speculation about the threats to their economic security and development that may arise from future pandemics, geopolitical tensions, or natural disasters. The US' Supply Chain Executive Order, Australia, Japan, and India's supply chain resilience initiative (SCRI), the EU policy evaluation for re-shoring, Africa's governance response to COVID-19, and the G7 statement on resilient supply chains, are just some examples of this heightened macro-level attention in the past two years. For international institutions, too, understanding what set of policies will make supply chains more resistant to future disruptions without compromising international trade and development cooperation has moved to the top of agendas (IMF 2022a, 87-107; G7 2022; OECD 2021; WTO 2022; Brenton et al. 2022).

Theoretically, however, answering this question may be more challenging because macro institutional factors of firms' SC and their resistance to global shocks, especially in the context of GVCs, have received little attention in trade and development literature. While we know a great deal about the micro (firm-level) organizational factors of SC resilience from the business literature (Kamalahmadi and Parast 2016;

Tukamuhabwa et al. 2015; Ponomarov and Holcomb 2009), the macro (country-level) institutional factors of SC resilience, especially in the context of GVCs, are not well understood. Understanding the macro sources of SC resilience is important because while the external causes of future SC disruptions cannot be fully prevented, trade policy can focus on measures that can mitigate and minimize the negative effect of disruption on trade and development.

The goal of this paper is to address this gap. The paper relies on new regionalism and institutionalism on the role of trade institutions in reducing the costs and uncertainty in trade cooperation (North 1990; Mansfield and Reinhardt 2008) and looks at the mitigating role of deep PTAs on trade and GVC activities of firms during the COVID-19 SC disruptions. More precisely, it asks whether the variations in the degree of states' commitments to deep trade agreements explain the heterogeneous performance of firms across countries in 2020-2021.

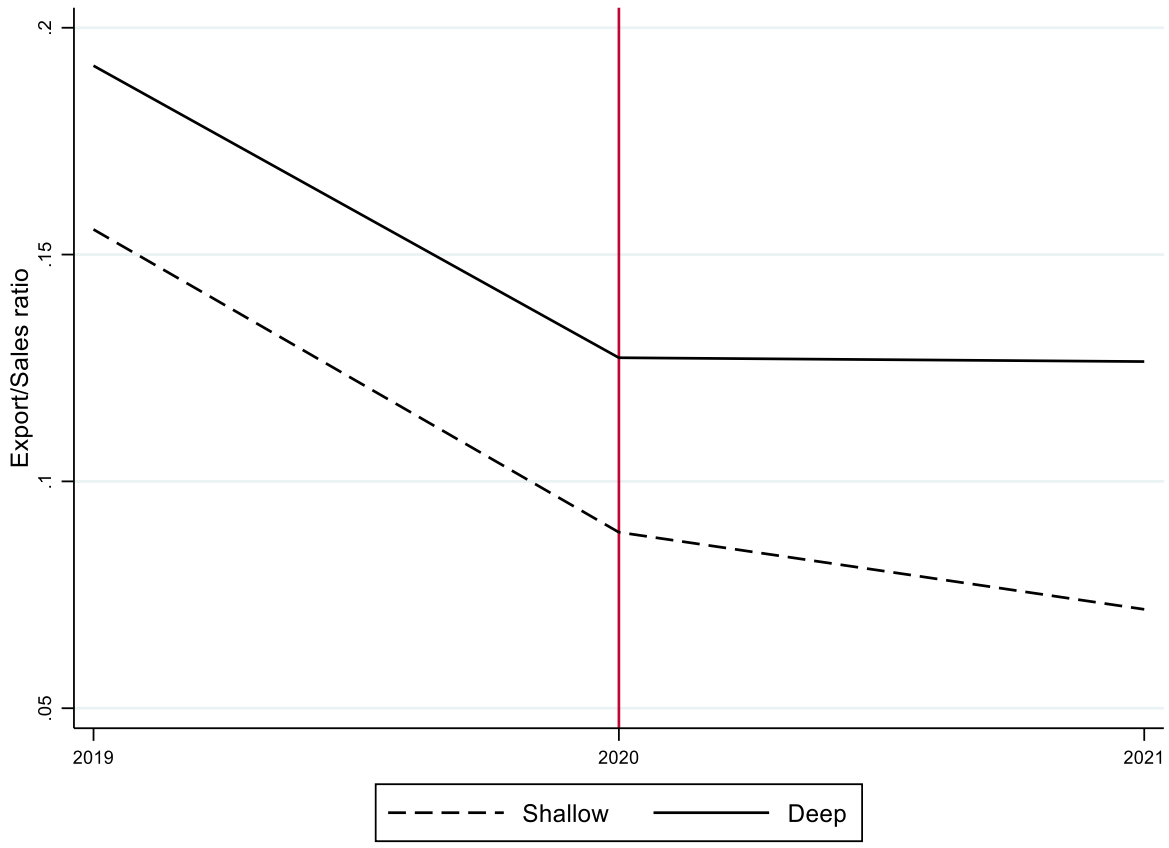
The paper brings the question of macro trade institutions into the discussion and analysis of SC resilience and trade in GVCs. It argues that trade institutions, namely the presence of deep PTAs at the country level, can reduce the negative effect of exogenous shocks on exporting firms' SC and their GVC participation. Trade institutions are created, after all, to stabilize trade relations, reduce trade costs, and guide decisions in the face of uncertainty. Their role "in a society is to reduce uncertainty" (North 1990, 2). In other words, the depth of PTAs mediates the negative effect of SC disruption on firms and is inversely related to the decline in their export. As a result, firms in countries that were, on average, more committed to deep PTAs before the pandemic will experience less decline in export as the government containment response to the pandemic increases. In contrast, firms in countries with more shal-

low agreements will experience considerable declines in export after lockdowns and closures.

The key reason for this positive mediating effect is twofold. First, deep PTAs facilitate trade cooperation not only among states (Mansfield and Reinhardt 2008; Baccini et al. 2015) but also among firms. They reduce trade costs for firms at the micro (firm) level. Therefore, firms in countries already committed to more comprehensive trade integration before the pandemic will have much lower variable costs under major disruption in their supply chains than those with shallow commitments. Second, deep PTAs foster long-term and durable SC relations among importers (buyers) and exporters (suppliers) not only at the country level (Razeq 2022) but also at firm levels (see Chapter 3).

Therefore, firms in countries that have already been committed to more comprehensive trade rules before the pandemic have more integrated and streamlined contractual relations with their suppliers and buyers. A temporary disruption in the trade flow and SC may not lead to the complete breakdown of relations for firms in these countries because they are more confident in the continuity of states' commitments to trade rules post-crisis. Once the immediate causes of SC disruption (a pandemic breakout, earthquake, tsunami, undeclared war, and others) disappear, export and GVC activities of firms in countries with greater depth of trade commitments will recover faster than those of firms operating under shallow trade integration. Descriptive statistics based on the dataset for this paper indeed point to this trend (see Figure 4.1).

Figure 4.1: Firm-level export across different levels of PTAs (annual average)



To empirically test this argument, I take a difference-in-differences (DID) approach and use the WB COVID-19 surveys of firms conducted between Q2 2020 and Q4 2021. To track firms' export activities during the pandemic, I limit the sample to firms that have been surveyed three times (i.e., over three waves) in 2020-2021 and which appear in the World Bank core (i.e., standard periodic pre-COVID-19) enterprise surveys (WBES) between 2015-2019. I treat the core WBES results as the pre-COVID-19 period and record them in the dataset as Q4 2019 values. This approach yields a quarterly (unbalanced) panel of 13015 firms in twenty-two developed and developing countries and 52060 observations with one pre-COVID-19 and three

COVID-19 follow-up waves of surveys. Firms' GVC participation indicators, which distinguish between high, low, backward, and forward GVC participant firms, are calculated based on core WBES and remain constant in 2020-2021. To this data, I add country-level data on COVID-19 stringency measures, average cumulative depth of trade agreements to which a country is a signatory, and other country and firm characteristics.

Results show that deeper trade agreements reduce the negative effect of COVID-19 containment measures and SC disruptions on firms' export. As the average rate of deep PTAs increases, the governments' stringent lockdown measures' adverse effect on firms' exports decreases. Furthermore, this effect is stronger for firms integrated more in GVCs and engaged more in backward than forward GVC linkages. These results are consistent with previous results (see Chapter 3) and show that deep trade agreements strongly and positively impact GVCs integration.

The theoretical implication of these findings is that trade institutions matter for trade in GVCs at the macro and micro levels. They effectively fulfill their primary objective in normal and hard times: they increase the certainty and stability of trade relations under GVCs, helping producers restore their operation quickly after SC disruption. At the policy level, this research implies that designing and supporting more comprehensive trade institutions may be the best policy option if the objective is to make global SC more agile and mitigate the risk of future supply chain disruptions. Therefore, making SC more resilient through deep trade integration can support global efforts towards development goals.

The paper is organized as follows. In the next section, I will discuss the theoretical

dimensions of the effect of deep PTAs on SC relations in the face of uncertainty. This section is followed by the method and result sections. The final two sections will discuss the results and implications of its findings.

4.2 Literature and hypotheses

SC disruptions and global trade

Why is it important to make firms' SC more resilient? SC disruptions are major threats to long-term economic security and development in the era of GVCs. Disruption in one location can seriously affect the performance and welfare of firms and consumers in another location, often leading to unforeseen structural and sectoral transformation in the long term.

For instance, in 2000, a lightning bolt struck a high-voltage electricity line in Albuquerque, New Mexico, causing power fluctuations and a 10-minute blaze in the Philips semiconductor plant, the supplier of radio-frequency chips for the two large European-Based telecommunication companies: Nokia and Ericson. Although the small fire lasted only a few minutes, the chips stocks were contaminated as smoke particles spread across the factory and into the sterile rooms. The incident halted production in the booming European mobile phone market, forcing Ericsson eventually to retreat from the phone handset production market in 2001 (Latour 2001).[1]

In another case in 2011, the tsunami in Japan halted the automotive supply chains at a global scale as Honda's, Toyota's, Nissan's, and Fuji Heavy Industries' plants in

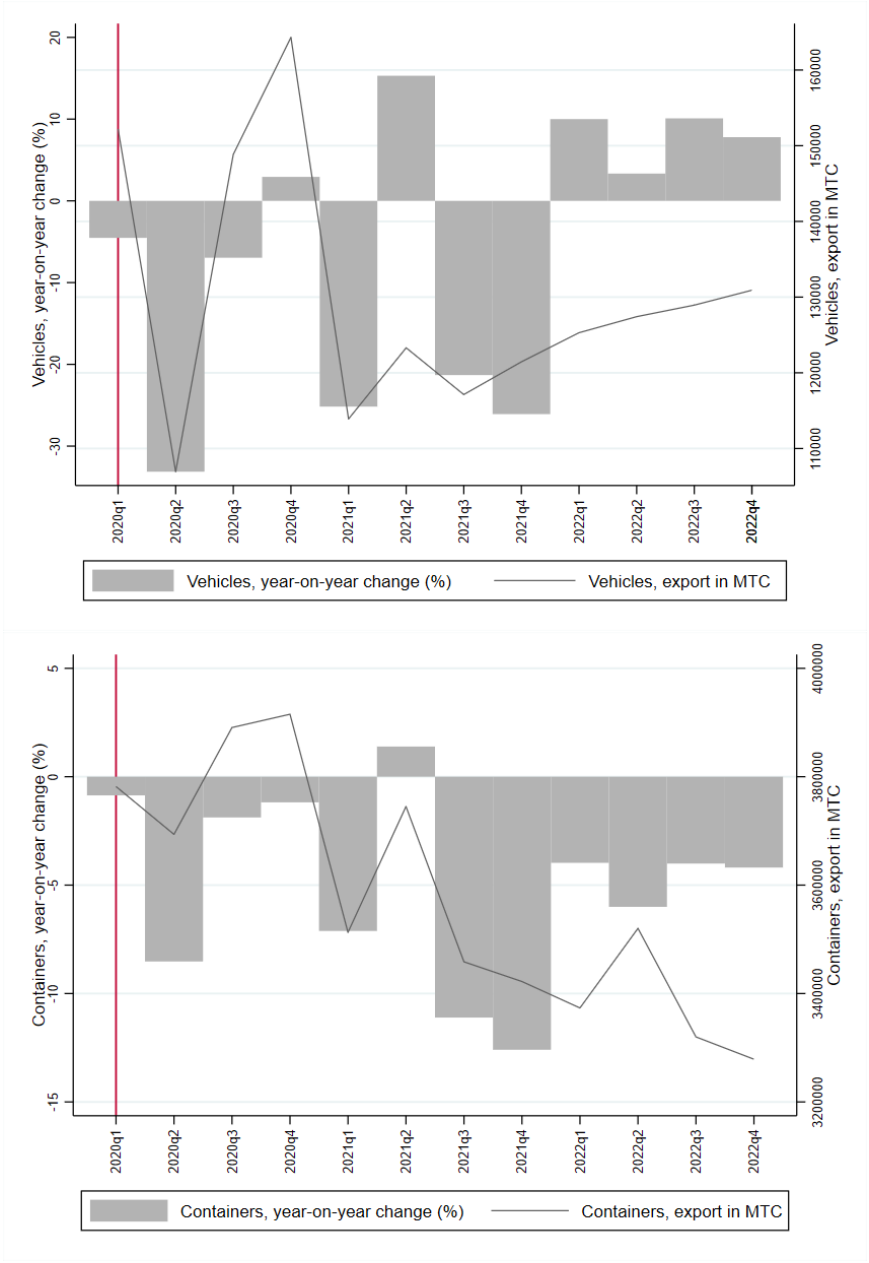
1. "A Fire in Albuquerque Sparks Crisis For European Cell-Phone Giants", *The Wall Street Journal*, January 29, 2001. Available here.

the affected areas were forced to close. The subsequent shortage of parts and components and the backlog of supply chains reduced production and almost halved the global output of major carmakers such as Toyota, Honda, Suzuki, Mazda, Nissan, and others, beyond Japan (Carvalho et al. 2021).

Although, in these cases, the effect of SC shocks has travelled far and beyond one location, the direct causes and consequences of disruptions were concentrated in only one GVC or a few firms and countries. The 2020 pandemic, "one of the most significant disruptive events in modern times" (Gereffi 2020, 288), brought the threat to the stability of global trade and development to a whole another level. When on March 11, 2020, the WHO characterized the outbreak of COVID-19 as a pandemic, the unprecedented restrictions on economic activities caused multi-country SC disruptions along almost all manufacturing GVCs across the globe. The aftershocks of COVID-19 SC disruptions on trade and development have been vast and unprecedented. In terms of trade, as the high-frequency seaborne trade estimates show, compared to the same levels in 2019, the supply of inputs and products shipped by containers and by vehicles carrying ships experienced unprecedented declines in the summer of 2020 (see Figure 4.6 and also IMF 2022a, 102).

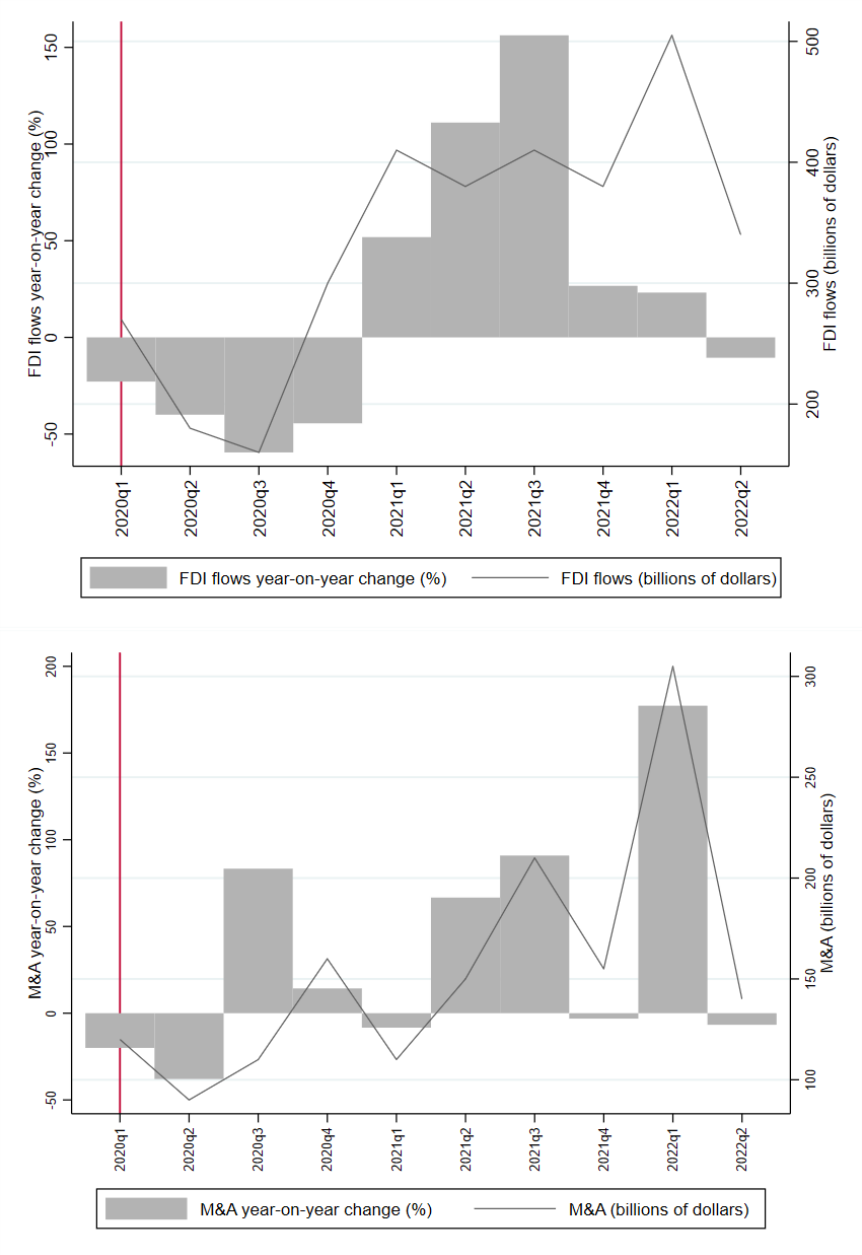
The development impact of this disruption is reflected in the recessionary records of global trade, investment, and growth in 2020-2021. In the second quarter of 2020 alone, international export dropped by more than 20%, compared to the same period in 2019 (see Figure 4.6). Likewise, global FDI flows fell by 35% in 2020 compared to the same period in 2019. The same trend is also observable across firms' M&A transactions, which dropped by 40% in the second quarter of 2020 compared to the same period in 2019 (see Figure 4.7).

Figure 4.2: Global seaborne export of containers/general cargo and vehicles (average quarterly data) in metric tons (MTC)



Source: based on real-time (with a 3-week lag) world seaborne trade estimates available at AIS Trade Volume Data Query Interface, UN Comtrade database (Cerdeiro et al. 2020).
Note: Vehicles carriers are specialized vessels (a special type of roll-on/roll-off) equipped to transport finished cars and other wheeled vehicles by waterways. The trend in their traffic reflects the onshore real-time patterns of production and consumption of non-commoditized downstream GVC products (Cerdeiro et al. 2020, 37). Container carriers include cargo (packaged goods) ships and carry goods, e.g., clothing, machinery, food, and furniture.

Figure 4.3: Investment trends (billions of dollars)



Source: based on data from *Investment Trends Monitor Issue 42 (Oct 2022)* the Division on Investment and Enterprise, UNCTAD.

In terms of development, the long-term progress towards sustainable development has also been affected. According to World Bank estimates, the effect of the pandemic

in 2020 alone has already pushed over 100 million people into extreme poverty (Brenton et al. 2022). Although, after the easing of restrictions across the globe in 2021, both international trade and FDI showed promising recovery, the 2022 recovery and stability of GVCs remained "gloomy and more uncertain" (IMF 2022b, 1).

