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Abstract

The rapid growth of regional trade agreements (RTAs) in recent decades has broadened their impact beyond trade creation. This paper explores the role of RTAs in fostering innovation through different types of provisions. Using the World Bank's Deep Trade Agreements dataset, we make two key contributions. First, we differentiate the influence of WTO-plus (enhancing commitments under WTO rules) and WTO-extra (extending beyond WTO rules) on domestic innovation. Second, we analyze how the breadth and depth measures of these provisions affect innovation outcomes differently. Our findings show that WTO-plus provisions play a more significant role in promoting innovation than WTO-extra provisions, with the horizontal and vertical depth of these commitments being particularly relevant. This effect is especially pronounced in lower-income groups with minimal innovation output. A strong heterogeneity is observed across different types of provisions. Yet, our results remain robust when we use alternative measures of innovation and when we control for the endogeneity of trade provisions.

Keywords: Deep trade agreements; domestic innovation; knowledge spillovers
JEL Classifications: F130; O32; F10

ملخص

أدى النمو السريع لاتفاقيات التجارة الإقليمية في العقود الأخيرة إلى توسيع نطاق تأثيرها ليشمل جوانب أخرى غير خلق التجارة. تستكشف هذه الورقة البحثية دور اتفاقيات التجارة الإقليمية في تعزيز الابتكار من خلال أنواع مختلفة من الأحكام. وباستخدام مجموعة بيانات اتفاقيات التجارة المعمقة التابعة للبنك الدولي، نقدم مساهمتين رئيسيتين. أولاً، نميز بين تأثير أحكام منظمة التجارة العالمية المعززة (التي تعزز الالتزامات بموجب قواعد منظمة التجارة العالمية) وأحكام منظمة التجارة العالمية الإضافية (التي تتجاوز قواعد منظمة التجارة العالمية) على الابتكار المحلي. ثانياً، نحلل كيف تؤثر مقاييس النطاق والعمق لهذه الأحكام بشكل مختلف على نتائج الابتكار. تُظهر نتائجنا أن أحكام منظمة التجارة العالمية المعززة تلعب دوراً أكثر أهمية في تعزيز الابتكار من أحكام منظمة التجارة العالمية الإضافية، مع أهمية خاصة للعمق الأفقي والرأسي لهذه الالتزامات. ويبرز هذا التأثير بشكل خاص في الفئات ذات الدخل المنخفض والتي لديها مخرجات ابتكارية ضئيلة. كما لوحظ تباين كبير بين أنواع الأحكام المختلفة. ومع ذلك، تظل نتائجنا قوية عند استخدام مقاييس بديلة للابتكار وعند التحكم في مشكلة التداخل بين أحكام التجارة.

1. Introduction

The last decades witnessed an increase in different types of provisions in regional trade agreements (RTAs), extending the gains to non-economic outcomes beyond enhanced trade volumes. Amongst non-economic outcomes is promoting innovation and technology transfer (Bastiaens et al., 2024). Particularly for developing countries, innovation growth is challenged with middling inputs like R&D stock, low absorptive capacities, inadequate infrastructure, and mismatched skill levels. Hence, channeling foreign knowledge through preferential trade agreements is of key importance to developing countries with minimal innovation output. Against this background, we explore the extent of relevance of different trade agreements' provisions to domestic innovation.

The policy areas covered by the RTAs are grouped depending on their relevance to the World Trade Organization (WTO) mandate, namely WTO-plus (WTO+) and WTO-extra (WTO-X) provisions. The first group pertains to the provisions that are within the mandate of the WTO. In these provisions, parties agree to undertake commitments that go beyond those accepted at the multilateral level, like reducing nontariff measures. On the other hand, WTO-X refers to the provisions that deal with issues beyond the commitments of the WTO (Horn et al., 2010), like labor or environmental standards. While both components extend beyond the traditional shallow trade agreements centered on tariff measures, the former consists of trade-related topics within the commitments of the WTO. Focusing on technology-related provisions, WTO+ relates to TRIPS commitments, and WTO-X includes extra innovation policies and intellectual property rights that go beyond TRIPS. In addition, non-technological provisions in WTO+ (like NTMs, institutions, and services) and WTO-X (like competition policy, industrial policy, and labor standards) can foster innovation and flourish the innovation ecosystem.