The policy (IMF 2022a; WTO 2022; G7 2022; Brenton et al. 2022) discussions that emerged from this experience in the past years at the macro level have been around how to make global SC more resilient to withstand amidst (and recover from) another episode of unexpected global SC disruption, and how to reduce the threats to trade and development. Solutions to future disruptions, such as re-shoring (localization of SC) and near-shoring (regionalization and shorter SC), are some hasty policy ideas that states entertain. However, if materialized, these knee-jerk responses, which are fueled by economic nationalism and populism, would lead to the worsening of global trade and progress achieved towards development. While some of these responses may work for certain products and strengthen the resilience of tier-one suppliers for a particular product in high and middle-income countries, they can potentially cut out from GVCs tier-two suppliers, many of whom are in trade-dependent small and low-income economies (Bonadio et al. 2021; IMF 2022a; OECD 2021).

Furthermore, mounting scholarly evidence on the effect of the COVID-19 pandemic on GVCs warns against raising barriers and inward-looking policies (Baldwin and Freeman 2022; Bonadio et al. 2021; Enderwick and Buckley 2020; Gereffi 2020; Grossman and Helpman 2020; Solingen 2021). For example, the WB's simulation of various re-shoring scenarios shows that the world GDP would drop by 1.5% across all regions "if major trading countries (high-income countries plus China) attempt to re-shore production" by limiting trade and subsidizing domestic production. Similarly,

"if low- and middle-income countries pursue similar policies," world GDP would drop by more than 2%. As a result, global trade, too, would decline "by as much as 22 percent by 2030" and "could drive an additional 52 million people into extreme poverty by 2030," 80 % of whom would be concentrated in low-income countries. In contrast, "GVC-friendly policies" and further trade integration promise to increase global trade "by 25 percent over 2019–30" and the "real income in low- and middle-income countries' by 10 percent, lifting more than "22 million additional people out of poverty by raising the incomes of the bottom 40 percent" (Brenton et al. 2022, 13-14).

For these reasons, the real challenge for international trade cooperation is making the global SC more resilient to weather another episode of a multi-country shock and reducing the threat to trade and development without hastily retreating to *beggar-thy-supplier* measures such as re-shoring.

SC resilience and deep PTAs

How can deep PTAs help? The issue of SC resilience (and SC in general) has previously found little attention in trade and development studies. For this reason, its causes and consequences at the macro (states and IOs) level are poorly understood. At the micro (firm), SC resilience is defined as the capability of firms "to reduce the probability of facing sudden disturbances" (Kamalahmadi and Parast 2016, 121) and restore "to a robust state of operations" after disruptions (Juttner and Maklan 2011, 246). It is an essential pillar of firms' competitive advantage in managing risk and dealing with disruptions (Michelman 2007; de Sa et al. 2019). Therefore, practical sources of SC resilience are internal and localized firm-level decisions, and SC resiliency is the firms' business and not the business of states or IOs.

However, as the COVID-19 episode shows, SC resilience has macroeconomic and development implications beyond firms' organizational environment in a globalized trade and production world. Its presence can tilt the distributional consequences of the growing trade in GVCs towards its host location. For this reason, the issue of resilient supply chains cannot be treated as a micro-organizational issue and firms' only competitive advantages. Rather, the issue is central to an effective national and international trade and development policy and calls for a better understanding and policy response at the macro-institutional level.

The paper brings the question of macro trade institutions into the discussion and analysis of SC resilience and trade in GVCs. It argues that trade institutions, namely the presence of deep PTAs at the country level, can reduce the negative effect of exogenous shocks on exporting firms' SC and their GVC participation. PTAs are signed, after all, to support trade relations and reduce trade costs. Their role "in a society is to reduce uncertainty" (North 1990, 2) through deeper policy commitments and more regulatory convergence among its members (Mansfield and Reinhardt 2008; Facchini et al. 2019; Graziano et al. 2021; Limao and Maggi 2015). Previous research shows that overall, countries in a PTA experience a less decline in their bilateral economic relations than countries that are not closely integrated (Naanwaab and Antwi 2019). For example, in the 2008-2009 financial crisis context, research has shown that trade integration can mitigate the effect of external shocks on trade and economic relations among states (Kahler 2013).

In particular, states bound by deeper commitment to non-discriminatory measures are more likely to avoid an arbitrary increase in trade barriers for security or economic reasons amidst an external shock or at least exclude their PTA partners from

emergency restrictions. For example, at the beginning of the COVID-19 pandemic, several countries restricted their export of "pharmaceuticals, followed by medical ventilators, and various types of PPE" to partner countries (Pelc 2020, 350). However, they also extended partners with deep trade ties. For example, while the US "banned the export of respirators and a range of PPE such as surgical masks and gloves", it nonetheless "excluded Mexico and Canada from this measure" (350). To what extent PTAs reduce export controls during a crisis is a question yet to be qualified. However, what is clear is that deep PTAs reduce the likelihood of being subject to self-interest measures by trade partners, even in emergencies.

In other words, the depth of PTAs mediates the negative effect of SC disruption on firms and is inversely related to the decline in their export. As a result, firms in countries that are, on average, more committed to deep PTAs before the pandemic will experience less decline in export as the government containment response to the pandemic increases. In contrast, firms in countries with more shallow agreements will experience a considerable decline in export after lockdowns and closures.

The key reason for this positive mediating effect is twofold. First, deep PTAs not only facilitate bilateral trade and economic cooperation among states at the macro (Mansfield and Reinhardt 2008; Baccini et al. 2015) but also reduce trade costs for firms at the micro level. Therefore, firms in countries already committed to more comprehensive trade integration before the pandemic will have much lower variable costs under major disruption in their supply chains than those in countries with shallow commitments. Second, deep PTAs foster long-term and durable SC relations among importers (buyers) and exporters (suppliers) firms not only at the country level (Razeq 2022) but also among firms at the micro level (see Chapter 3). Therefore, firms in

countries that have already been committed to more comprehensive trade rules before the pandemic have more integrated and streamlined contractual relations with their suppliers and buyers. A temporary disruption in the trade flows and SC may not lead to the complete breakdown of relations for firms in these countries because they are more confident in the continuity of states' commitments to trade rules post-crisis. Once the immediate causes of SC disruption (a pandemic breakout, earthquake, tsunami, undeclared war, and others) disappear, export and GVC activities of firms in countries with greater depth of trade commitments will recover faster than those of firms operating under shallow trade integration.

Therefore, PTAs in general, and deep PTAs in particular, can mitigate the negative effect of closures and unprecedented containment response to the pandemic on firms' (and countries') export because they increase certainty:

H1: Deep trade agreements increase the resilience of firms' export under supply chain shocks more than shallow agreements.

GVC participation and export

As discussed in Chapter 3, GVC participation comprises backward (relation with foreign suppliers) and forward (relation with foreign buyers) linkages. For this reason, firms' export alone does not capture the full extent of the GVC integration of firms. As noted in Chapter 1, firms are both suppliers and buyers in GVCs. Furthermore, because most developing countries import foreign parts and components for assembly or processing, they may actively participate in GVCs through backward linkages, which is not captured by just focusing on export. For this reason, while this paper looks at the effect of deep PTAs on export and GVC participation, the latter is of main

interest here because it more accurately reflects how firms are affected by a major SC crisis in the context of GVCs.

Firms that participated more in GVCs before the pandemic were more likely to experience only interruptions and delays in their SC rather than a full breakdown. IMF estimates show that during the 2020 pandemic, high GVC-integrated regions "were able to increase their share in the imports of other regions" (IMF 2022a, 87). For this reason, the effect of deep preferential trade integration on firms' export during the pandemic may be different for high- (above the sample mean) and low- (below the sample mean) integrated with GVCs firms. The mitigating effect of institutional commitment to deep PTAs is expected to be higher on those firms that are more integrated with GVCs because of distinct features of SC relations under GVCs: product (relationships) specificity, contract intensity, and just-in-time (JIT) delivery.

Under trade in GVCs, SC relations are more product specific. Because inputs are more customized and require a specific set of technologies, resources, and features that only a particular set of upstream producers can deliver, downstream buyers cannot "rely on spot markets" to immediately fulfill their contracts (Levchenko 2007, 791). In addition, because GVCs comprise a set of fragmented production processes involving trade in multiple customized parts and components, GVC trade is more contract-intensive than traditional trade. In other words, in making one item in GVCs, several transactions (and contracts) are frequently involved (Dollar and Kidder 2017; Nunn 2007).

Furthermore, modern SCs rely on JIT delivery to receive their inputs. Because the cost of keeping large inventories of inputs is high, producers strive to receive their

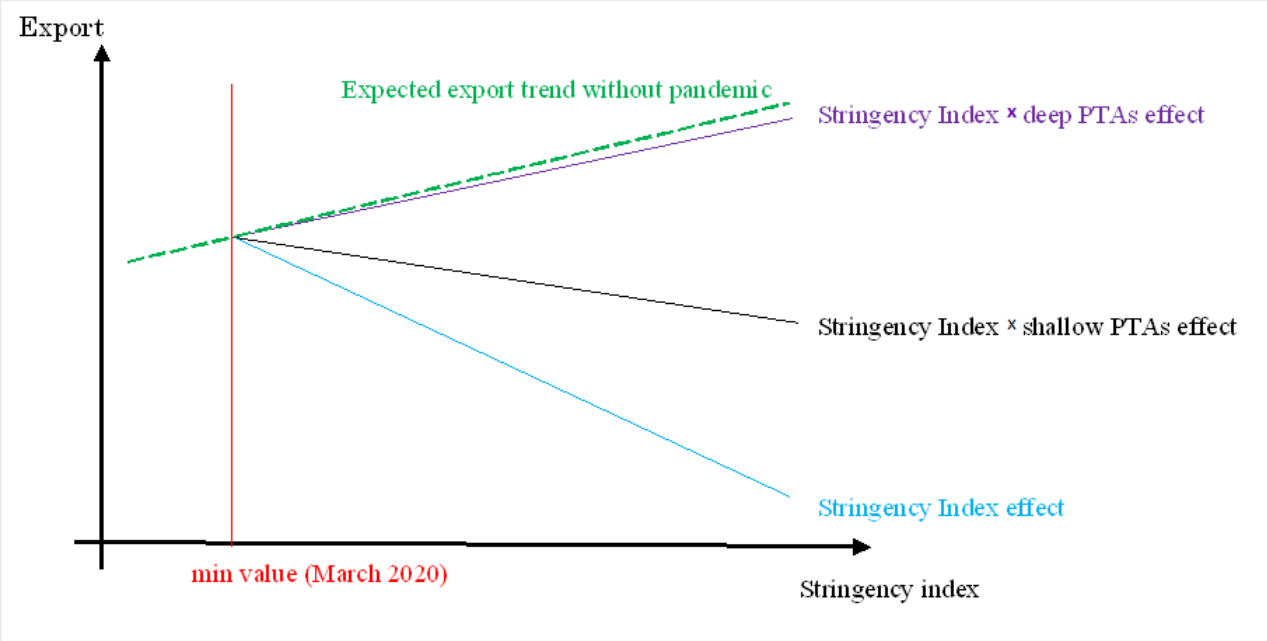
inputs as close as possible to when they are used in production (Pisch 2020). The JIT delivery strategy and specificity of supplier-buyer relations or, to use Antras and Chor's term, the "stickiness" (2021) of contracts in GVCs, make it costly (if not impossible) for buyers to change suppliers quickly and preserve the stability of their supply chains meanwhile. For example, because Polo Ralph Lauren uses knitted pique fabric rather than woven fabrics to make most of its classic Polo shirts, it works only with a few suppliers producing this specific input and performing its JIT delivery. Switching to new suppliers would involve a substantial and costly reorganization of supply chains and contracts for the company.

These features of GVC amplify the significance of institutions for the stability and resilience of supply chains through a decrease in uncertainty and associated costs. The risk and costs associated with under-fulfillment or non-enforcement of contracts increase for buyers in the state's absence of commitment to more comprehensive trade integration. Because of these characteristics, the production and operation of more GVC-integrated firms can be susceptible to short-term fluctuations in certainty and stability associated with both suppliers' and buyers' markets (environments). In the absence of institutionalized commitments and production linkages, buyer firms in the destination country face a heightened risk associated with the cost of import and rising trade barriers when the stringency measures increase in the source country, for example, because of high incidents of the pandemic. Therefore, more comprehensive commitments to preferential trade liberalization should have a more significant mitigating effect on more GVC-integrated firms' export as containment measures get more stringent:

H2: Deep trade agreements increase the resilience of firms more integrated with GVCs

under supply chain shocks than less integrated firms.

Figure 4.4: The hypothetical effect of lockdowns and containment policies (stringency index) on firms' export at different levels of PTA depth



4.3 Data and variables

Dataset

This paper uses the World Bank's firm-level COVID-19 follow-up enterprise surveys implemented in countries with a recent wave of ES (WBCES). Despite data cleaning and coverage challenges, these surveys have an unparalleled advantage. Given the recency of the crisis, annual data (even when available) cannot capture the fluctuation in export as the stringency of closures policies changed. Therefore, using high-frequency quarterly firm data is important for analyzing the effect of closures on firms.

The dataset used here comprises an unbalanced panel of 13015 firms in 22 countries that have been surveyed three times between Q1 2020 and Q4 2021[2] and that also appear in one of the standard surveys conducted between 2015 and 2019 (pre-2020). Because standard surveys do not distinguish firms over time, I cannot rely on more than one wave of pre-2020 surveys. After merging and cleaning the survey responses, the dataset includes a sample of 52060 firms that have been surveyed four times between 2015 and the end of 2021 (see Appendix A, Tables 4.5-4.7).

I treat the responses of each of these 13015 firms to the latest wave of standard surveys conducted between 2015 and 2019 as the baseline pre-pandemic wave and record them as Q4 2019. For example, if firm A has been surveyed in Q2 2020, Q4 2020, and Q2 2021, I use firm A's 2018 responses, the latest wave of standard surveys, as the values for Q4 2019. Therefore, each firm in the dataset appears four times, the first of which captures its pre-COVID-19 period performance.

Variables

The key outcome variable is the firm-level export, measured as the percentage of sales that was exported directly and indirectly divided by 100, reported during the COVID-19 follow-up surveys $(Export_{fq})$.[3] The key independent variable is the interaction between the monadic annual cumulative average of the depth of PTAs and the stringency of closure and lockdown policies undertaken by states during the pandemic

2. Firms with only one or two waves of COVID-19 surveys are dropped from the analysis.

3. Surveys do not report on other measures of export or performance, such as revenue. The measure of productivity used as a control in this paper is calculated in terms of labour productivity, i.e., total sales per labour cost, using core enterprise surveys conducted before COVID-19 (see Chapter 3). The questionnaire used in follow-up surveys by the World Bank can be accessed here.

$(PTA\_Depth\_c * Stringency\_Index_{cq})$ (see Figure 4.5).

I measure the monadic depth of PTAs at the country level (PTA_Depth_c) as the annual cumulative average of the depth of all PTAs that a country signed since 1985 (Dür et al. 2014). It is calculated as the annual cumulative sum of the Depth Rasch Index (Dür et al. 2014) of all PTAs signed by a single country divided by the annual cumulative number of PTAs. This approach is necessary as DESTA measures the depth of PTAs at the dyad level and does not have a monadic single-country measure of the depth of PTAs. Countries that sign deeper PTAs have a higher annual cumulative average than countries that do not sign deeper PTAs. Because the PTA_Depth_c varies by country but not by quarter, its values remain constant across the four survey waves.

The stringency of closure and lockdown policies $(Stringency\_Index_{cq})$ is from the Oxford COVID-19 Government Response Tracker (OxCGRT), which until the end of 2022 has been tracking, measuring, and publishing several real-time indices of states' COVID-19 policies among others (Hale et al. 2021). The $Stringency\_Index_{cq}$ records the strictness of "lockdown style" policies and is calculated using "all ordinal containment and closure policy indicators, plus an indicator recording public information campaigns" (see Figures 4.9 and 4.10 for descriptive statistics).[4]

I also use three more OxCGRT indices for robustness checks in addition to the main $Stringency\_Index_{cq}$. These include 1) the overall government response index (OGR_Index_{cq}), which measures the variation in the overall governments' responses

4. The Oxford Covid-19 Government Response Tracker (OxCGRT) is available here.

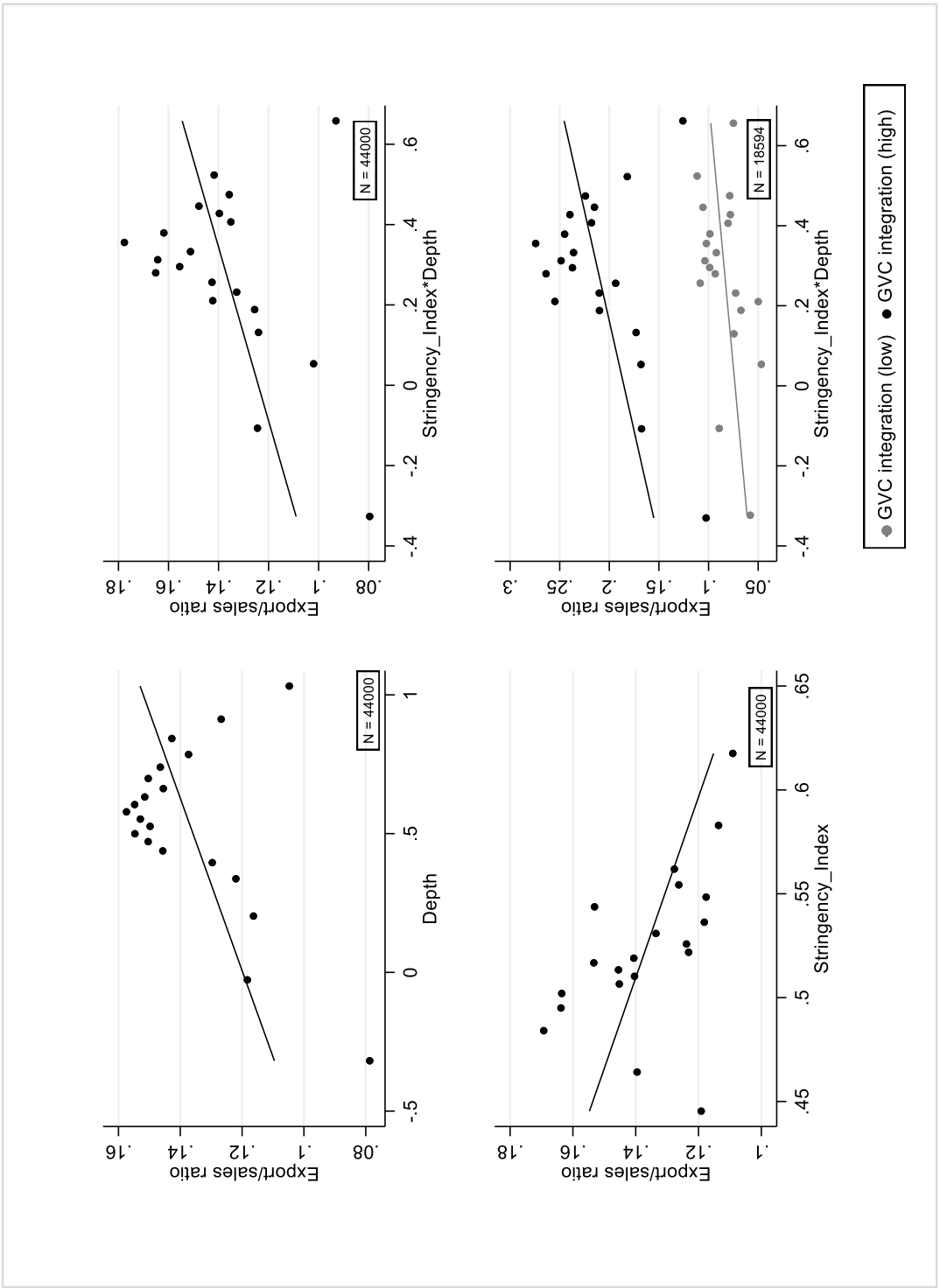


Figure 4.5: Descriptive scatterplots of main variables

to the pandemic; 2) the containment and health index (CH_Index_{cq}), which in addition to 'lockdown' restrictions and closures measures governments' testing, contact tracing, and investment in healthcare and vaccines policies; 3) and economic support index (ES_Index_{cq}), which measures governments income support and debt relief policies.

To capture firms' participation intensity in GVCs, I use their pre-pandemic level of GVC participation. Since this variable enters the dataset as a constant, I use it only to split the overall sample into high participation (equal to or above the sample mean) and low participation (below the sample means) of firms on GVCs. I also use and interact with the main interaction terms of several important control variables expected to change the mediating effect of deep PTAs on firms' export for different closure levels. These include country-level (size of trade, GDP per capita, population, and the quality of domestic institutions) and firm-level (use of a foreign license in export and level of productivity) variables.[5]

To control for unobserved between groups variations, firm, country, and time (year-quarter) fixed effects (FE). Firm (and country) FE control for the many time-invariant determinants of GVC linkages that differ across firms (and countries), while (time) year-quarter fixed effects capture time-varying shocks specific to each combination of quarter and year. I add industry-country time trends in one model to test that the effect of differentiated pre-pandemic trends in GVC trade across industries does not significantly affect the result.

5. In additional tests not shown in this paper, I also add size as a control variable. Since productivity already captures the variations that come from the size of firms, the results presented in this paper with only productivity as control do not change significantly. Results are available on request.

4.4 Empirical strategy

I run ordinary least square (OLS) models with standard errors clustered at the firm level to estimate the difference-in-differences of the effect of deep PTAs on firms' export across different levels of stringency of containment measures. In its most extended form, the model is:

$$\begin{aligned} Export_{fq} =& \beta_0 + \beta_1(Stringency\_Index_{cq}) + \beta_2(PTA\_Depth_c) + \\ & \beta_3(PTA\_Depth_c \times Stringency\_Index_{cq}) + \beta_4(X_{fq}) + \\ & \beta_5(X_{fq} \times Stringency\_Index_{cq}) + \beta_6(X_{fq} \times PTA\_Depth_c) + \\ & \beta_7(Z_{cy}) + \beta_8(Z_{cy} \times Stringency\_Index_{cq}) + \\ & \sigma_f + \tau_c + \gamma_{yq} + \epsilon_{fq}, \end{aligned} \tag{4.1}$$

where $Export_{fq}$ is the main outcome variable,$PTA\_Depth_{cy} \times Stringency\_Index_{cq}$ is the main independent variable, X_{fq} is firm-level controls, Z_{cy} is country-level controls, and σ_f, τ_c, and γ_{yq} are firm, country, and year-quarter FE. $\beta_0 - \beta_8$ are coefficients. β_3 is the main coefficient of interest, and ϵ_{fq} is the error term.

As noted, I use the GVC participation dummy (*GVC dummy*) to split the main sample into high and low GVC participating firms. *GVC dummy* equals one if a firm's participation level in GVCs was above the average in the pre-2020 period. *GVC dummy* equals zero if the level was below the average. Finally, I use the GVC position dummy (*position*) to split the main sample into backward GVC participating firms. The GVC position dummy equals one if, in the pre-2020 period, a firm was participating in GVCs more through backward production linkages (as a buyer) and zero if it was participating in GVCs more through forward linkages (as a supplier).

4.5 Results

Table 4.1 presents the mediating effect of PTAs on firms' export (export/sales ratio) given the changes in the stringency of lockdowns in 2020-2021. All models include country, firm, and time FE. Model 1 estimates the effect with no control variables. Models 2 and 3 add country (income, trade, population density, and the quality of institution) and firm-level (productivity and use of foreign license) controls. Model 4 adds industry-specific time trends to Model 3 to check if the results will change if we consider the seasonality of some industries and that some industries might have been on different time trends in 2020-2021. The coefficient of interaction in model 4 does not change dramatically from model 3.

As noted, because the variation in the PTA_Depth_c variable is not significant and is constant over 2020-2021, its coefficient is absorbed by country FE. The coefficient of the main interaction term $Stringency\_Index_{cq} \times PTA\_Depth_c$ is positive and significant across all models. This result means that as the containment measures and lockdowns increased in stringency, firms in countries with deeper PTAs experienced lower exports than those with more shallow PTAs. In other words, deep PTAs reduce shocks' negative effects on firms' supply chains in the face of major external shocks.

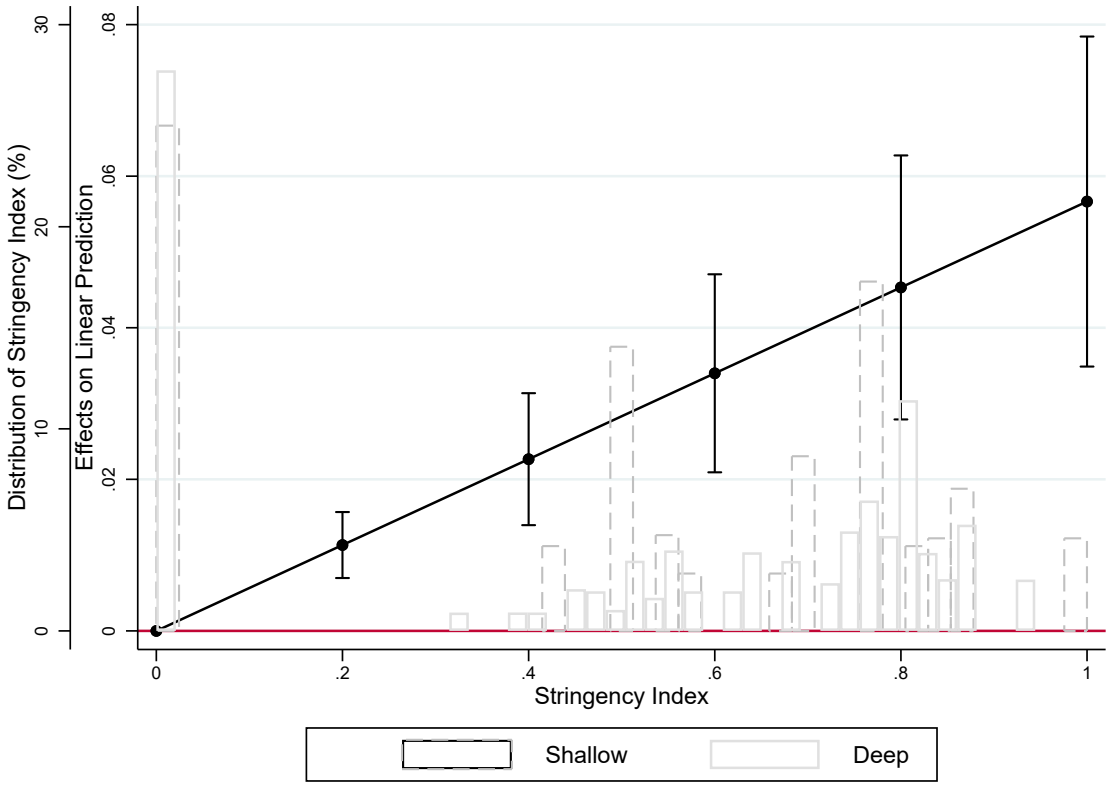
Table 4.1: The mediating effect of deep PTAs on firms' export in the face of lockdowns

	(1)	(2)	(3)	(4)
	Export			
Stringency_Index*PTA_Depth	**0.014***	**0.060*****	**0.057*****	**0.069*****
	(0.007)	**(0.010)**	**(0.011)**	**(0.013)**
Stringency_Index	-0.005	0.109***	-0.049	0.009
	(0.012)	(0.033)	(0.052)	(0.055)
Constant	0.131***	0.214	0.005	3.026
	(0.006)	(0.181)	(0.208)	(4.057)
Country-level controls		✓	✓	✓
Firm-level controls			✓	✓
Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year-quarter FE	✓	✓	✓	✓
ISIC year-quarter trends				✓
Observations	51,814	50,811	44,000	44,000
R-squared	0.645	0.643	0.652	0.655

Note: OLS with standard errors clustered at the firm level in parentheses. The unit of observation is firm-country-year-quarter. *** p<0.01, ** p<0.05, * p<0.1.

To ease the interpretation of the coefficient of $Stringency\_Index_{cq} \times PTA\_Depth_{c}$ on firms' export activities during the pandemic, Figure 4.6 estimates the marginal effect of PTAs on the outcome for different levels of Stringency_Index at 95% CI, using model 3, the most expanded model. The marginal effect plot shows that as the lockdown measures to contain the spread of the virus increase from zero (no lockdown) to 1 (enforced stay-at-home orders and curfews), the effect of deeper PTAs on firms' export increases. More comprehensive trade integration helps export in the face of a major economic and supply chain disruption.

Figure 4.6: Average marginal effect of deep integration on firms' export for different levels of Stringency Index (95% CI)

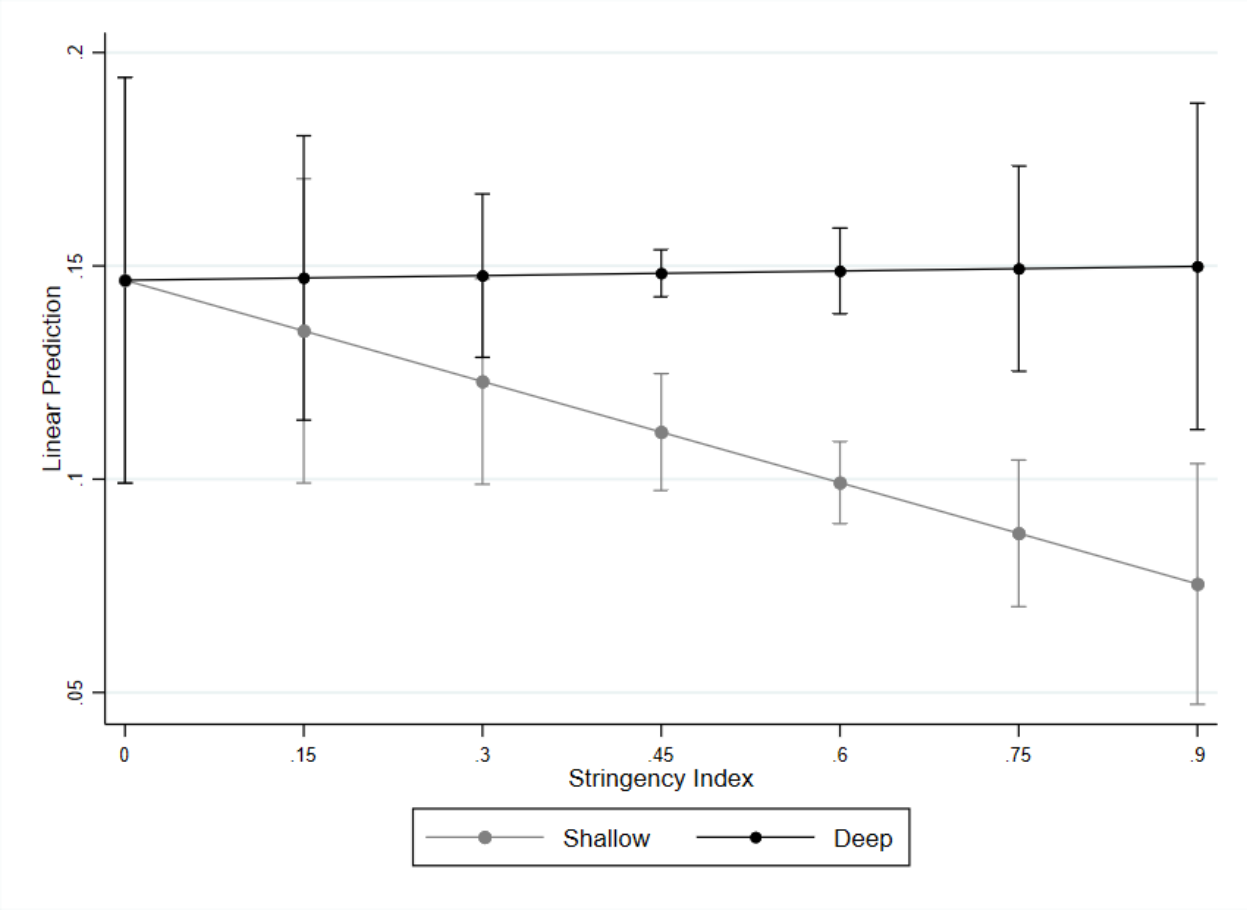


To visualize the difference in the effect of shallow and deep PTAs on firms' export, Figure 4.7 does a simple slopes analysis based on model 3. At 90% CI, the slopes of shallow and deep PTAs are considerably different and do not include zero.[6] The difference is statistically significant as the stringency index increases, meaning that the difference between the shallow and deep PTAs increases and becomes statistically significant when the closures and lockdown measures increase. The slope of

6. At 95% CI, the CI of the two groups overlaps when the value of the stringency index reaches 0.9 but remains different for the stringency index >0.3. This outcome is because the stringency index surpassed 0.9 for only a few countries (observations) in the dataset (see Appendix A, Figures 4.9 and 4.10). A pair-wise comparison of the differences between the two lines shows they remain significant at 1% when the stringency index is more than 0.3.

shallow PTAs is negative, meaning that when the stringency index increases, firms in countries with shallow PTAs experience more decline in their export and that the negative effect of supply chain disruption during COVID-19 is higher for these firms. In contrast, the export of firms in countries with deep PTAs remains unaffected by the changes in the stringency of lockdowns and temporary interruption of economic activities.

Figure 4.7: Simple slope analysis of the effect of deep integration on firms' export for different levels of Stringency Index (90% CI)



Models 1-3 in Table 4.2 test the effect of other dimensions of governments' re-

sponses to the pandemic. While the stringency index measures the strictness of lockdown and closure policies that primarily restrict citizens' behaviour, the overall government response (OGR) index measures the overall government COVID-19 policies throughout the pandemic. The containment-health (CH) index includes lockdowns and government health-related policies, e.g., testing, contact tracing, and investment in healthcare and vaccines. Finally, the economic support (ES) index measures government economic policy responses, such as income support and debt relief.

As the results in Table 4.2 show, there is no statistical difference between the coefficients of the interaction of deep PTAs and these other three measures of policy responses to the pandemic. PTAs mediate more the negative effect of the OGR on firms' export than CH and ES policies. The effect of ES on firms' export is the smallest of all four measures (including the stringency index) because it targets the demand rather than the economy's supply side, which could have an immediate effect on firms. The results are significant in the presence of controls for the time-invariant characteristics of countries, firms, and time included.

Table 4.2: Other government policy measures

	(1)	(2)	(3)
	Export		
OGR_Index*PTA_Depth	0.061***		
	(0.012)		
OGR_Index	-0.017		
	(0.056)		
CH_Index*PTA_Depth		0.056***	
		(0.012)	
CH_Index		-0.074	
		(0.055)	
ES_Index*PTA_Depth			0.047***
			(0.012)
ES_Index			0.182***
			(0.058)
Constant	-0.176	-0.071	-0.492**
	(0.209)	(0.210)	(0.207)
Country-level controls:	✓	✓	✓
Firm-level controls:	✓	✓	✓
Country FE	✓	✓	✓
Firm FE	✓	✓	✓
Year-quarter FE	✓	✓	✓
Observations	44,000	44,000	44,000
R-squared	0.652	0.652	0.652

Note: OLS with standard errors clustered at the firm level in parentheses. The unit of observation is firm-country-year-quarter. *** p<0.01, ** p<0.05, * p<0.1.

Table 4.3 estimates the interaction effect of PTAs and stringency index on firms' performance during the pandemic across different levels of GVC integration and the GVC position of firms. Models 1 and 2 split the overall sample (Model 3, Table 4.1) into firms less integrated with GVC, i.e., whose GVC participation index was below the mean of the overall sample in the pre-COVID-19 period and firms that were more integrated with GVCs. The variable GVC participation comes from the pre-COVID-19 WB core ES. As argued in H2 and H3, deep PTAs have a higher effect on the supply chains of firms that are more integrated with GVC than less integrated firms. Models

3 and 4 estimate the interaction effect on firms' GVC position.

These models split the entire sample (Model 3, Table 4.1) into firms more backwardly integrated to GVC (i.e., firms with foreign value-added content of export more than domestic value-added content in the pre-COVID-19 period) and firms more forwardly integrated to GVC (firms with foreign value-added content of export less than domestic value-added content in the pre-COVID-19 period). [7]

During the pandemic, the mitigating effect of deep trade agreements is larger on firms that participate more in GVC through backward production linkages, i.e., firms that are more downstream. As the containment measures become stringent, the effect of deeper trade agreements on the export of firms more integrated with GVCs through backward production linkages increases (see Chapter 3). This outcome is unsurprising as upstream firms export more raw, unprocessed, and less contract-specific components, e.g., cotton, than downstream firms that buy more value-added components along the supply chains, e.g., textile. It is because institutions reduce uncertainty caused by the pandemic, and their effect is larger on the trade of customized and tailored-to-the-needs-of-buyers products for which the stability of supplier-buyer is important.

7. These results are confirmed with a simple triple interaction specification: the difference in the effect of the depth of PTAs on firms' export across different levels of the Stringency Index and firms' GVC participation (and position). These results are presented in Appendix A, Table 4.9 and Figures 4.13 and 4.14.

Table 4.3: The effect of GVC indicators

	(1)	(2)	(3)	(4)
	Export			
	GVC integration		GVC position	
	Low	High	Backward	Forward
Stringency_Index*PTA_Depth	**0.021***	**0.084*****	**0.235*****	**0.039*****
	(0.011)	**(0.021)**	**(0.038)**	**(0.010)**
Stringency_Index	-0.148***	0.057	0.102	0.044
	(0.056)	(0.089)	(0.171)	(0.048)
Constant	-0.025	0.455	-0.486	-0.051
	(0.254)	(0.346)	(0.658)	(0.204)
Country-level controls	✓	✓	✓	✓
Firm-level controls	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year-quarter FE	✓	✓	✓	✓
Observations	25,406	18,594	7,880	36,120
R-squared	0.592	0.675	0.657	0.608

Note: OLS with standard errors clustered at the firm level in parentheses. The unit of observation is firm-country-year-quarter. *** p<0.01, ** p<0.05, * p<0.1.

4.6 Conclusions and implications

This paper used micro- and macro-level data to examine whether institutions of deep PTAs, namely deep PTAs, increase SC resilience and help firms maintain their production linkages to GVCs during a major disruption. The main findings are twofold. First, results show that deeper trade agreements reduce the negative effect of increasing COVID-19 lockdowns and SC disruptions on firms' export. When the average depth of PTAs changes from shallow to deep, the negative effect of governments' containment measures on firms' export decreases. On average, firms in countries committed to more comprehensive trade agreements experience less breakdown of

SC relations. They can restore export when the lockdown measures are relaxed and economic activities are resumed.

Second, the effect of deep PTAs is stronger on the export of firms more integrated with GVCs. Firms that, on average, have been more integrated with GVCs before the pandemic can restore their export faster under the effect of deep agreements than firms that have been less integrated with GVCs and firms operating under shallow trade integration. In addition, deep PTAs help more backward GVC-integrated firms to weather the effect of external shocks than forward GVC-integrated firms. In other words, the effect of deep PTAs is greater on firms that buy more inputs from foreign suppliers than firms that sell more to foreign buyers.