Through the intertwined relationship between international trade and knowledge spillovers, provisions in trade agreements upscale absorptive capacities and facilitate knowledge transmission (Khan, 2022; Aghion et al., 2019). Recent empirical literature exploring the nexus between trade agreements and domestic innovation shows a positive association (Martínez-Zarzoso and Chelala, 2021). Considering the increasing breadth and depth of trade agreements (Larch and Yotov, 2023), studying the effect of different measures on domestic innovation is important to scrutinize the complexities of the multiple provisions targeting goals beyond enhancing trade.

Broad empirical literature employs patent data to measure domestic innovation output and technological spillovers (Hall et al., 2005; Branstetter, 2006; Jinji et al., 2019; Eissa and Zaki, 2023). Indeed, the literature has evolved to extend the determinants of domestic innovation beyond the level of development, R&D stock, and size of the economy to interlinkages through global value chains, trade policy, quality of institutions, competition, and innovation policy (Eissa and Zaki, 2023). This paper extends the work of Eissa and Zaki (2023) by examining the role of the

different types of provisions in trade agreements on resident patents across the different income groups.

Previous literature examining the role of RTAs in fostering technology spillovers analyzes specific trade agreements. Using a gravity model for 18 countries in Western Europe and North America, Peri (2005) estimates a negative effect of regional, national, and linguistic borders on technology spillovers. Yet, the impact of the "trade bloc" -the European Union and North American Free Trade Agreement- is statistically insignificant. In contrast, Jinji et al. (2013) capture a positive effect of RTAs on technology spillovers for a sample of nine RTAs for 103 countries spanning the years 1990 to 1999. By extending the number of RTAs, Jinji (2019) captures a positive association between the depth of RTAs and technology spillovers. Likewise, the depth measure of RTAs promotes upgrading across the value chain among trading partners (Dang et al., 2024).

Through collaborative R&D, regional integration is a key source of knowledge spillovers and incentivizes firms' innovation (Audretsch et al., 2025; Tojerio-Riverio, 2019). In the same line of thought, RTAs increase knowledge spillovers through five main channels. First, reduced trade barriers enhance the volume of intermediate goods imports, leading to knowledge spillovers from origin counterparts. Indeed, a large body of literature demonstrates how the liberalization of intermediate inputs leads to productivity increases and technology transfer (Martinez-Zarzoso et al., 2021; Bas, 2013). Second, following the literature of learning by exporting, a firm's performance improves after entering export markets (Loecker, 2013), signaling productivity and innovation gains. Third, besides the dependence of exports on imports, where the latter enhances the competitiveness of the former, a separate strand of literature argues that innovation increases with tougher competition induced by high-quality imports (Bloom et al., 2016; Chen et al., 2017). Third, trade agreements facilitate the movement of service flows (ranging from non-tangible assets to human capital), leading to knowledge transmission between signatories. In line with the skill-biased technological change, tougher competition with deeper trade agreements increases the demand for skilled labor (Berman et al., 1998), constituting essential prerequisites for innovation (Dakhli and De Clercq, 2004). The fourth channel relates to foreign direct investment (FDI), through which multinational firms possessing advanced technologies enhance the technological capabilities of host-country firms (Cheung and Ping, 2004). While this result applies chiefly to developing countries, Resmini (2003) argues that enhanced capabilities depend on the sector to which these FDI are channeled.

From another angle, increased provisions can mitigate knowledge transmission due to increased compliance costs that divert expenditures away from R&D (Melitz and Redding, 2021). Likewise, stringent and excessive intellectual property (IP) rules can limit the transmission of technology to countries with low absorptive capacities (Eissa and Zaki, 2023). Furthermore, the fragmentation of trade agreements creates a "spaghetti bowl effect" in which overlapping trade agreements increase complexity due to inconsistent rules of origin and regulatory standards (Govindaraj,

2023). Consequently, increased fragmentation leads to a mixed impact on integration and innovation.