These results show that deep trade agreements effectively fulfill their primary objective in normal and hard times: they increase the certainty and stability of trade relations under GVCs, helping producers restore their operation quickly after SC disruption. For this reason, more comprehensive trade agreements at the macro (country) level are effective institutional devices that can increase the resilience of firm-level SC and trade in GVCs in the face of a major crisis and decrease its adverse effect on trade and development. The policy implication of this research is that designing and supporting more comprehensive trade institutions may be an effective policy option if states and international organizations aim to make the global SC more resilient and mitigate the risk of future SC disruptions on global trade and development.

The COVID-19 pandemic provides a unique opportunity to fill the void and bring the role and effect of macro institutions into the discussion and analysis of growing

trade in GVCs and SC stability. Future research needs to test the results presented in this paper on a larger sample of firms for multiple episodes of SC disruptions. However, the main challenge remains access to high-frequency and fine-grained cross-country firm-level data, which may push us back to resort to case-bound studies of issues highlighted in this paper or rely on developed countries' data to draw implications for developing countries' issues too.

4.7 Bibliography

Baccini, Leonardo, Andreas Dür, and Manfred Elsig. 2015. "The Politics of Trade Agreement Design: Revisiting the Depth-Flexibility Nexus." *International Studies Quarterly* 59, (4): 765–775.

Baldwin, Richard, and Rebecca Freeman. 2022. "Risks and Global Supply Chains: What We Know and What We Need to Know." *Annual Review of Economics* 14, (1): 153–180.

Bonadio, Barthélémy, Zhen Huo, Andrei A. Levchenko, and Nitya Pandalai-Nayar. 2021. "Global Supply Chains in the Pandemic." *Journal of International Economics* 133, (103534): 1–23.

Brenton, Paul, Michael J. Ferrantino, and Maryla Maliszewska. 2022. *Reshaping Global Value Chains in Light of COVID-19: Implications for Trade and Poverty Reduction in Developing Countries.* The World Bank.

Carvalho, Vasco M., Makoto Nirei, Yukiko U. Saito, and Alireza Tahbaz-Salehi. 2021. "Supply Chain Disruptions: Evidence from the Great East Japan Earthquake." *The Quarterly Journal of Economics* 136, (2): 1255–1321.

Cerdeiro, Diego A., András Komáromi, Yang Liu, and Mamoon Saeed. 2020. *World Seaborne Trade in Real Time: A Proof of Concept for Building AIS-Based Nowcasts from Scratch.* IMF working paper 2020/057. International Monetary Fund.

De Sa, Marcelo Martins, Priscila Laczynski de Souza Miguel, Renata Peregrino de Brito, and Susana Carla Farias Pereira. 2019. "Supply Chain Resilience: The Whole Is Not the Sum of the Parts." *International Journal of Operations & Production Management* 40, (1).

Dollar, David, and Matthew Kidder. 2017. *Institutional Quality and Participation in Global Value Chains.* The World Bank.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig. 2014. "The Design of International Trade Agreements: Introducing a New Dataset." *The Review of International Organizations* 9, (3): 353–375.

Enderwick, Peter, and Peter J. Buckley. 2020. "Rising Regionalization: Will the Post-COVID-19 World See a Retreat from Globalization?" *Transnational Corporations Journal* 27, (2): 99–112.

Facchini, Giovanni, Maggie Y Liu, Anna Maria Mayda, and Minghai Zhou. 2019. "China's 'Great Migration': The Impact of the Reduction in Trade Policy Uncertainty." *Journal of International Economics* 120,126–144.

G7. 2022. *G7 Trade Ministers' Statement.* Accessed December 9, 2022.

Gereffi, Gary. 2020. "What Does the COVID-19 Pandemic Teach Us about Global Value Chains? The Case of Medical Supplies." *Journal of International Business Policy* 3, (3): 287–301.

Graziano, Alejandro G., Kyle Handley, and Nuno Limao. 2021. "Brexit Uncertainty and Trade Disintegration." *The Economic Journal* 131, (635): 1150–1185.

Grossman, Gene M, and Elhanan Helpman. 2020. "When Tariffs Disturb Global Supply Chains." NBER Working Paper 27722.

Hale, Thomas, Noam Angrist, Rafael Goldszmidt, Beatriz Kira, Anna Petherick, Toby Phillips, Samuel Webster, Emily Cameron-Blake, Laura Hallas, and Saptarshi Majumdar. 2021. "A Global Panel Database of Pandemic Policies (Oxford COVID-19 Government Response Tracker)." *Nature Human Behaviour* 5, (4): 529–538.

IMF. 2022a. *World Economic Outlook, April 2022: War Sets Back The Global Recovery.* International Monetary Fund.

———. 2022b. *World Economic Outlook Update, July 2022: Gloomy and More Uncertain.* International Monetary Fund.

Juttner, Uta, and Stan Maklan. 2011. "Supply Chain Resilience in the Global Financial Crisis: An Empirical Study." *Supply Chain Management: An International Journal* 16, (4): 246–259.

Kahler, Miles. 2013. "Economic Crisis and Global Governance: The Stability of a Globalized World." *Procedia - Social and Behavioral Sciences* 77,55–64.

Kamalahmadi, Masoud, and Mahour Mellat Parast. 2016. "A Review of the Literature on the Principles of Enterprise and Supply Chain Resilience: Major Findings and Directions for Future Research." *International Journal of Production Economics* 171,116–133.

Latour, Almar. 2001. "Trial by Fire: A Blaze in Albuquerque Sets off Major Crisis for Cell-Phone Giants." *Wall Street Journal:* 2001.

Levchenko, Andrei A. 2007. "Institutional Quality and International Trade." *The Review of Economic Studies* 74, (3): 791–819.

Limao, Nuno, and Giovanni Maggi. 2015. "Uncertainty and Trade Agreements." *American Economic Journal: Microeconomics* 7, (4): 1–42.

Mansfield, Edward D., and Eric Reinhardt. 2008. "International Institutions and the Volatility of International Trade." *International Organization* 62, (4): 621–652.

Michelman, Paul. 2007. "Building a Resilient Supply Chain." *Harvard Business Review*.

Naanwaab, Cephas, and Johnson Antwi. 2019. "International Integration, Trade, and the Great Recession." *International Economic Journal* 33, (1): 128–148.

North, Douglas. 1990. *Institutions, Institutional Change and Economic Performance.* Cambridge.

Nunn, Nathan. 2007. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *The Quarterly Journal of Economics* 122, (2): 569–600.

OECD. 2021. *Global Value Chains: Efficiency and Risks in the Context of COVID-19.* OECD Policy Responses to Coronavirus (COVID-19), OECD Policy Responses to Coronavirus (COVID-19).

Pelc, Krzysztof. 2020. "Can COVID-Era Export Restrictions Be Deterred?" *Canadian Journal of Political Science* 53, (2): 349–356.

Pisch, Frank. 2020. "Managing Global Production: Theory and Evidence from Just-in-Time Supply Chains." University of St. Gallen Discussion Paper No. 2020-08.

Ponomarov, Serhiy Y., and Mary C. Holcomb. 2009. "Understanding the Concept of Supply Chain Resilience." *The International Journal of Logistics Management.*

Razeq, Zarlasht. 2022. "Deep Trade Integration and North-South Participation in GVCs." *Transnational Corporations Journal* 29, (3): 1–40.

Solingen, Etel, ed. 2021. *Geopolitics, Supply Chains, and International Relations in East Asia.* Cambridge: Cambridge University Press.

Tukamuhabwa, Benjamin R., Mark Stevenson, Jerry Busby, and Marta Zorzini. 2015. "Supply Chain Resilience: Definition, Review and Theoretical Foundations for Further Study." *International Journal of Production Research* 53, (18): 5592–5623.

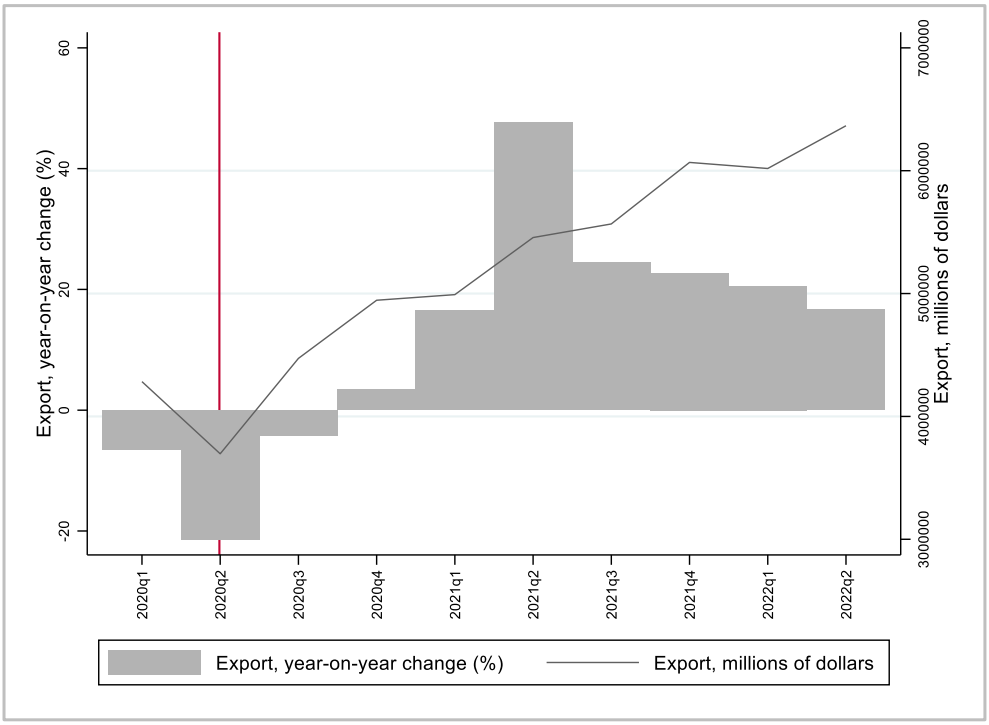
WTO. 2022. *Global Supply Chains Forum Report.* World Trade Organization.

4.8 Appendix to Chapter 4

Appendix A

Descriptive statistics

Figure 4.8: Global export of goods (millions of dollars)



Source: based on Exports by areas and countries, DOTS IMF dataset, available here.

Figure 4.9: Distribution of Stringency Index (2020-2021)

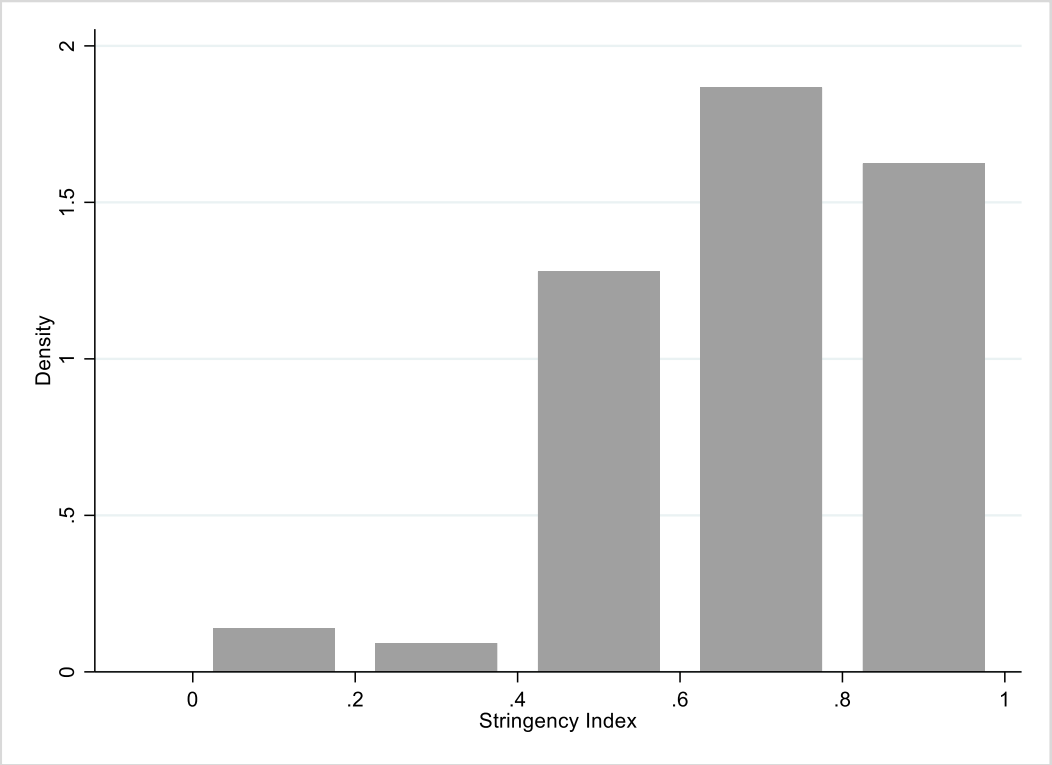


Figure 4.10: Stringency Index by countries in the dataset

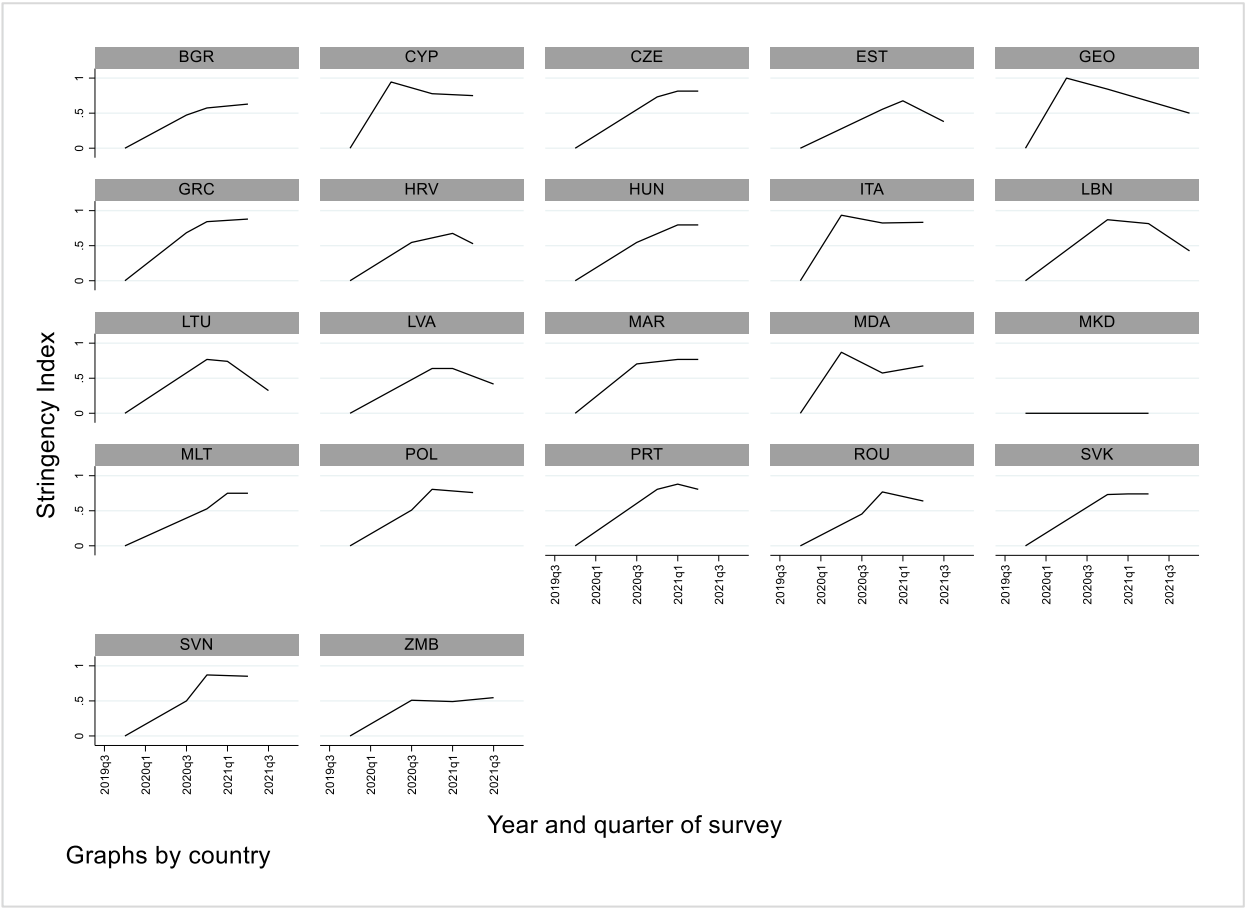


Table 4.4: Tabulation of observations by waves of surveys and year-quarter

Year and quarter of survey	pre-COVID-19 (core WBES 2015-2019)	COVID-19 surveys			
	Waves				
	0	1	2	3	Total
2019q4	13015	0	0	0	13015
2020q2	0	1941	0	0	1941
2020q3	0	6870	0	0	6870
2020q4	0	4204	5905	0	10109
2021q1	0	0	6218	360	6578
2021q2	0	0	892	9864	10756
2021q3	0	0	0	1678	1678
2021q4	0	0	0	1113	1113
Total	13015	13015	13015	13015	52060

Table 4.5: Tabulation of observations by country and year-quarter

	Year and quarter of survey								
country1	239	241	242	243	244	245	246	247	Total
Bulgaria	772	0	772	772	0	772	0	0	3088
Croatia	404	0	404	0	404	404	0	0	1616
Cyprus	240	240	0	240	0	240	0	0	960
Czechia	502	0	0	502	502	502	0	0	2008
Estonia	360	0	0	360	360	0	360	0	1440
Georgia	581	581	0	581	0	0	0	581	2324
Greece	600	0	600	600	0	600	0	0	2400
Hungary	805	0	805	0	805	805	0	0	3220
Italy	760	760	0	760	0	760	0	0	3040
Latvia	359	0	0	359	359	0	359	0	1436
Lebanon	532	0	0	532	0	532	0	532	2128
Lithuania	358	0	0	358	358	0	358	0	1432
Macedonia	360	0	0	360	360	360	0	0	1440
Malta	242	0	0	242	242	242	0	0	968
Moldova	360	360	0	360	0	360	0	0	1440
Morocco	1096	0	1096	0	1096	1096	0	0	4384
Poland	1369	0	1369	1369	0	1369	0	0	5476
Portugal	1062	0	0	1062	1062	1062	0	0	4248
Romania	814	0	814	814	0	814	0	0	3256
Slovakia	429	0	0	429	429	429	0	0	1716
Slovenia	409	0	409	409	0	409	0	0	1636
Zambia	601	0	601	0	601	0	601	0	2404
Total	13015	1941	6870	10109	6578	10756	1678	1113	52060

Table 4.6: Summary statistics

	N	min	max	Mean	St.Dev	skewness
Export/sales ratio (firm)	52060	0	1	.086	.237	2.862
Stringency Index ratio	52060	0	1	.514	.338	-.612
Depth	52060	-.546	.922	.522	.443	-1.279
GVC participation (high/low)	52060	0	1	.474	.499	.106
GVC position	52060	0	1	.831	.375	-1.765
Government Response ratio	52060	0	.879	.494	.319	-.702
Health Containment Measures ratio	52060	0	.88	.5	.324	-.682
Economic Support ratio	52060	0	1	.476	.349	-.264
GDP growth rate (country)	52060	-6.7	5.54	2.778	2.35	-2.579
log(Export), (country)	51056	6.833	11.69	9.325	1.25	-.065
Population density	52060	21.063	1386.664	139.896	203.52	4.744
Use of technology license	49652	1	2	1.838	.369	-1.831
Labour productivity (firm)	47208	3.023	17.87	10.552	1.458	-.455
Quality of institutions (WGI)	52060	0	1	.926	.262	-3.259