In this paper, we use the WTO-plus (WTO+) and WTO-extra (WTO-X) groups to classify the policy areas of trade agreements' provisions, construct depth measures of trade agreements (Ezzat and Zaki, 2022 and Guillin et al., 2023), and analyze the effect of each on resident patents per capita across income groups. Hence, we contribute to existing literature in three ways. First, we differentiate between WTO+ and WTO-X in capturing the effect of provisions on domestic innovation. Second, we differentiate between the horizontal and the vertical depths of each group of provisions in fostering innovation. Third, we scrutinize the different types of provisions through which RTAs can affect innovation, especially non-tariff measures (NTMs), services, and institutions. Our analysis is particularly important in bridging the wide gap in innovation across income levels. We find that WTO-plus provisions play a more significant role in promoting innovation than WTO-extra provisions, with the horizontal and vertical depth of these commitments being particularly relevant. This effect is especially pronounced in lower-income groups with minimal innovation output. Our results remain robust when we use alternative measures of innovation and when we control for the endogeneity of trade provisions.

The remainder of the paper is organized as follows: Section 2 presents the data and some stylized facts. Section 3 explains the methodology. Section 4 analyzes the results, and Section 5 concludes and provides some policy recommendations.

2. Data and stylized facts

In studying the nexus between trade agreements' provisions and domestic innovation, we need to illustrate the trends of key determinants over time. In this section, we present and analyze trends of RTAs and innovation. Our dataset consists of 2,490 observations for 83 countries at different income levels, spanning the years 1990 and 2019. The dependent and control variables rely on the World Development Indicators and EORA26 dataset, while all provisions indicators rely on the World Bank Deep Trade Agreements dataset[3].

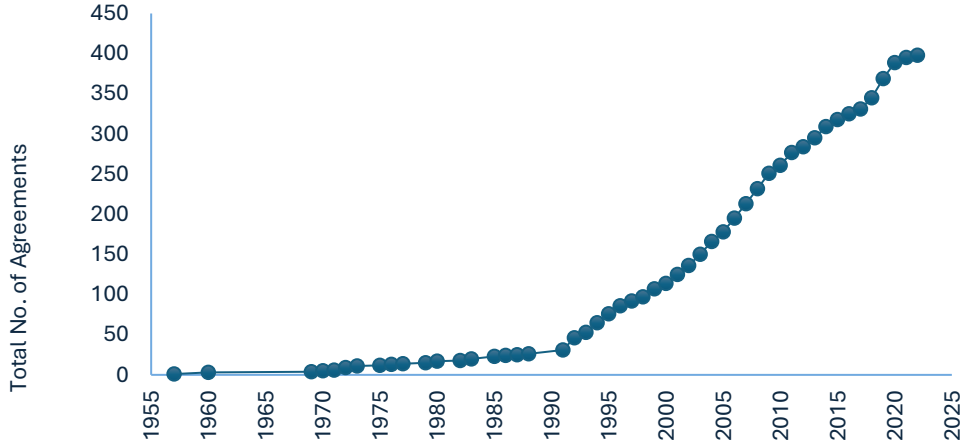
In parallel to the increase in the number of RTAs over time, with a particularly higher slope in the 1990s (see Figure 1), Figure 2 shows a steady increase in the number of resident patents from 1990 to 2010, followed by a steeper increase from 2010 to 2018. Besides the possible association between RTAs and innovation, the sharp growth in resident patents is due to significant technological expansion following the fourth industrial revolution. As for the GDP per capita, it depicts a rather gradual and steady increase throughout the three decades. Although the trends of resident patents and GDP per capita show similarity from 1990 to 2010, the divergence of the slope

[3] Appendix 2 presents the descriptive statistics of the data.

of resident patents displays a non-wealth-related increase in innovation post-2010. One reason behind the sharper increase in innovation compared to GDP per capita is the regional integration shaped by growing enforced provisions during this period.

Analyzing the trends of trade agreements' provisions helps disentangle the role trade agreements play in fostering domestic innovation. Figure 3 presents the trend of provisions categorized as follows: provisions that go beyond the WTO core commitments (WTO-X), provisions that deepen WTO commitments (WTO+), and an aggregated measure including both types of provisions (all)[4]. Over the period 1990 – 2020, WTO-X depicts the slowest rate of increase and the lowest number. In contrast, WTO+ has a sharper and steadier increase over time, showing that countries are more willing to commit to deeper trade liberalization measures that align with WTO commitments than to the extra obligations. The aggregated measure, including all provisions, shows an upward trend over time, with a significant increase post-2000, suggesting active trade negotiations and implementation of agreements with deeper provisions during this period. While these measures show an increasing breadth of provisions, analyzing the trend of depth is important to understanding the extent of going beyond the traditional trade liberalization measures, like tariffs. Figure 4 presents the depth measure of WTO-X, WTO+, and aggregated related measures. As shown, WTO+ provisions have the highest depth that steadily increases over time. The low depth of WTO-X provisions leads to dampening the total aggregated depth measure. In this respect, the effect of depth in WTO+ provisions can be diluted by the shallow WTO-X provisions (see Figures A1 and A2 for the different types of provisions included in trade agreements). This heterogeneity in the extent of depth across types of provisions in trade agreements is relevant to understanding the importance of disentangling the role of each type in incentivizing and the possible "spaghetti bowl" leading to a neutral overall effect (Bhagwati, 1995 and Govindaraj, 2023).

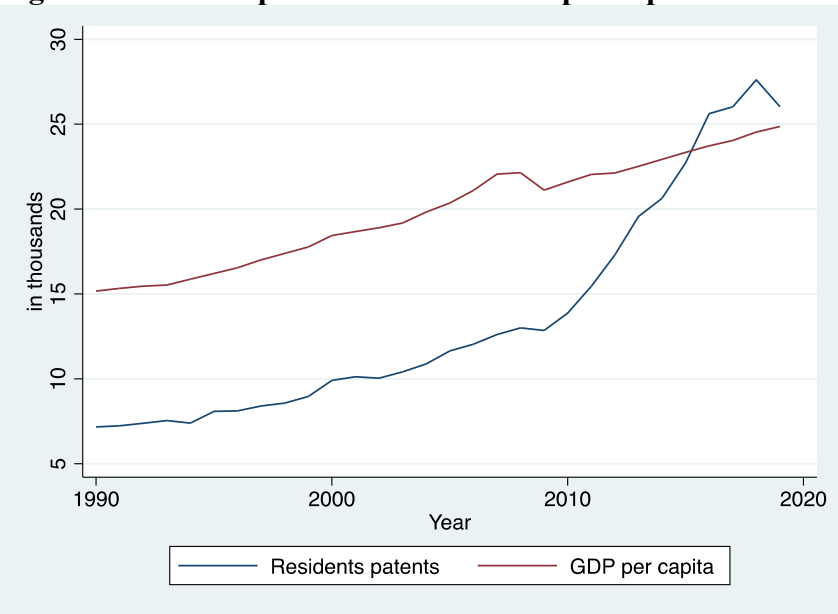
Figure 1. Number of regional trade agreements over time



Source: Own construction based on World Trade Organization online database.

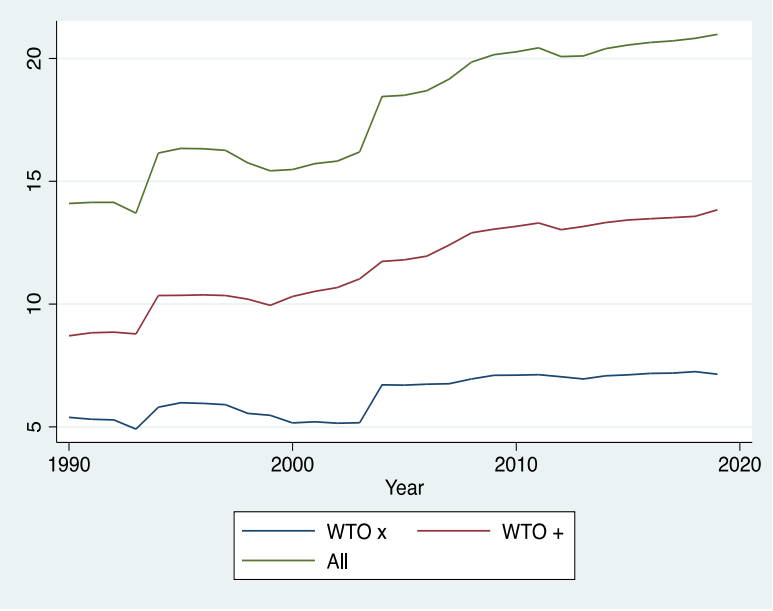
[4] Appendix 1 presents the shares of policy areas with each group.