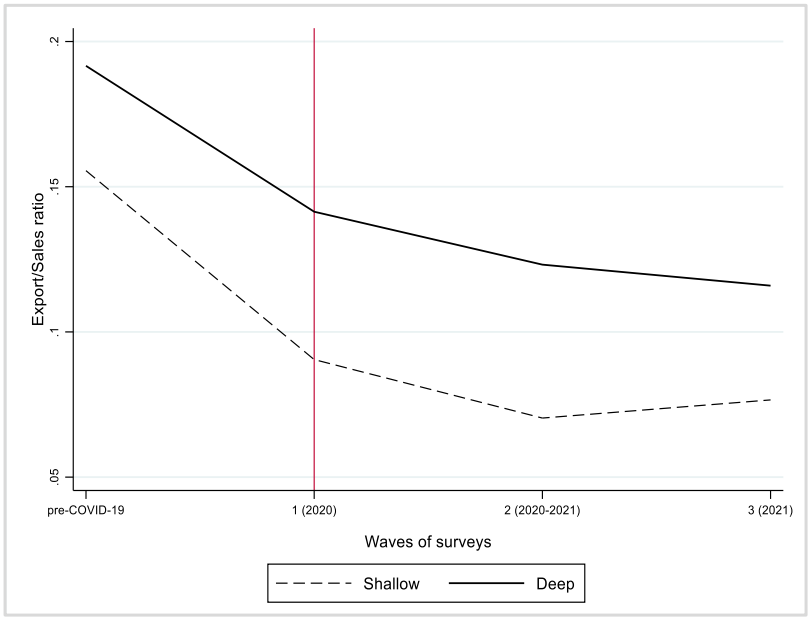
Table 4.7: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Export/sales ratio (firm)	1.000										
(2) Stringency Index ratio	0.173	1.000									
(3) Depth	0.046	-0.005	1.000								
(4) GVC participation (high/low)	0.151	0.015	-0.053	1.000							
(5) GVC position	-0.246	0.018	-0.035	-0.135	1.000						
(6) GDP growth rate (country)	-0.012	-0.061	0.444	-0.044	0.001	1.000					
(7) log(Export), (country)	0.015	0.153	0.507	0.028	0.058	0.074	1.000				
(8) Population density	-0.020	0.028	-0.114	-0.007	-0.002	-0.330	-0.125	1.000			
(9) Use of technology license	-0.074	0.006	-0.009	-0.070	0.162	-0.013	0.011	-0.006	1.000		
(10) Labour productivity (firm)	0.064	0.056	0.374	-0.035	-0.104	-0.075	0.216	0.139	-0.058	1.000	
(11) Quality of institutions (WGI)	0.029	0.024	0.216	0.001	-0.023	-0.016	0.416	0.075	-0.013	0.180	1.000

Table 4.8: VIF of variables

	VIF	1/VIF
Depth	2.110	0.473
log(Export), (country)	1.740	0.576
GDP growth rate (country)	1.550	0.644
Labour productivity (firm)	1.310	0.761
Quality of institutions (WGI)	1.250	0.801
Population density	1.180	0.844
GVC position	1.070	0.936
Stringency Index ratio	1.040	0.960
Use of technology license	1.030	0.968
GVC participation (high/low)	1.030	0.968

Figure 4.11: Firm-level export across different waves of surveys and levels of PTAs and GVC integration



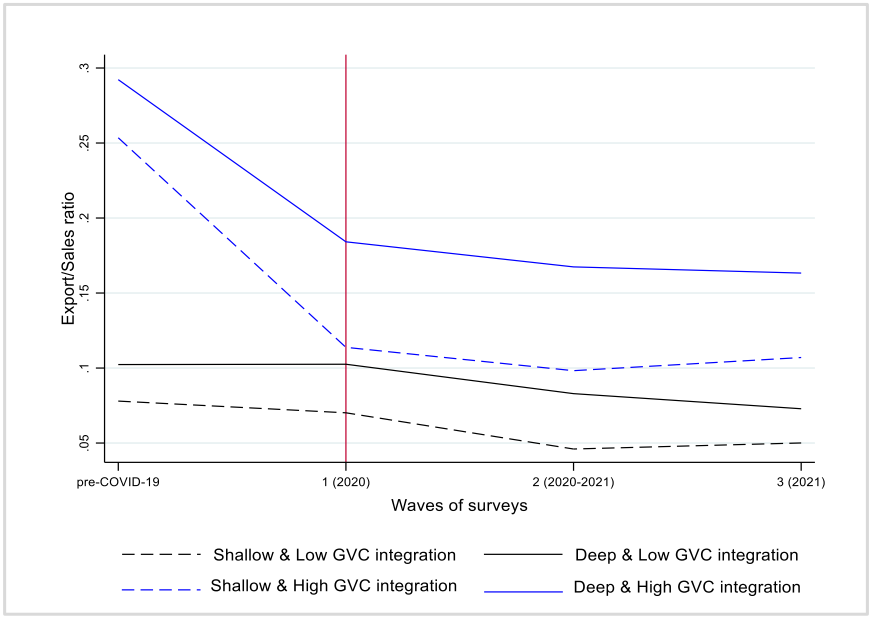
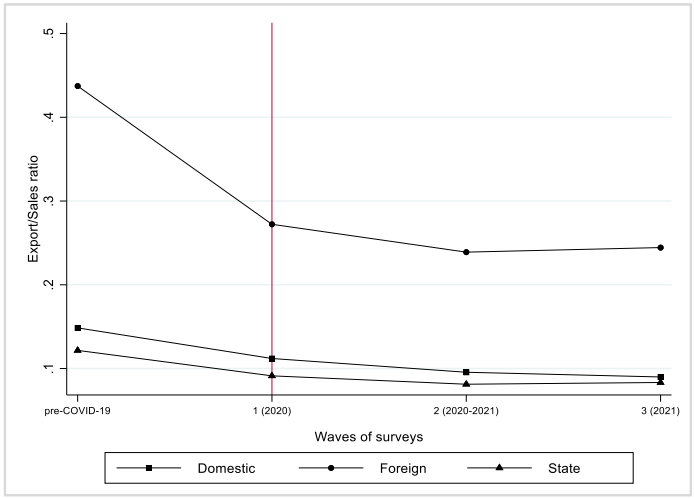
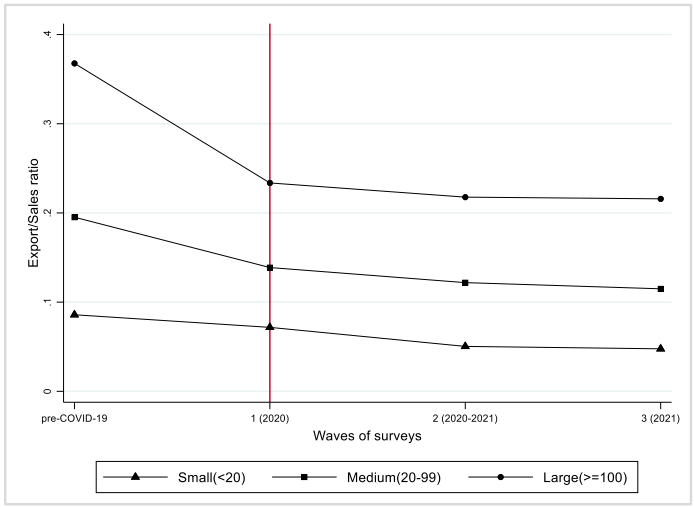


Figure 4.12: Firm-level export across different waves of surveys and levels of ownership, size, and country income





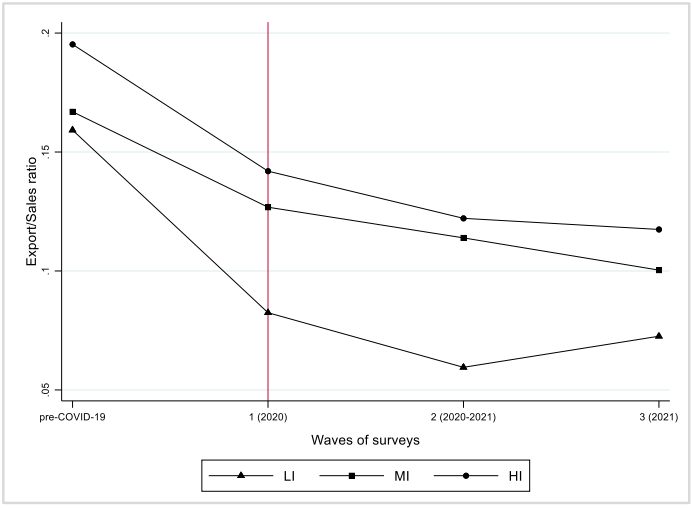


Table 4.9: Average marginal effect of a triple difference test)

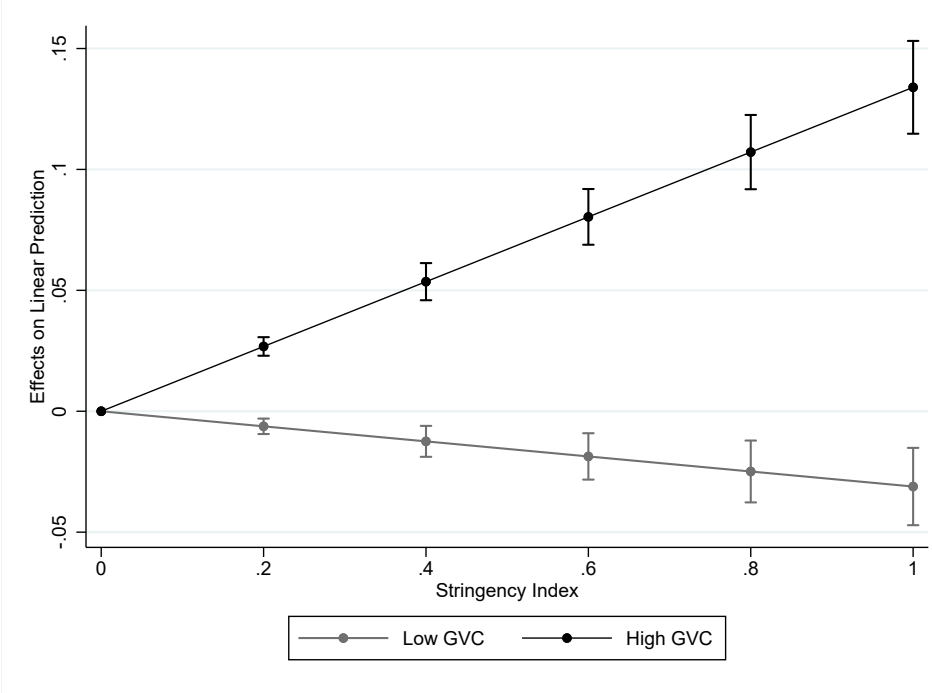
Table 4.9 shows the mediating effect of deep PTAs on firms' export for different levels of the Stringency Index. Model 1 shows the triple difference for low and high levels of GVC participation. Model 2 shows the triple difference for backward and forward GVC positions (see Table 4.3.

	(1)	(2)
	Export	
Stringency_Index*PTA_Depth*Low GVC	-0.031***	
	(0.008)	
Stringency_Index*PTA_Depth*High GVC	0.134***	
	(0.010)	
Stringency_Index*PTA_Depth*Backward		0.304***
		(0.016)
Stringency_Index*PTA_Depth*Forward		-0.010
		(0.008)
Stringency_Index	-0.113**	-0.139***
	(0.048)	(0.047)
Constant	0.212***	0.204***
	(0.026)	(0.026)
Country-level controls	✓	✓
Firm-level controls	✓	✓
Observations	44,000	44,000
R-squared	0.036	0.052

Note: Pooled OLS with standard errors clustered at the firm level in parentheses. The unit of observation is firm-country-year-quarter.

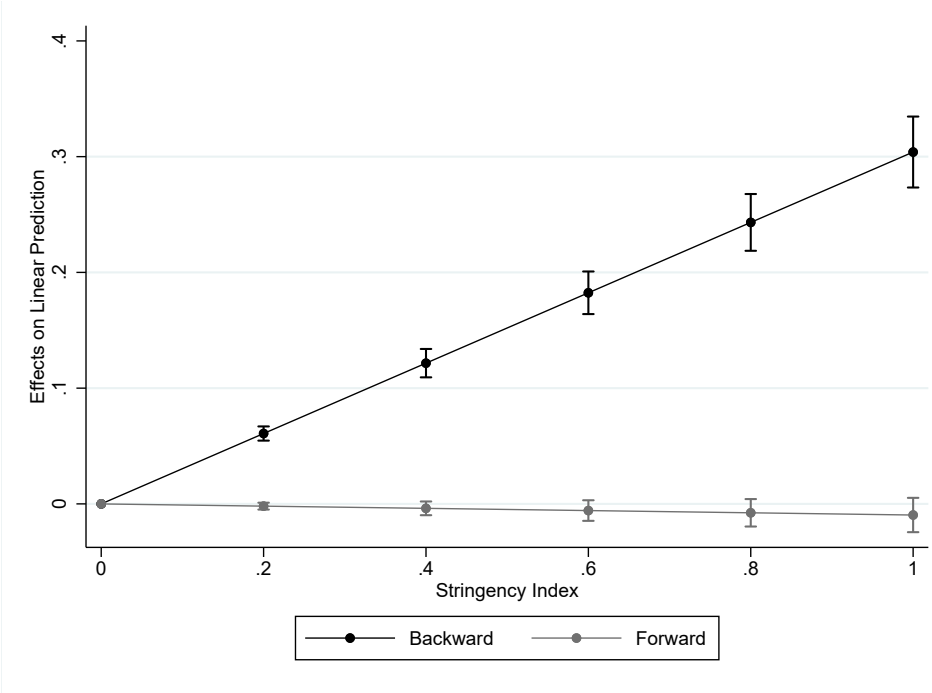
*** p<0.01, ** p<0.05, * p<0.1.

Figure 4.13: Average marginal effect of deep PTAs on firms' export across different levels of GVC position and Stringency Index



Note: based on Model 1 Table 4.9.

Figure 4.14: Average marginal effect of deep PTAs on firms' export across different levels of GVC participation and Stringency Index



Note: based on Model 2 Table 4.9.

Chapter 5

Final discussion and conclusions

5.1 Summary of findings

Does signing deeper trade agreements help countries and their producers to integrate with GVCs and gain from the globalization of production? If it does, then under what conditions and why? The overarching argument of this project was that, under the growing internationalization of supply chains where production activities are no longer concentrated in one firm or country, deep PTAs help countries and their firms to produce and add more value to their export. They increase countries' (and firms') trade in VA more effectively than shallow agreements because they provide a unified and idiosyncratic institutional framework conducive to long-term stability in trade, investment, and production relations.

The project answered the question and provided strong empirical evidence for the argument in three related but independent journal articles in the preceding chapters, progressing from macro (country) to micro (firms) -level analysis. The first paper looked at the effect of trade agreements on bilateral trade in GVCs at the country level. It examined if the proliferation of deep bilateral integration increases states'

participation in global value chains (GVCs). It provides robust evidence that deep PTAs increase states' participation in GVCs. This effect size is more pronounced over the long term when PTAs include provisions supporting investment or if at least one partner is a developing country. The second paper brought the question of local institutions into the discussion of firms' participation in GVCs and the distributional consequences of trade integration in this context. It combines macro (country) and micro (firm) level data and examines the mediating effect of domestic institutions on the relation between deep integration and firms' participation in GVCs. It finds that when the regulatory quality of domestic institutions is high, the deepening of trade integration increases productive firms' participation in GVCs. The third paper examined if deep PTAs increase the resilience of GVC trade against external shocks, such as pandemics, at the firm level. It shows that countries (and firms) that have actively participated in GVCs pre-pandemic experience much less reduction in their export during the pandemic under the effect of deep trade agreements.

These papers' comprehensive conceptual, analytical, and empirical approach helped illuminate important mechanisms under-explored, until now, because of conceptual and analytical limitations. Conceptually, the first paper engaged with the literature on new regionalism and the design of trade agreements, development studies, and empirical studies of trade in GVCs. The second paper also engaged with the key conceptual assumptions of NNTT and new institutionalism. The third paper discussed the mitigating role of preferential trade institutions in reducing uncertainty during a major trade shock. Analytically, the first paper took a macro approach and focused on the country-level bilateral trade in value-added export under the deepening and proliferation of a preferential trade regime. The second paper took a micro approach and, while considering country-level factors, focused on firms' participation in GVCs, ex-

ploring the variations in the quality of domestic institutions. Finally, the third paper remained focused on firm-level analysis but shifted its temporal focus from normal times to the time of crisis.

Empirically, the project built and used three separate datasets. The first paper built a dyadic dataset that varied by year and country and used a gravity model framework with interval data and a full set of fixed effects (exporter-year, importer-year, and dyad fixed effects). It measured dyadic GVC participation as bilateral value-added trade (Eora), and the depth index (DESTA) measured the depth of PTAs. The second paper built a repeated cross-section firm-level dataset that varied by country (2006-2020), industry (ISIC 4 digits), and year. It used a difference-in-differences approach with country-year, industry-fixed effects, and samples split across different institutional settings. In this paper, I calculated a new firm-level measure of GVC participation using firm-level survey responses and an average monadic measure of states' commitments to deep PTAs, using the dyadic depth index (DESTA). Finally, the third paper built a quarterly panel of firms surveyed in 2020-2021 that varied across firms, countries, and year-quarter and used a difference-in-differences approach and country, firm, and year-quarter fixed effects with the sample split across various levels of GVC integration. In this paper, the outcome variable is firm-level export for different groups of firms, and the depth of PTAs is measured as in the previous paper.

Overall, findings in these papers support the overarching argument: deep PTAs are more effective in countries and firms' participation in GVCs in normal and hard times than shallow integration. This project provided new evidence that deep PTAs are a powerful and long-lasting institutional and policy engine that can effectively tai-

lor and mobilize trade in GVCs for development. In the context of the recent changes in production and comprehensive (deep) trade agreements that include at least three or more provisions and go beyond tariff cuts are effective institutional frameworks that can help countries (and firms) to increase their GVC participation and export. This project provided new evidence that this effect occurs with certain nuances at the macro (country) and micro (firm) levels.

At the country level, dyads that sign PTAs that cover beyond tariff areas, such as investment, services, and intellectual property rights, export significantly more value-added than dyads that sign agreements with a shallow scope or are not in any PTAs. However, the size and significance of this effect vary across different features of PTAs and time. First, PTAs that involve at least one developing country, i.e., North-South, or South-South, are more effective in increasing the VA trade between dyads than N-N PTAs or WTO membership. A more significant effect of (deep) PTAs on developing countries' VA export is important because it shows that, in comparison to multilateral agreements, preferential trade integration is more effective in improving product quality and specialization.

Second, certain provisions of PTAs that are particularly important for trade in VA, especially for developing counties, support investment and investment-related activities such as services and IPRs. The effect of these provisions is significantly less on final exports, as tables in Appendix C, Chapter 2, show. Finally, deep PTAs facilitating GVC trade have a stronger cumulative effect over time than shallow and multilateral trade agreements. A statistically significant effect on VA trade over the long (4-8 years) rather than short term (less than four years) is also a novel finding of this project since previous works, in the context of final export, paid scant attention

to the distinction between the short- and long-term effect of (deep) PTAs.

At the firm level, PTAs that go beyond tariff cuts and broaden the scope of integration and governance of trade relations increase firms' participation in GVCs trade during normal and hard (crisis) times than shallow PTAs with certain nuances. First, the effect of deep trade agreements on firms' participation in GVCs depends not only on firms' performance (e.g., productivity, as trade theory argues) but also on the quality of domestic institutions and regulations. More complex trade agreements have a strong reallocation effect on firms in countries that maintain a good quality of domestic institutions, regardless of their income levels. As preferential trade integration becomes deep, firms in high-quality institutional (HQI) environments participate more in GVCs than low-quality institutional (LQI) environments. Second, evidence in Chapter 3 also suggests that the mediating effect of the quality of regulatory and contract enforcement institutions, which are important determinants of country-level export of contract-intensive and complex products, is more conducive to firms' GVCs integration.