Figure 2. Resident patents and real GDP per capita over time



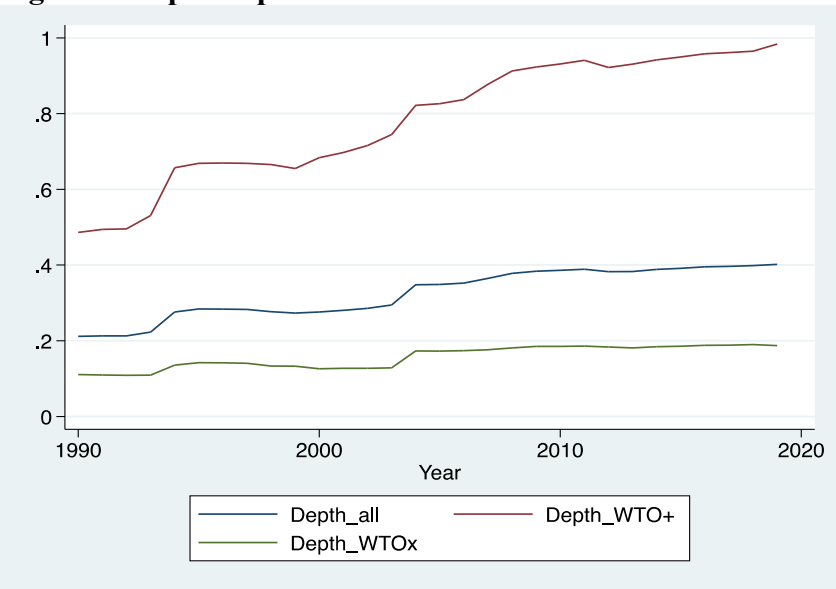
Source: Own construction based on World Development Indicators.

Figure 3. Types of agreements' provisions over time



Source: Own construction based on the World Bank Trade Agreements Data.

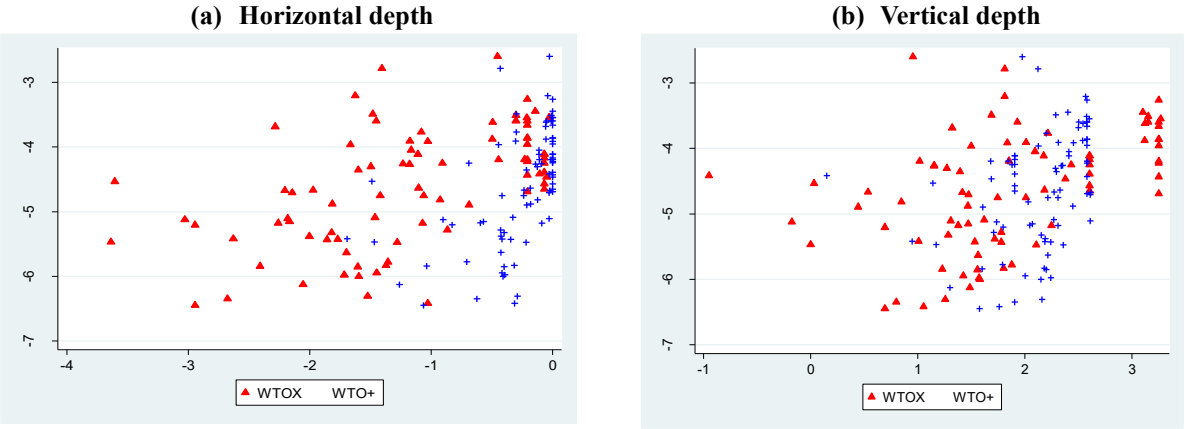
Figure 4. Depth of provisions over time



Source: Own construction based on the World Bank Trade Agreements Data.

Figures 5 a and b show a positive association between our different measures of the agreement depth for both types of provisions (WTOX and WTO+) and patents. For the horizontal depth, these measures are calculated by taking the share of provisions included in a certain agreement in the total number of provisions one can have. As per the vertical depth, we examine the legal enforceability of these provisions by looking at the total number of provisions that are legally enforceable for each dimension. It is important to note that the highest elasticity is that of horizontal depth for WTO+ (1.3), followed by that of vertical depth for WTO+ (0.76). The elasticities of WTOX are lower for both the horizontal (0.52) and the vertical (0.44) depth. Thus, WTO+ provisions play the main role in incentivizing innovation as it facilitates trade more, which increases both imported innovation and learning by exporting.