A statistically significant and strong effect from deep PTAs on firms' export and integration with GVCs is further supported by quarterly data during the COVID-19's global supply chain disruptions. As the results of Chapter 4 show, deeper trade agreements reduce the negative effect of increasing COVID-19 lockdowns and supply chain disruptions on firms' export. When the average depth of PTAs changes from shallow to deep, the negative effect of governments' containment measures on firms' export decreases. On average, firms in countries committed to more comprehensive trade agreements experience less breakdown of supply chain relations. They can restore their export when the lockdown measures are removed and economic activities are

resumed.

Finally, the effect of deep PTAs is stronger on the export of firms more integrated with GVCs. Firms that, on average, have been more integrated with GVCs before the pandemic can restore their export faster under the effect of deep agreements than firms that have been less integrated with GVCs and firms operating under shallow trade integration. In addition, deep PTAs help backward GVC-integrated firms to weather the effect of external shocks more than forward GVC-integrated firms. In other words, their effect is greater on firms that buy more inputs from foreign suppliers than on firms that sell more to foreign buyers (see Table 5.1).

5.2 Broadening implications

The proliferation of deep PTAs is changing the landscape of trade regimes. The formation of GVCs is changing countries' and firms' comparative advantages in international production. Testing the former's effect on the latter contributes towards a better understanding of how and why the new generation of trade agreements can help enhance the welfare gain from the internationalization of production. The findings in this doctoral thesis offer important theoretical and practical implications for more synergy between trade and development policy. In the following sections, I will focus on three implications (in line with the three strands of the literature identified in Chapter 1).

Design of PTAs

When integration into GVCs is a policy priority, deep PTAs will be preferred by states over shallow and multilateral agreements. Why? This statement is based on findings

Table 5.1: Summary

Overarching research question	Does the deepening of the preferential trade regime help members and their producers to integrate and trade more with GVCs? If they do, what are the implications of this effect on development and trade policy, especially in developing countries?		
Overarching argument	that under the globalization of supply chains, where production activities are no longer concentrated geographically in one firm or country, deep PTAs increase the share of domestic value added to export at the country and firm levels.		
Papers:	1	2	3
Research questions	• Do comprehensive trade agreements increase states' participation in global value chains (GVCs) and contribute to their development?	• Do the differences in the quality of domestic institutions across countries mediate the distributional effect of deep integration on firms' participation in GVCs?	• Does comprehensive trade integration increase the resilience of firms' GVCs linkages against supply chain disruptions?
Unit of analysis	• Dyad-year	• Firm-country-year	• Firm-country-quarter
Depth measure	• Dyadic depth index for each dyad (Dur et al., 2014)	• Average annual cumulative depth index for each country (by author)	• Average annual cumulative depth index for each country (by author)
GVC participation measure	• Bilateral VA trade (Koopman et al, 2014)	• A new firm-level GVC participation measure (by author)	• The intensity of GVC linkages at baseline (pre-COVID-19) (by author)
Dataset coverage	• 188 countries, 1990-2018 (4-year interval)	• 124 countries, 9719 surveys were conducted between 2006-2020	• 22 countries, 13015 firms, surveyed in 2020-2021
Key finding	• Deep PTAs increase bilateral trade in GVCs over the long term; when they involve at least one developing (South) country; and when they specifically include provisions that support investment and investment-related activities.	• Deep PTAs increase GVC participation of productive firms only when the quality of domestic institutions is strong, especially regulatory institutions and contract enforcement.	• Deep PTAs reduce the crisis's negative effect on firms' GVC participation and help increase supply chains' resilience under global trade shocks.
Overarching finding	These papers suggest that deep trade integration is a powerful and long-lasting policy engine that can effectively tailor and mobilize trade in GVCs for development. In addition, deep integration adds to the certainty of trade policy and increases the resilience of GVCs linkages against external shocks at the firm level. However, it must also be noted that the context matters: participation in GVCs is conditioned not only on deep integration and the heterogenous characteristics of firms, such as productivity, but also on the quality of the local institutional environment, which have a strong mediating and distributional effect on countries' and their firms' ability to participate in GVCs under deeper trade integration.		

in this project that deep agreements have a more profound effect on the rise of VA trade than on final trade and that this effect on VA trade is certainly more than the effect of shallow and multilateral trade agreements, such as WTO.

Chapter 2 benchmarked the effect of (deep) PTAs on both traditional (final export) and GVC (VA) measures of trade. Results showed that the effect of shallow preferential and multilateral agreements (i.e., WTO membership) on traditional trade flows is significantly higher than that of deep PTAs. The magnitude and significance of this effect were in line with previous seminal works on the effect of trade liberalization on traditional trade flows (Baier and Bergstrand 2007; Mansfield and Milner 1999). In contrast, deep PTAs with investment-related provisions, developing countries, and over the long term, increase trade in VA more than shallow and multilateral agreements, and their effect on traditional trade flows is significantly small.[1]

The difference between the effects of deep and shallow (preferential or multilateral) agreements points to a qualitative distinction between the traditional and new trade flows, as discussed in Chapter 1. Moreover, because the formation of GVCs depends on investment flows, availability of support services, and other non-tariff

1. It must be noted that while Chapter 2 disaggregates the effect of PTAs on GVC trade by different groups of provisions, the effect and mechanisms of specific provisions on trade and GVCs should be further examined in future research using smaller datasets or case studies. For example, it can be further examined why market-access provisions (i.e., procurement and competition) decrease VA trade for certain dyads (see Chapter 2). Currently, at least two other papers using the World Bank deep PTAs data on procurement and competition provisions support these findings. Using inter-country input-output tables data for OECD countries, Mulabdic and Rotunno (2022) found that provisions on government procurement increase cross-border flows of services more than the flow of goods, which are insignificantly and even negatively affected by these provisions. In addition, they also found a strong home bias effect, i.e., buying local, from government procurement provisions on purchase of inputs, which can dampen VA trade between the two countries. On competition provisions, others show a negative effect on bilateral trade from provisions that "establish cooperation in the field of competition" among PTA members. The negative effect holds for PTA members and third countries in a different PTA with competition provision (Crowley et al. 2021, 34-35).

factors (Razeq 2022), more shallow agreements are poorly suited to govern trade liberalization and integration under GVCs. States, therefore, will continue to strive to join more comprehensive trade agreements when their development and trade priority is to engage and trade more in GVCs.

These results provide strong empirical support for previous arguments that with the increasing complexity of international production and formation of GVCs, shallow agreements and WTO membership "will be relatively poorly suited for liberalizing tariffs on the customized inputs that form the bulk of GVC trade". For this reason, states will increasingly "seek alternative agreements with the countries in their GVCs as a way to achieve the deep integration that WTO commitments" cannot provide (Staiger 2022, 232; Antràs and Staiger 2012.

An important question arising from this evidence for deep preferential trade liberalization is whether more PTAs threaten trade integration. Are these agreements then stumbling blocks for a fair global trading system? My answer would be no. PTAs have been a stepping stone towards a fair and inclusive multilateral trade system under traditional trade, and they remain so where trade in GVCs is prevalent. A gravitation towards deeper agreements would have been a stumbling block for global trade if there was no difference between shallow PTAs, deep PTAs, and multilateral agreements.

Replacing multilateral agreements with preferential integration would create a factional and dysfunctional trading system that cannot generate added value for its members. However, this is not the case: deep PTAs improve members' welfare through more trade in VA. For this reason, they can be used as a stepping

stone towards a more comprehensive integration with a larger number of countries and GVCs and "to encourage plurilateral agreements within the WTO framework" (Staiger 2022, 235).

BITs are, however, a different case. Similar to PTAs, BITs have also "proliferated over the past 50 years", and their stand-alone welfare effect on dyads' economy is as significant as the welfare effect of PTAs (Bergstrand and Egger 2013, 107). Compared to shallow and multilateral agreements, they complement and reinforce the effect of (deep) PTAs on GVC trade. Chapter 2 showed that the effect of BITs and PTAs with investment-related provisions on VA trade, especially for developing countries, is greater than that of shallow preferential and multilateral agreements or stand-alone BITs. While shallow and multilateral trade liberalization may boost the export of upstream inputs from resource-rich countries, they cannot increase the VA content of export. Developing countries can upgrade to higher VA tasks and processes by improving the quality and customization of their production only by engaging in beyond-tariffs integration and investment. Therefore, the overlap between BITs and deep PTAs does not divert or substitute the impact of preferential regimes on GVCs. In contrast, BITs complement this effect because of their direct impact on the quality of production and the regulation of legal aspects of investments.

Theoretically, the overlap between the two agreements can lead to a less effective trade and investment policy (Davis 2009); however, empirical evidence presented in Chapter 1 and discussed here suggests this is not the case in the context of trade in GVCs. The synergy between the co-evolution and design of deep PTAs and BITs finds support in suggestive evidence of previous research on trade and investment regimes. Defining the overlap between PTAs and BITs as "regime complex", i.e., the "presence

of nested, partially overlapping, and parallel international regimes that are not hierarchically ordered" (Alter and Meunier 2009, 13), Kim and Lee (2019) show that the two agreements' overlap "are largely complementary" rather than conflicting (361).

While investment provisions in PTAs underline the wholeness of "trade liberalization commitments", BITs are more geared towards the "protection of investor interests and property rights" (380). Evidence also suggests that states draw on the design features of PTAs to draft their BITs and investment laws but also "switch strategically between them" when needed (Chaisse et al. 2022). Therefore, BITs complement the effect of PTAs on VA trade. When integration into GVCs is a policy priority, deep PTAs, especially those that include investment provisions, may be preferred by states in conjunction with BITs.

Trade theory and domestic institutions

Trade analysis must engage more with micro-level location-specific factors of the distribution of gains from deep integration, such as domestic institutions. Why? Chapter 3 showed that the distributional effect of (deep) trade integration does not depend on the heterogeneity of firm characteristics, such as productivity, as trade theory suggests, but also on the governance quality of domestic institutions.

As discussed in Chapter 1, new models of trade theory (Melitz 2003), especially those that shifted towards the study of GVCs (Antràs 2015), are more equipped to analyze the new patterns of trade that arise from the globalization of production and trade in VA than other neo-classical models of trade. However, as recent works show, the role of domestic institutions as an explanatory factor in firm-level trade analysis has been neglected: institutions, broadly defined, mediate the effect of trade liberal-

ization on firms' and workers' gains from final export (Baccini et al. 2022, 71). The implication of an institution-free trade theory for trade has led to the good and bad of the welfare effect of preferential trade liberalization being attributed to firms' productivity, size, and (to a certain extent) foreign ownership. Therefore, the analysis of trade without the reallocation effect of other micro-locational factors, such as institutions, has depicted trade integration "as a policy choice that concentrates wealth in the hands of the few, at the expense of the many", further reinforcing globalization critiques (71).

Chapter 3 brought institutions into the discussion and analysis of firms' participation in GVCs (Eckhardt and Poletti 2018) along the new line of research. Results show that institutions can strongly mediate and affect how productive firms win from deepening trade integration and participation in GVCs. Adding institutions to the analysis of firm-level GVC trade also shows the synergy between NNTT (Melitz 2003; Helpman et al. 2004), new institutionalism (Acemoglu et al. 2005; North 1990), and more recent GVC literature that focuses on the importance of contracts and supplier-buyers' relations (Nunn 2007; Levchenko 2007; La Porta et al. 2008; Antràs and Staiger 2012; Antràs 2020), and others.

Firm productivity explains most (but not all) of the differences in firms' participation in GVCs, as preferential liberalization becomes comprehensive. Under the globalization of production and proliferation of trade integration, the role of domestic institutions has not become obsolete. In contrast, as results in this paper show, the quality of domestic institutions continues to exert influence over new and more globalized patterns of trade and production that are assumed to be exogenously imposed on countries, especially in the developing world. While states may not have control

over all factors to increase their welfare gain from the globalization of production and the deepening of trade integration, they very much can improve the quality of their domestic institutions, which is a strong source of comparative advantage for GVCs.

The case of Vietnam and its successful participation in GVCs (not just export) can be explained by its ability to have better institutions than other countries in its income group. The other emerging case is Rwanda and its effort to attract and maintain global producers by improving its institutions' regulatory and bureaucratic quality. Therefore, the proliferation of deep integration and trade in GVCs cannot serve as a useful development tool unless the local regulatory and governance conditions are improved.

A strong reallocation effect from trade integration on firms' participation in GVCs in HQI also suggests that firms (and the public) in HQI may be more divided on the benefits from more GVC integration and trade than firms (and the public) in LQI. In broader terms, the backlash against globalization and offshoring may be a developed-country phenomenon, whereas private and public interests in developing countries remain interested in an open trade system.

Since I do not find a negative (and significant) effect on firms' participation in GVCs in LQI, further analysis is required to suggest that most losers are concentrated in LQI environments, mainly developing and emerging economies. However, the quality of domestic institutions is a source of comparative advantage for GVCs' integration under trade liberalization. Therefore, their improvement must be essential to policies geared toward GVC integration. The key implication is that the proliferation of deep integration and trade in GVCs will not yield significant economic welfare

locally unless the local regulatory and governance conditions are improved.

Development policy

Results in Chapter 2 show that the effect of deep PTAs on VA trade is higher than their short-term effect. In addition, this effect is also more significant than the long-term effect of stand-alone BITs and WTO membership. Although the effect of BITs declines gradually over time, it remains positive over the medium and long term. The effect of WTO, however, is only positive and significant over the short term. This result points again to the fact that shallow liberalization, i.e., the removal of tariff barriers, does not have a long-term reforming effect on the development and expansion of bilateral GVC trade among countries.

The significance of deep PTAs over the long- rather than short-term indicates that deep PTAs (with or without BITs) are more conducive to institutional changes and to create an enabling environment for firms to produce and add more value to their export. This outcome is unsurprising because deep PTAs involve more extensive industrial and institutional changes in the member countries that can increase the short-term costs of trade liberalization. Therefore, referencing the potential distorting spillovers of deep PTAs without evidence may strengthen myopic economic-nationalistic and protectionist sentiments and reduce public support for deep PTAs.

India withdrew from the Regional Comprehensive Economic Partnership (RCEP) in 2019, citing concerns over becoming a dumping ground for cheap imports from other countries as global uncertainty around trade increases. Likewise, President Trump withdrew from the Trans-Pacific Partnership (TPP) in 2017, citing his commitment to putting “America first”. In similar situations, especially when a develop-

ing country is involved, it is important to remember that, unlike trade in finals, deep PTAs require time to realize their full welfare potential in the context of GVCs. In this context, developing countries may be more than developed countries in need of assistance to withstand the short-term costs of joining and implementing deep agreements.

Furthermore, the significant effect of deep PTAs on GVC trade of dyads that includes a developing country, i.e., N-S and S-S dyads, points to developing countries' unparalleled comparative advantages in terms of low costs of production and resource endowment. At the same time, it also underlines the importance of an open international trade system for developing countries, most of whom are upstream exporters, to access downstream buyers. Therefore, it is essential to recognize that any intentional (e.g., trade conflicts) or unintentional (e.g., pandemics) disruptions of supply chains in the context of the current fragile economic and geopolitical environment will be more costly for developing than developed countries.

Findings in Chapter 4 precisely showed this: in the absence of deep PTAs, firms may find it challenging to prevent a complete breakdown of their supply relations and endure the effect of supply chain shocks. These results show that deep trade agreements effectively fulfill their primary objectives in normal and hard times: they increase the certainty and stability of trade relations under GVCs. Therefore, promoting comprehensive trade integration may be the best policy option if states and international organizations aim to make GVCs work for development and mitigate the negative effect of future supply chain disruptions on trade and development. For this reason, other things being equal, more comprehensive trade agreements at the macro (country) level are effective institutional devices that can increase the resilience of

firm-level SC and trade in GVCs and decrease their adverse effect on trade and development in the face of a major crisis.

Final notes and future directions

There are some limitations and room for improvement that future research and the future iteration of current manuscripts must attempt to address. First, while the papers in this thesis took all the recommended and possible methodological precautions to address the issue of endogeneity, the issue is only partially addressed because the designs of the papers are non-experimental. Only a well-controlled research design can claim close to full control of endogeneity threats to causal claims, which is impossible with observational data. In addition, trade policy is not exogenous to trade flows as it is not a naturally occurring intervention. For that reason, the only way to be confident about the treatment effect of trade policy on VA trade is to implement a carefully designed study in line with best practices in the field, which this thesis implements across all three appears.

As noted in Chapter 2, endogeneity can arise for three main reasons: omitted variables, measurement errors, or reverse causality/simultaneity. While the first two are minimized in this thesis by controlling for a battery of unit-level characteristics and fixed effects, double-checking the data inputs, and using data from published and well-documented sources, the solution to the latter issue is minimized by taking the following steps. With panel data, the empirical application of the gravity model suggests using interval data and a full set of fixed effects, which promise to minimize the threat arising from simultaneity and reverse causality. This is what the empirical section in Chapter 2 does to minimize the simultaneity bias. Chapter 2 also tests for

the strict exogeneity of trade policy by adding the lead variable of PTA to the right-hand side of the main models. As Table 2.9 shows, while a small anticipatory effect is associated with signing PTAs (negative and significant coefficient), the same negative effect is not observed for deep PTAs: the coefficient for Depth (anticipatory) variable (although close to zero) is, in contrast, positive and significant. Simply put, in anticipation of deep PTAs, firms may slightly accelerate their supply chain relations with buyers from the destination countries in anticipation of a deep PTA to be signed soon. Depth PTAs, therefore, may cause the acceleration of VA trade by 0.5% ($(e^{\beta}-1)100\%$).

With cross-sectional data (such as in Chapter 3), one way to ensure that endogeneity does not cause the observed effect with double differences is to conduct additional difference tests, such as triple differences. Chapters 3 and 4 conduct these tests, and the results obtained with double differences are comparable in magnitude and significant to triple differences results. One popular test for endogeneity not taken in this thesis is an instrumental variable test. Investing more time in finding a methodologically correct, theoretically sound instrument can help to address some of the endogeneity, specifically reverse causality, concerns related to the effect of GVCs on trade agreements. Some studies on this topic have recently started to develop in this direction. Future versions of papers 2 and 3 in this thesis will benefit from exploring these approaches. In addition, small-N case studies may also be explored, especially in the context of COVID-19 and the question of the effect of institutions. While econometric approaches pursued in this thesis provide an excellent first set of cross-country and cross-firm evidence, a well-designed most-different comparative case study will help to uncover covert mechanisms and examine whether good things (deep PTAs and GVC participation) always go together in the same direction.

Second, the firm-level analysis in papers 2 and 3 used samples with firms of various sizes and ownership origins (state-owned, small, medium, large, domestic and foreign). Future works and iterations of these papers should examine more closely the role of specific groups of firms in the context of small-N studies or by using other techniques suitable for a smaller number of observations. Large foreign multinationals and small and medium enterprises (MNEs and SMEs) may be particularly interested in the development context. While the former typically controls the first part of the smile curve, the latter contributes to the middle or last parts. Since the availability of cross-country data remains a significant limitation for analyzing firms by their size or ownership, a more focused small-n approach on a particular value chain, e.g., a specific brand of a consumer product, can help to better put the role of MNEs or SMEs in GVCs under the microscope.

The findings in this project build the platform for further research. While all three papers in this project have taken a large-N approach, I plan to use mixed methods in the next project. In addition to large-N analysis, I plan to draw on small-N and qualitative methods, such as in-depth case studies and elite interviews. The first line of research, for which I geo-coded firm-level data, is the role of locational (spatial) advantages in explaining the uneven participation of countries and firms in GVCs. Given that some countries and firms participate more in GVCs than others, the development gain from GVC integration is unevenly distributed among countries and firms, especially across the North and South. Therefore, moving beyond country- and firm-level factors and focusing on the heterogeneity of location-specific factors of GVC integration of a single firm (or industry, or country) through in-depth case study and process tracing promise to uncover geographic and institutional mechanisms that large-N studies tend to overlook. Moreover, putting GVC producers in the context of

their local environment and, in addition to institutions, bringing geography and public policy determinants into the discussion will help to understand and explain the location-based and bottom-up determinants of uneven participation of firms (or sectors) in GVCs and draw more nuanced implication for development and trade policy.