Figure 5. Association between patents and provisions

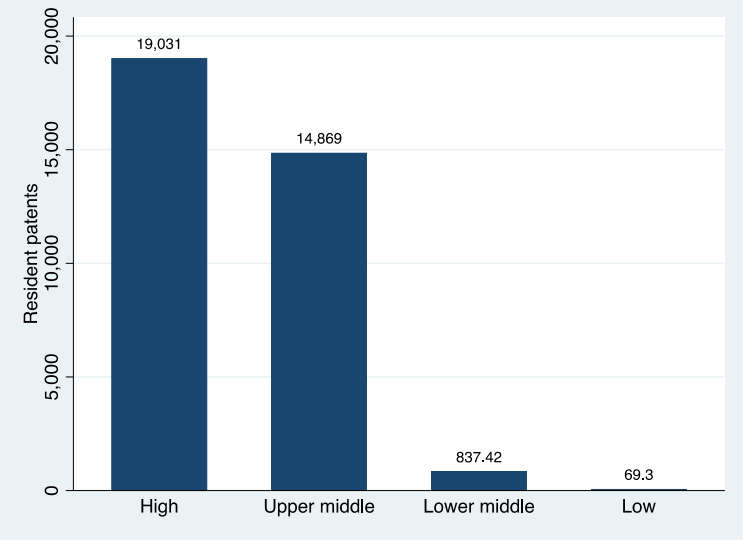


Source: Own construction, averaging the years 1990-2019.

Note: Both horizontal and vertical depth for WTOX and WTO+ and patents are expressed in natural logarithms.

In studying the effect of provisions in incentivizing innovation, it is important to show the heterogeneity in innovation output across income groups. As Figure 6 presents, high- and upper-middle- income countries are the producers of innovation. When it comes to other income groups, innovation output is minimal. This innovation gap is rooted in the lack of knowledge inputs like R&D stock and expenditure at lower income groups. The concentration of innovation in higher-income countries necessitates targeted policies and different mechanisms leading to knowledge spillovers to lower-income countries. In attempting trade-related and non-trade-related policy areas, regional trade agreements can have a significant role in an affluent innovation ecosystem, facilitating learning through international interlinkages. Yet, to guarantee this innovation channel and to differentiate between the effects of different provisions, econometric modeling is necessary.

Figure 6. Resident patents against income groups



Source: Own construction based on the World Development Indicators averaging the years 1990-2019.

3. Methodology

Relying on the World Development Indicators (WDI) and the World Bank Deep Trade Agreements datasets, we estimate the effect of different types of trade agreements' provisions on domestic innovation, proxied by resident patents per capita. First, we estimate the baseline effect of the breadth of provisions on resident patents per capita as presented in Equation 1:

$$PAT_{it} = a_0 + a_1\, Provisions_{it} + a_2\, X_{it} + u_i + u_t + \varepsilon_{it} \quad (1)$$

Where PAT_{it} is the logarithm of resident patents per capita, *Provisions'* measure alternates the WTO+, WTOX, and the aggregated provisions in regional trade agreements. For each variable, we construct a dummy variable that takes the value of 1 if the agreement includes the provision in question (from a total of 52 provisions) and zero otherwise. To calculate WTO+ and WTOX, we sum up the number of ones. WTOALL is the sum of both WTO+ and WTOX. $X_{it}$is a vector of control variables including GDP per capita in log, R&D stock in log, knowledge spillovers through GVCs, population in log, tariffs, and share of oil exports in merchandise. *GDP per capita* controls for the level of development and is expected to have a positive effect on innovation output. *R&D stock* is the main domestic innovation input, and knowledge spillovers through GVCs (*GVCRD*) is the foreign innovation input (Eissa and Zaki, 2023). *Fuel export* controls for oil dependence trap the economy in extracting activities, limiting innovation. *Population* controls for the size of the country, and *tariffs* are the direct and traditional trade costs limiting knowledge innovation. $u_i and\, u_t$ are country- and year-fixed effects to control for unobservables. ε_{it} is the error term. Table A1 includes descriptive statistics for all our variables.