The second line of research, for which I use bilateral sectoral data, focuses on the role of investment and international investment agreements, e.g., international investment agreements, GVC integration, and VA production of firms and countries. Given the significance of investment provisions and BITs on bilateral VA trade (see Chapter 2), investment regimes and flows can explain a great deal of variation in how firms and countries participate in GVC. Investment can foster not only firms' vertical integration (i.e., specialization across different sectors) but also their horizontal integration (i.e., diversification of specialization within the same sector). Therefore, it is important to understand when and how investment regimes (in conjunction with or without PTAs) can lead to structural changes in trade and production.

Finally, the positive effect of deep PTAs on firms' SC during COVID-19 begs the question of whether these agreements are always a good policy instrument, for example, during other supply chain shocks caused by natural disasters, financial market instability, or inter-state wars. Limitations of data hinder this quest. However, exploring the question, even at the theoretical level, promises to add to the current policy debate about supply chain disruption, decoupling, and weaponization of tariffs. Therefore, examining the effect of deep PTAs across different supply chain shock episodes will help reveal the underlying mechanisms through which supply chains respond to deep PTAs in different contexts.

5.3 Bibliography

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2005. “Institutions as a Fundamental Cause of Long-Run Growth.” *Handbook of economic growth* 1,385–472.

Alter, Karen J., and Sophie Meunier. 2009. “The Politics of International Regime Complexity.” *Perspectives on Politics* 7, (1): 13–24.

Antràs, Pol. 2015. *Global Production: Firms, Contracts, and Trade Structure*. Princeton University Press.

———. 2020. “Conceptual Aspects of Global Value Chains.” *The World Bank Economic Review* 34, (3): 551–574.

Antràs, Pol, and Robert W. Staiger. 2012. “Offshoring and the Role of Trade Agreements.” *American Economic Review* 102, (7): 3140–83.

Baccini, Leonardo, Mattia Guidi, Arlo Poletti, and Aydin B. Yildirim. 2022. “Trade Liberalization and Labor Market Institutions.” *International Organization* 76, (1): 70–104.

Baier, Scott, and Jeffrey Bergstrand. 2007. “Do Free Trade Agreements Actually Increase Members’ International Trade?” *Journal of international Economics* 71, (1): 72–95.

Bergstrand, Jeffrey H., and Peter Egger. 2013. “What Determines BITs?” *Journal of International Economics* 90, (1): 107–122.

Chaisse, Julien, Manfred Elsig, Sufian Jusoh, and Andrew Lugg. 2022. “Drafting Investment Law: Patterns of Influence in the Regional Comprehensive Economic Partnership (RCEP).” *Journal of International Economic Law* 25, (1): 110–128.

Crowley, Meredith A., Lu Han, and Thomas Prayer. 2021. *The Value of Deep Trade Agreements in the Presence of Pricing-to-Market.*

Davis, Christina L. 2009. "Overlapping Institutions in Trade Policy." *Perspectives on Politics* 7, (1): 25–31.

Eckhardt, Jappe, and Arlo Poletti. 2018. "Introduction: Bringing Institutions Back in the Study of Global Value Chains." *Global Policy* 9,5–11.

Helpman, Elhanan, Marc Melitz, and Stephen Yeaple. 2004. "Export versus FDI with Heterogeneous Firms." *American Economic Review* 94, (1): 300–316.

Kim, Soo Yeon, and Clara Lee. 2019. "The Regime Complex in Investment Governance: Overlapping Provisions in PTAs and BITs." In *The Shifting Landscape of Global Trade Governance: World Trade Forum,* edited by Elsig Manfred, Michael Hahn, and Gabriele Spilker, 359–387. Cambridge University Press.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2008. "The Economic Consequences of Legal Origins." *Journal of Economic Literature* 46, (2): 285–332.

Levchenko, Andrei A. 2007. "Institutional Quality and International Trade." *The Review of Economic Studies* 74, (3): 791–819.

Mansfield, Edward D., and Helen V. Milner. 1999. "The New Wave of Regionalism." *International Organization* 53, (3): 589–602.

Melitz, Marc. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71, (6): 1695–1725.

Mulabdic, Alen, and Lorenzo Rotunno. 2022. "Trade Barriers in Government Procurement." *European Economic Review* 148,104204.

North, Douglas. 1990. *Institutions, Institutional Change and Economic Performance.* Cambridge.

Nunn, Nathan. 2007. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *The Quarterly Journal of Economics* 122, (2): 569–600.

Razeq, Zarlasht. 2022. "Deep Trade Integration and North-South Participation in GVCs." *Transnational Corporations Journal* 29, (3): 1–40.

Staiger, Robert W. 2022. *A World Trading System for the Twenty-First Century*. MIT Press.

Bibliography

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91, (5): 1369–1401.

———. 2005. "Institutions as a Fundamental Cause of Long-Run Growth." *Handbook of economic growth* 1,385–472.

Allee, Todd, and Clint Peinhardt. 2014. "Evaluating Three Explanations for the Design of Bilateral Investment Treaties." *World Politics* 66, (1): 47–87.

Alter, Karen J., and Sophie Meunier. 2009. "The Politics of International Regime Complexity." *Perspectives on Politics* 7, (1): 13–24.

Altomonte, Carlo, and Filippo di Mauro. 2022. *The Economics of Firm Productivity: Concepts, Tools and Evidence.* Cambridge: Cambridge University Press.

Amendolagine, Vito, Amadou Boly, Nicola Daniele Coniglio, Francesco Prota, and Adnan Seric. 2013. "FDI and Local Linkages in Developing Countries: Evidence from Sub-Saharan Africa." *World Development* 50,41–56.

Amiti, Mary, and Jozef Konings. 2007. "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia." *American Economic Review* 97, (5): 1611–1638.

Anderson, James, and Yoto Yotov. 2016. "Terms of Trade and Global Efficiency Effects of Free Trade Agreements, 1990–2002." *Journal of International Economics* 99,279–298.

Anderson, Robert, Anna Mueller, Kodjo Osei-lah, Josefita de Leon, and Philippe Pelletier. 2012. "Government Procurement Provisions in Regional Trade Agreements: A Stepping Stone to GPA Accession?" In *The WTO Regime on Government Procurement,* edited by Sue Arrowsmith and Robert Anderson. Cambridge University Press Cambridge.

Anderson, Robert, and Anna Muller. 2008. "Market Access for Government Procurement of Services: Comparing Recent PTAs with WTO Achievements," edited by Martin Roy and Juan Marchetti. Cambridge University Press.

Ang, James S., Yingmei Cheng, and Chaopeng Wu. 2014. "Does Enforcement of Intellectual Property Rights Matter in China? Evidence from Financing and Investment Choices in the High-Tech Industry." *Review of Economics and Statistics* 96, (2): 332–348.

Angrist, Joshua, and Jorn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, Princeton.

Antràs, Pol. 2003. "Firms, Contracts, and Trade Structure." *The Quarterly Journal of Economics* 118, (4): 1375–1418.

———. 2015. *Global Production: Firms, Contracts, and Trade Structure.* Princeton University Press.

———. 2020. "Conceptual Aspects of Global Value Chains." *The World Bank Economic Review* 34, (3): 551–574.

Antras, Pol, and Davin Chor. 2021. "Global Value Chains." In *National Bureau of Economic Research.* Working Paper. National Bureau of Economic Research.

Antràs, Pol, and Davin Chor. 2018. "On the Measurement of Upstreamness and Downstreamness in Global Value Chains." In *World Trade Evolution,* edited by Pol Antras and Davin Chor. Routledge.

Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry. 2012. "Measuring the Upstreamness of Production and Trade Flows." *American Economic Review* 102, (3): 412–416.

Antràs, Pol, and Elhanan Helpman. 2004. "Global Sourcing." *Journal of Political Economy* 112, (3): 552–580.

Antràs, Pol, and Esteban Rossi-Hansberg. 2009. "Organizations and Trade." *Annual Review of Economics* 1, (1): 43–64.

Antràs, Pol, and Robert W. Staiger. 2012. "Offshoring and the Role of Trade Agreements." *American Economic Review* 102, (7): 3140–83.

Aslam, Aqib, Natalija Novta, and Fabiano Rodrigues-Bastos. 2017. *Calculating Trade in Value Added.* International Monetary Fund.

Atanasov, Vladimir, and Bernard Black. 2016. "Shock-Based Causal Inference in Corporate Finance and Accounting Research." *Critical Finance Review* 5, (2): 207–304.

Autor, David, David Dorn, and Gordon Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *American Economic Review* 103, (6): 2121–68.

Baccini, Leonardo. 2019. "The Economics and Politics of Preferential Trade Agreements." *Annual Review of Political Science* 22, (1): 1–18.

Baccini, Leonardo, and Andreas Dür. 2018. "Global Value Chains and Product Differentiation: Changing the Politics of Trade." *Global Policy* 9,49–57.

Baccini, Leonardo, Andreas Dür, and Manfred Elsig. 2015. "The Politics of Trade Agreement Design: Revisiting the Depth-Flexibility Nexus." *International Studies Quarterly* 59, (4): 765–775.

———. 2018. "Intra-Industry Trade, Global Value Chains, and Preferential Tariff Liberalization." *International Studies Quarterly* 62, (2): 329–340.

Baccini, Leonardo, Mattia Guidi, Arlo Poletti, and Aydin B. Yildirim. 2022. "Trade Liberalization and Labor Market Institutions." *International Organization* 76, (1): 70–104.

Baccini, Leonardo, Ian Osgood, and Stephen Weymouth. 2017. *The Service Economy: Understanding Sectoral Differences in Patterns of Lobbying for Trade in the United States.* Mimeo.

Baccini, Leonardo, Pablo Pinto, and Stephen Weymouth. 2017. "The Distributional Consequences of Preferential Trade Liberalization: Firm-Level Evidence." *International Organization* 71, (2): 373–395.

Baier, Scott, and Jeffrey Bergstrand. 2007. "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of international Economics* 71, (1): 72–95.

Bair, Jennifer, and Gary Gereffi. 2001. "Local Clusters in Global Chains: The Causes and Consequences of Export Dynamism in Torreon's Blue Jeans Industry." *World Development* 29, (11): 1885–1903.

Baldwin, Richard. 2012. "Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going." CEPR Discussion Paper No. DP9103.

Baldwin, Richard, and Rebecca Freeman. 2022. "Risks and Global Supply Chains: What We Know and What We Need to Know." *Annual Review of Economics* 14, (1): 153–180.

Baldwin, Richard, Masahiro Kawai, and Ganeshan Wignaraja, eds. 2014. *A World Trade Organization for the 21st Century: The Asian Perspective.* Edward Elgar Publishing.

Baldwin, Richard, and Daria Taglioni. 2006. "Gravity for Dummies and Dummies for Gravity Equations." In *Working Paper 12516.* National Bureau of Economic Research.

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 2003. "Law and Finance: Why Does Legal Origin Matter?" *Journal of Comparative Economics* 31, (4): 653–675.

Berger, Axel, Dominique Bruhn, Andrea Bender, Julia Friesen, Katharina Kick, Felix Kullmann, Robert Roßner, and Svenja Weyrauch. 2016. *Deep Preferential Trade Agreements and Upgrading in Global Value Chains: The Case of Vietnam.* 92. Bonn: Deutsches Institut für Entwicklungspolitik (DIE).

Bergstrand, Jeffrey H., and Peter Egger. 2013. "What Determines BITs?" *Journal of International Economics* 90, (1): 107–122.

Bernard, Andrew B., and J. Bradford Jensen. 1999. "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics* 47, (1): 1–25.

Bernard, Andrew, Jonathan Eaton, Bradford Jensen, and Samuel Kortum. 2003. "Plants and Productivity in International Trade." *American Economic Review* 93, (4): 1268–1290.

Boehm, Johannes. 2022. "The Impact of Contract Enforcement Costs on Value Chains and Aggregate Productivity." *The Review of Economics and Statistics* 104, (1): 34–50.

Boffa, Mauro, Marion Jansen, and Olga Solleder. 2019. "Do We Need Deeper Trade Agreements for GVCs or Just a BIT?" *The World Economy* 42, (6): 1713–1739.

Bonadio, Barthélémy, Zhen Huo, Andrei A. Levchenko, and Nitya Pandalai-Nayar. 2021. "Global Supply Chains in the Pandemic." *Journal of International Economics* 133, (103534): 1–23.

Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. "Understanding Interaction Models: Improving Empirical Analyses." *Political Analysis* 14, (1): 63–82.

Brenton, Paul, Michael J. Ferrantino, and Maryla Maliszewska. 2022. *Reshaping Global Value Chains in Light of COVID-19: Implications for Trade and Poverty Reduction in Developing Countries.* The World Bank.

Brusick, Philippe, Ana Maria Alvarez, and Lucian Cernat. 2005. *Competition Provisions in Regional Trade Agreements: How to Assure Development Gains.* UNCTAD.

Büthe, Tim, and Helen V. Milner. 2014. "Foreign Direct Investment and Institutional Diversity in Trade Agreements: Credibility, Commitment, and Economic Flows in the Developing World, 1971-2007." *World Politics* 66, (1): 88–122.

Carvalho, Vasco M., Makoto Nirei, Yukiko U. Saito, and Alireza Tahbaz-Salehi. 2021. "Supply Chain Disruptions: Evidence from the Great East Japan Earthquake." *The Quarterly Journal of Economics* 136, (2): 1255–1321.

Casella, Bruno, Richard Bolwijn, Daniel Moran, and Keiichiro Kanemoto. 2019. "Improving the Analysis of Global Value Chains: The UNCTAD-Eora Database." *Transnational Corporations* 26, (3): 28.

Cattaneo, Matias D., Richard K. Crump, Max H. Farrell, and Yingjie Feng. 2021. "Binscatter Regressions."

Cerdeiro, Diego A., András Komáromi, Yang Liu, and Mamoon Saeed. 2020. *World Seaborne Trade in Real Time: A Proof of Concept for Building AIS-Based Nowcasts from Scratch.* IMF working paper 2020/057. International Monetary Fund.

Chaisse, Julien, Manfred Elsig, Sufian Jusoh, and Andrew Lugg. 2022. "Drafting Investment Law: Patterns of Influence in the Regional Comprehensive Economic Partnership (RCEP)." *Journal of International Economic Law* 25, (1): 110–128.

Chaney, Thomas. 2008. "Distorted Gravity: The Intensive and Extensive Margins of International Trade." *American Economic Review* 98, (4): 1707–21.

Chong, Alberto, and Luisa Zanforlin. 2000. "Law Tradition and Institutional Quality: Some Empirical Evidence." *Journal of International Development: The Journal of the Development Studies Association* 12, (8): 1057–1068.

Chor, Davin. 2010. "Unpacking Sources of Comparative Advantage: A Quantitative Approach." *Journal of International Economics* 82, (2): 152–167.

Cinelli, Carlos, Jeremy Ferwerda, and Chad Hazlett. 2020. "Sensemakr: Sensitivity Analysis Tools for OLS in R and Stata." *Available at SSRN 3588978.*

Cinelli, Carlos, and Chad Hazlett. 2020. "Making Sense of Sensitivity: Extending Omitted Variable Bias." *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 82, (1): 39–67.

Coase, Ronald H. 1992. "The Institutional Structure of Production." In *Handbook of New Institutional Economics,* 31–39. Springer.

Costinot, Arnaud. 2009. "On the Origins of Comparative Advantage." *Journal of International Economics* 77, (2): 255–264.

Crowley, Meredith A., Lu Han, and Thomas Prayer. 2021. *The Value of Deep Trade Agreements in the Presence of Pricing-to-Market.*

Cunat, Alejandro, and Marc J. Melitz. 2012. "Volatility, Labor Market Flexibility, and the Pattern of Comparative Advantage." *Journal of the European Economic Association* 10, (2): 225–254.

Dallas, Mark P. 2015. "'Governed' Trade: Global Value Chains, Firms, and the Heterogeneity of Trade in an Era of Fragmented Production." *Review of International Political Economy* 22, (5): 875–909.

Davis, Christina L. 2009. "Overlapping Institutions in Trade Policy." *Perspectives on Politics* 7, (1): 25–31.

De Marchi, Valentina, Elisa Giuliani, and Roberta Rabellotti. 2018. "Do Global Value Chains Offer Developing Countries Learning and Innovation Opportunities?" *The European Journal of Development Research* 30, (3): 1–19.

De Sa, Marcelo Martins, Priscila Laczynski de Souza Miguel, Renata Peregrino de Brito, and Susana Carla Farias Pereira. 2019. "Supply Chain Resilience: The Whole Is Not the Sum of the Parts." *International Journal of Operations & Production Management* 40, (1).

Dixon, Jay, and Paul Alexander Haslam. 2016. "Does the Quality of Investment Protection Affect FDI Flows to Developing Countries? Evidence from Latin America." *The World Economy* 39, (8): 1080–1108.

Dollar, David, and Matthew Kidder. 2017. *Institutional Quality and Participation in Global Value Chains.* The World Bank.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig. 2014. "The Design of International Trade Agreements: Introducing a New Dataset." *The Review of International Organizations* 9, (3): 353–375.

Eaton, Jonathan, and Samuel Kortum. 2002. "Technology, Geography, and Trade." *Econometrica* 70, (5): 1741–1779.

Eckhardt, Jappe, and Arlo Poletti. 2018. "Introduction: Bringing Institutions Back in the Study of Global Value Chains." *Global Policy* 9,5–11.

Egger, Peter, and Sergey Nigai. 2015. "Effects of Deep versus Shallow Trade Agreements in General Equilibrium." In *Trade Cooperation: The Purpose, Design and Effects of Preferential Trade Agreements,* edited by Andreas Dür and Manfred Elsig. Cambridge University Press.

Enderwick, Peter, and Peter J. Buckley. 2020. "Rising Regionalization: Will the Post-COVID-19 World See a Retreat from Globalization?" *Transnational Corporations Journal* 27, (2): 99–112.

Facchini, Giovanni, Maggie Y Liu, Anna Maria Mayda, and Minghai Zhou. 2019. "China's 'Great Migration': The Impact of the Reduction in Trade Policy Uncertainty." *Journal of International Economics* 120,126–144.

Feenstra, Robert, and Gordon Hanson. 1996. "Globalization, Outsourcing and Wage Inequality." *American Economic Review* 86, (2): 240–245.

Fernandez, Raquel, and Jonathan Portes. 1998. "Returns to Regionalism: An Analysis of Non-traditional Gains Form Regional Trade Agreements." *World Bank Economic Review* 12, (2): 197–220.

Figini, Paolo, and Enrico Santarelli. 2006. "Openness, Economic Reforms, and Poverty: Globalization in Developing Countries." *The Journal of Developing Areas:* 129–151. JSTOR: 4193008.

Francois, Joseph, and Bernard Hoekman. 2010. "Services Trade and Policy." *Journal of Economic Literature* 48, (3): 642–92.

Freund, Caroline, and Martha Denisse Pierola. 2015. "Export Superstars." *Review of Economics and Statistics* 97, (5): 1023–1032.

G7. 2022. *G7 Trade Ministers' Statement.* Accessed December 9, 2022.

Ge, Ying, David Dollar, and Xinding Yu. 2020. "Institutions and Participation in Global Value Chains: Evidence from Belt and Road Initiative." *China Economic Review* 61, (101447).

Gereffi, Gary. 2018. *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism*. Cambridge University Press.

———. 2020. "What Does the COVID-19 Pandemic Teach Us about Global Value Chains? The Case of Medical Supplies." *Journal of International Business Policy* 3, (3): 287–301.

Gereffi, Gary, John Humphrey, Raphael Kaplinsky, and Timothy J. Sturgeon. 2001. "Introduction: Globalisation, Value Chains and Development." *IDS Bulletin* 32, (3): 1–8.

Gereffi, Gereffi, John Humphrey, and Timothy Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy* 12, (1): 78–104.

Gibbons, Charles E., Juan Carlos Suarez Serrato, and Michael B. Urbancic. 2019. "Broken or Fixed Effects?" *Journal of Econometric Methods* 8, (1): 1–12.

Gilpin, Robert. 2000. *The Challenge of Global Capitalism: The World Economy in the 21st Century*. Princeton University Press.

Giuliani, Elisa, Carlo Pietrobelli, and Roberta Rabellotti. 2005. "Upgrading in Global Value Chains: Lessons from Latin American Clusters." *World development* 33, (4): 549–573.

Goldberg, Pinelopi, Amit Khandelwal, Nina Pavcnik, and Petia Topalova. 2010. "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India." *The Quarterly Journal of Economics* 125, (4): 1727–1767.

Graziano, Alejandro G., Kyle Handley, and Nuno Limao. 2021. "Brexit Uncertainty and Trade Disintegration." *The Economic Journal* 131, (635): 1150–1185.

Grossman, Gene M., and Elhanan Helpman. 2005. "Outsourcing in a Global Economy." *The Review of Economic Studies* 72, (1): 135–159.

Grossman, Gene M, and Elhanan Helpman. 2020. "When Tariffs Disturb Global Supply Chains." NBER Working Paper 27722.

Grubel, Herbert G, and Peter John Lloyd. 1975. *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products.* Vol. 12. Macmillan London.

Hale, Thomas, Noam Angrist, Rafael Goldszmidt, Beatriz Kira, Anna Petherick, Toby Phillips, Samuel Webster, Emily Cameron-Blake, Laura Hallas, and Saptarshi Majumdar. 2021. "A Global Panel Database of Pandemic Policies (Oxford COVID-19 Government Response Tracker)." *Nature Human Behaviour* 5, (4): 529–538.

Hall, Robert E., and Charles I. Jones. 1999. "Why Do Some Countries Produce so Much More Output per Worker than Others?" *The Quarterly Journal of Economics* 114, (1): 83–116.

Harding, Torfinn, and Beata Javorcik. 2011. "Roll out the Red Carpet and They Will Come: Investment Promotion and FDI Inflows." *Economic Journal* 121, (557): 1445–1476.

Hartman, Stephen W. 2013. "The WTO, the Doha Round Impasse, PTAs, and FTAs/RTAs." *The International Trade Journal* 27, (5): 411–430.

Hayes, Andrew F., Carroll J. Glynn, and Michael E. Huge. 2012. "Cautions Regarding the Interpretation of Regression Coefficients and Hypothesis Tests in Linear Models with Interactions." *Communication Methods and Measures* 6, (1): 1–11.

Helpman, Elhanan, and Paul R Krugman. 1985. *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy.* MIT Press.

Helpman, Elhanan, Marc Melitz, and Yona Rubinstein. 2008. "Estimating Trade Flows: Trading Partners and Trading Volumes." *The Quarterly Journal of Economics* 123, (2): 441–487.

Helpman, Elhanan, Marc Melitz, and Stephen Yeaple. 2004. "Export versus FDI with Heterogeneous Firms." *American Economic Review* 94, (1): 300–316.

Hettne, Björn. 2006. "Beyond the 'New' Regionalism." In *Key Debates in New Political Economy,* edited by Anthony Payne, 128–160. Routledge.

Hofmann, Claudia, Alberto Osnago, and Michele Ruta. 2017. *Horizontal Depth: A New Database on the Content of Preferential Trade Agreements. Policy Research Working.* World Bank Policy Research Working Paper No. 7981.

Hopkins, Terence, and Immanuel Wallerstein. 1986. "Commodity Chains: Construct and Research," edited by Gary Gereffi and Miguel Korzeniewicz. Westport, CT: Praeger.

Hummels, David, Jun Ishii, and Kei-Mu Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 54, (1): 75–96.

Iacobucci, Dawn, Matthew J. Schneider, Deidre L. Popovich, and Georgios A. Bakamitsos. 2016. "Mean Centering Helps Alleviate "Micro" but Not "Macro" Multicollinearity." *Behavior Research Methods* 48, (4): 1308–1317.

IMF. 2022a. *World Economic Outlook, April 2022: War Sets Back The Global Recovery.* International Monetary Fund.

———. 2022b. *World Economic Outlook Update, July 2022: Gloomy and More Uncertain.* International Monetary Fund.

Jakubik, Adam, and Victor Stolzenburg. 2021. "The 'China Shock' Revisited: Insights from Value Added Trade Flows." *Journal of Economic Geography* 21, (1): 67–95.

Johnson, Robert. 2018. "Measuring Global Value Chains." *Annual Review of Economics* 10, (1): 207–236.

Johnson, Robert, and Guillermo Noguera. 2012. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of International Economics* 86, (2): 224–236.

Juttner, Uta, and Stan Maklan. 2011. "Supply Chain Resilience in the Global Financial Crisis: An Empirical Study." *Supply Chain Management: An International Journal* 16, (4): 246–259.

Kahler, Miles. 2013. "Economic Crisis and Global Governance: The Stability of a Globalized World." *Procedia - Social and Behavioral Sciences* 77,55–64.

Kamalahmadi, Masoud, and Mahour Mellat Parast. 2016. "A Review of the Literature on the Principles of Enterprise and Supply Chain Resilience: Major Findings and Directions for Future Research." *International Journal of Production Economics* 171,116–133.

Keller, Matthew C. 2014. "Gene-by-Environment Interaction Studies Have Not Properly Controlled for Potential Confounders: The Problem and the (Simple) Solution." *Biological Psychiatry* 75, (1).

Kerner, Andrew, and Krzysztof J. Pelc. 2022. "Do Investor–State Disputes (Still) Harm FDI?" *British Journal of Political Science* 52, (2): 781–804.

Kim, Soo Yeon. 2021. "Investment Commitments in PTAs and MNCS in Partner Countries." *Economics & Politics* 33,415–442.

Kim, Soo Yeon, and Clara Lee. 2019. "The Regime Complex in Investment Governance: Overlapping Provisions in PTAs and BITs." In *The Shifting Landscape of Global Trade Governance: World Trade Forum,* edited by Elsig Manfred, Michael Hahn, and Gabriele Spilker, 359–387. Cambridge University Press.

Knack, Stephen, and Philip Keefer. 1995. "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." *Economics & Politics* 7, (3): 207–227.

Konan, Denise, and Keith Maskus. 2006. "Quantifying the Impact of Services Liberalization in a Developing Country." *Journal of Development Economics* 81, (1): 142–162.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei. 2008. "How Much of Chinese Exports Is Really Made in China? Assessing Domestic Value-Added When Processing Trade Is Pervasive." National Bureau of Economic Research.

———. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104, (2): 459–494.

Krueger, Anne. 1998. *The WTO as an International Organization*. University of Chicago Press.

Krugman, Paul. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade." *The American Economic Review* 70, (5): 950–959.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2008. "The Economic Consequences of Legal Origins." *Journal of Economic Literature* 46, (2): 285–332.

Laget, Edith, Alberto Osnago, Nadia Rocha, and Michele Ruta. 2020. "Deep Trade Agreements and Global Value Chains." *Review of Industrial Organization* 57, (2): 379–410.

Latour, Almar. 2001. "Trial by Fire: A Blaze in Albuquerque Sets off Major Crisis for Cell-Phone Giants." *Wall Street Journal:* 2001.

Lenzen, Manfred, Daniel Moran, Keiichiro Kanemoto, and Arne Geschke. 2013. "Building Eora: A Global Multi-Region Input–Output Database at High Country and Sector Resolution." *Economic Systems Research* 25, (1): 20–49.

Levchenko, Andrei A. 2007. "Institutional Quality and International Trade." *The Review of Economic Studies* 74, (3): 791–819.

Levine, Ross, Chen Lin, and Wensi Xie. 2018. "Corporate Resilience to Banking Crises: The Roles of Trust and Trade Credit." *Journal of Financial and Quantitative Analysis* 53, (4): 1441–1477.

Limao, Nuno. 2016. "Preferential Trade Agreements." In *Handbook of Commercial Policy,* edited by Kyle Bagwell and Robert W. Staiger, 1:279–367. North-Holland.

Limao, Nuno, and Giovanni Maggi. 2015. "Uncertainty and Trade Agreements." *American Economic Journal: Microeconomics* 7, (4): 1–42.

Lipsey, Richard G., and Kenneth I. Carlaw. 2004. "Total Factor Productivity and the Measurement of Technological Change." *Canadian Journal of Economics / Revue canadienne d'économique* 37, (4): 1118–1150.

Long, Cheryl Xiaoning. 2010. "Does the Rights Hypothesis Apply to China?" *The Journal of Law and Economics* 53, (4): 629–650.

Manova, Kalina. 2013. "Credit Constraints, Heterogeneous Firms, and International Trade." *Review of Economic Studies* 80, (2): 711–744.

Mansfield, Edward D., and Helen V. Milner. 1999. "The New Wave of Regionalism." *International Organization* 53, (3): 589–602.

Mansfield, Edward D., and Eric Reinhardt. 2008. "International Institutions and the Volatility of International Trade." *International Organization* 62, (4): 621–652.

Markusen, James, and Keith Maskus. 2001. "General-Equilibrium Approaches to the Multinational Firm: A Review of Theory and Evidence." National Bureau of Economic Research.

Maskus, Keith, and Carsten Fink. 2005. *Intellectual Property and Development: Lessons from Recent Economic Research.* The World Bank.

Maskus, Keith, and Mohan Penubarti. 1995. "How Trade-Related Are Intellectual Property Rights?" *Journal of International Economics* 39, (3-4): 227–248.

Melitz, Marc. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71, (6): 1695–1725.

Michelman, Paul. 2007. "Building a Resilient Supply Chain." *Harvard Business Review.*

Montalbano, Pierluigi, Silvia Nenci, and Carlo Pietrobelli. 2018. "Opening and Linking up: Firms, GVCs, and Productivity in Latin." *America. Small Business Economics* 50, (4): 917–935.

Mulabdic, Alen, and Lorenzo Rotunno. 2022. "Trade Barriers in Government Procurement." *European Economic Review* 148,104204.

Murray, Alexander. 2016. "Partial versus Total Factor Productivity Measures: An Assessment of Their Strengths and Weaknesses." *International Productivity Monitor,* no. 31: 113.

Naanwaab, Cephas, and Johnson Antwi. 2019. "International Integration, Trade, and the Great Recession." *International Economic Journal* 33, (1): 128–148.

North, Douglas. 1990. *Institutions, Institutional Change and Economic Performance.* Cambridge.

Nunn, Nathan. 2007. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *The Quarterly Journal of Economics* 122, (2): 569–600.

Nunn, Nathan, and Daniel Trefler. 2014. "Domestic Institutions as a Source of Comparative Advantage." In *Handbook of International Economics,* 4:263–315. Elsevier.

OECD. 2019. *Guide to OECD's Trade in Value Added (TiVA) Indicators, 2018 Edition.* OECD, Directorate for Science, Technology and Innovation.

OECD. 2021. *Global Value Chains: Efficiency and Risks in the Context of COVID-19.* OECD Policy Responses to Coronavirus (COVID-19), OECD Policy Responses to Coronavirus (COVID-19).

Olden, Andreas, and Jarle Møen. 2022. "The Triple Difference Estimator." *The Econometrics Journal* 25, (3): 531–553.

Olivero, Maria Pia, and Yoto Yotov. 2012. "Dynamic Gravity: Endogenous Country Size and Asset Accumulation." *Canadian Journal of Economics/Revue canadienne d'économique* 45, (1): 64–92.

Orefice, Gianluca, and Nadia Rocha. 2014. "Deep Integration and Production Networks: An Empirical Analysis." *The World Economy* 37, (1): 106–136.

Ottaviano, Gianmarco IP. 2008. "Contract Enforcement, Comparative Advantage and Long-Run Growth." In *In Elhanan Helpman, Dalia Marin, and Thierry Verdier, Eds. "The Organization of Firms in a Global Economy"*. Harvard University Press.

Pahl, Stefan, and Marcel P. Timmer. 2020. "Do Global Value Chains Enhance Economic Upgrading? A Long View." *The Journal of Development Studies* 56, (9): 1683–1705.

Pelc, Krzysztof. 2020. "Can COVID-Era Export Restrictions Be Deterred?" *Canadian Journal of Political Science* 53, (2): 349–356.

Piermartini, Roberta, and Michele Budetta. 2009. "A mapping of regional rules on technical barriers to trade." In *Regional Rules in the Global Trading System,* edited by Antoni Estevadeordal, Kati Suominen, and Robert Teh, 250–315.

Pietrobelli, Carlo, Roberta Rabellotti, and Ari Van Assche. 2021. "Making Sense of Global Value Chain-Oriented Policies: The Trifecta of Tasks, Linkages, and Firms." *Journal of International Business Policy* 4, (3): 327–346.

Pinna, Matteo. 2020. *Binned Scatterplots With Marginal Histograms: Binscatterhist.* SSRN Scholarly Paper ID 3719940. Rochester, NY: Social Science Research Network.

Pisch, Frank. 2020. "Managing Global Production: Theory and Evidence from Just-in-Time Supply Chains." University of St. Gallen Discussion Paper No. 2020-08.

Pistor, Katharina. 2005. "Legal Ground Rules in Coordinated and Liberal Market Economies." SSRN Scholarly Paper, Rochester, NY.

Poletti, Arlo, Daniela Sicurelli, and Aydin B. Yildirim. 2021. "Promoting Sustainable Development through Trade? EU Trade Agreements and Global Value Chains." *Italian Political Science Review/Rivista Italiana di Scienza Politica* 51, (3): 339–354.

Ponomarov, Serhiy Y., and Mary C. Holcomb. 2009. "Understanding the Concept of Supply Chain Resilience." *The International Journal of Logistics Management.*

Ranjan, Priya, and Jibonayan Raychaudhuri. 2016. "The "New-New" Trade Theory: A Review of the Literature." In *International Trade and International Finance,* 3–21.

Razeq, Zarlasht. 2022. "Deep Trade Integration and North-South Participation in GVCs." *Transnational Corporations Journal* 29, (3): 1–40.

Rose, Andrew. 2004. "Do We Really Know That the WTO Increases Trade?" *American Economic Review* 94, (1): 98–114.

Roth, Jonathan, Pedro H C SantAnna, Alyssa Bilinski, and John Poe. 2021. "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature."

Rudra, Nita, and Jennifer Tobin. 2017. "When Does Globalization Help the Poor?" *Annual Review of Political Science* 20,287–307.

Sachs, Jeffrey D., Andrew Warner, Anders Åslund, and Stanley Fischer. 1995. "Economic Reform and the Process of Global Integration." *Brookings papers on economic activity* 1995, (1): 1–118. JSTOR: 2534573.

Samuelson, Paul A., and William D. Nordhaus. 2010. *Economics.* 19th ed. Boston: McGraw-Hill Irwin.

Shieh, Gwowen. 2011. "Clarifying the Role of Mean Centring in Multicollinearity of Interaction Effects." *British Journal of Mathematical and Statistical Psychology* 64, (3): 462–477.

Söderbaum, Fredrik. 2016. "Old, New, and Comparative Regionalism." *The Oxford handbook of comparative regionalism:* 16–37.

Solingen, Etel, ed. 2021. *Geopolitics, Supply Chains, and International Relations in East Asia.* Cambridge: Cambridge University Press.

Spilker, Gabriele, Thomas Bernauer, In Song Kim, Helen Milner, Iain Osgood, and Dustin Tingley. 2018. "Trade at the Margin: Estimating the Economic Implications of Preferential Trade Agreements." *The Review of International Organizations* 13, (2): 189–242.

Staiger, Robert W. 2022. *A World Trading System for the Twenty-First Century.* MIT Press.

Stepner, Michael. 2013. "BINSCATTER: Stata Module to Generate Binned Scatterplots."

Taglioni, Daria, and Deborah Winkler. 2016. *Making Global Value Chains Work for Development.* World Bank Publications.

Topalova, Petia, and Amit Khandelwal. 2011. "Trade Liberalization and Firm Productivity: The Case of India." *Review of Economics and Statistics* 93, (3): 995–1009.

Trefler, Daniel. 2004. "The Long and Short of the Canada-US Free Trade Agreement." *American Economic Review* 94, (4): 870–895.

Tukamuhabwa, Benjamin R., Mark Stevenson, Jerry Busby, and Marta Zorzini. 2015. "Supply Chain Resilience: Definition, Review and Theoretical Foundations for Further Study." *International Journal of Production Research* 53, (18): 5592–5623.

UN, ed. 2009. *System of National Accounts 2008.* New York: United Nations.

———, ed. 2013. *International Merchandise Trade Statistics: Compilers Manual, Revision 1 (IMTS 2010-CM).* Revision 1. [Studies in Methods] / United Nations, Department of Economic and Social Affairs, Statistics Division Ser. F, 87, Rev. 1. New York: United Nations.

———. 2018. *Classification by Broad Economic Categories, Rev.5: Defined in Terms of the Harmonized Commodity Description and Coding System (2012) and the Central Product Classification, 2.1* ST/ESA/STAT/SER.M/53/Rev.5. UN.

UNCTAD. 2013a. *Global Value Chains and Development: Investment and Value Added Trade in the Global Economy.* United Nations New York.

———. 2013b. *Global Value Chains: Investment and Trade for Development. World Investment Report.* New York: United Nations Press.

———, ed. 2020. *International Production beyond the Pandemic.* 30th anniversary edition. World Investment Report 2020. Geneva New York: United Nations.

Van Biesebroeck, Johannes, and Emmanuel Buadi Mensah. 2019. "The Extent of GVC Engagement in Sub-Saharan Africa." Policy Research Working Paper 8937, World Bank.

Vijil, Mariana. 2014. "Aid for Trade Effectiveness: Complementarities with Economic Integration." *The World Economy* 37, (4): 555–566.

Viner, Jacob. 1950. *The Customs Union Issue.* Carnegie Endowment for International Peace.

Wang, Zhi, Shang-Jin Wei, and Kunfu Zhu. 2013. "Quantifying International Production Sharing at the Bilateral and Sector Levels." National Bureau of Economic Research.

WB. 2020a. *Handbook of Deep Trade Agreements.* Washington, DC: World Bank.

———. 2020b. *World Development Report 2020: Trading for Development in the Age of Global Value Chains.* Washington, DC: World Bank.

WB and WTO. 2017. *Measuring and Analyzing the Impact of GVCs on Economic Development: Global Value Chains Development Report 2017.* Washington, DC: World Bank Group.

Wing, Coady, Kosali Simon, and Ricardo A. Bello-Gomez. 2018. "Designing Difference in Difference Studies: Best Practices for Public Health Policy Research." *Annual Review of Public Health* 39,453–469.

Winkler, Deborah Elisabeth, and Thomas Farole. 2015. *Global Value Chain Integration and Productivity: Evidence from Enterprise Surveys in Namibia, South Africa, and Swaziland.* The World Bank.

Wooldridge, Jeffery. 2010. *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

WTO. 2011. *The WTO and Preferential Trade Agreements: From Co-Existence to Coherence WTO.* World Trade Organization.

———. 2021. *Global Value Chain Development Report 2021: Beyond Production.* Manila, Philippines: Asian Development Bank.

———. 2022. *Global Supply Chains Forum Report.* World Trade Organization.

Yotov, Yoto V., Roberta Piermartini, José-Antonio Monteiro, and Mario Larch. 2016. *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model.* World Trade Organization.

Yzerbyt, Vincent Y., Dominique Muller, and Charles M. Judd. 2004. "Adjusting Researchers' Approach to Adjustment: On the Use of Covariates When Testing Interactions." *Journal of Experimental Social Psychology* 40, (3): 424–431.