The analysis is extended in several ways. First, we study the role of the horizontal and vertical depth of agreements in incentivizing innovation. In this analysis, we integrate the depth measures for WTO-X, WTO+, and their combination. Again, for the horizontal depth, these measures are calculated by taking the share of provisions included in a certain agreement in the total number of provisions one can have (52 policy topics, out of which 38 pertain to WTOX and 14 to WTO+). As per the vertical depth, we examine the legal enforceability of these provisions by looking at the total number of provisions that are legally enforceable for each dimension (WTO+, WTOX, and WTOALLL). From the stylized facts presented in Section 2, we expect that WTO+ deep measure plays the main role in incentivizing innovation as it facilitates trade more, which increases both imported innovation and learning by exporting. Second, given that WTO+ provisions are rather heterogeneous, we estimate the effect of specific groups of provisions related to WTO commitments (NTMs, services, and institutions) on innovation to understand the role of each in fostering innovation. In addition, we study the effect of the detailed provision within each area. Table A2 in the appendix includes the classification of different provisions. Third, we examine the impact across different income groups to understand the relevance of these provisions to lower-income groups with limited innovation output.

Finally, we tackle robustness by alternating the dependent variable with R&D-weighted imports (Coe and Helpman, 1995). Moreover, we address the endogeneity of provisions stemming from reverse causality. In particular, countries with higher innovation output can be more incentivized to engage in deep agreements to protect the property rights of innovators. In this respect, a positive association can be a result of endogeneity bias, and a causal effect of provisions on domestic innovation is not guaranteed with a significant and positive coefficient. To bypass this endogeneity, we employ an instrumental variable estimation method where the instrument is the quality of institutions of the main trade partner. The rationale behind this is as follows. Generally, high-quality institutions can lead to deeper trade agreements as legal enforceability and non-trade provisions require good institutions (Aly and Zaki, 2025). This is particularly related to stronger intellectual property, dispute settlement, and investment protection. Moreover, better institutions can reduce the transaction cost (Anderson and Marcouiller, 2002) and make commitments credible (North and Weingast, 1989). Given that institutions of the main trade partner are exogenous to the country in question, they economically satisfy the exogeneity assumption. Thus, a better institutional setup in the main trade partner leads to an institutional improvement in the country in question, which increases the likelihood of signing deeper agreements and thus increases innovation.

4. Empirical results

Our results on the effect of trade agreements' provisions on domestic innovation are presented in Tables 1 to 6. The baseline results analyze the impact of the different types of provisions (WTO+ versus WTO-X) in Table 1. We then extend the analysis to explore the depth and the details of provisions that matter in Tables 2 and 3. Table 4 presents the four channels mentioned above. In Tables 5 and 6, we present different robustness checks by alternating the dependent variable and exploring the endogeneity of trade provisions.

4.1. Baseline

Table 1 provides insight into the impact of different types of provisions (WTO-X, WTO+, and a combination of both) on domestic innovation proxied with resident patents per capita. As presented, WTO+ provisions are positively associated with domestic patenting. In particular, a one-unit increase in WTO+ provisions corresponds to a 0.73% increase in resident patents per capita. Our results align with the empirical literature showing that trade agreements' provisions facilitate the transfer of technology across trade partners, highlighting the importance of enforcing provisions that directly foster technology transmission mechanisms (Martínez-Zarzoso and Chelala, 2021). In contrast, WTO-X provisions that go beyond trade goals and the combination of both types are insignificant in incentivizing domestic innovation.

While WTO+ provisions extend the commitments of trade agreements as intellectual properties, trade in services, and technical trade barriers, WTO-X refers to obligations beyond those regulated and covered by the WTO. As our results show, extra commitments to trade agreements focusing on non-traditional trade areas like labor standards and environmental protection do not directly encourage domestic patenting. Furthermore, the aggregated effect of all provisions is insignificant, indicating that the positive effect of WTO+ provisions dilutes when combined with WTO-X provisions. This unpronounced effect is unexpected because WTO-X provisions include technology-specific provisions like IPRs beyond TRIPs commitment, R&D, and innovation policy. However, extra provisions impose a compliance cost that can be burdensome (Autor et al., 2013; Puri, 2005). Yet, these results require further analysis given the heterogeneity of different provisions, as will be shown later.

As for the control variables, results show consistency with expected effects. Across all regressions, domestic R&D stock, GDP per capita, GVCRD, and population are positively associated with resident patents per capita due to higher absorptive capacities, domestic (R&D stock), and foreign (GVCRD) innovation inputs. As for direct trade costs, tariffs are negatively associated with domestic innovation due to the higher barriers to knowledge transmission through trade. Indeed, higher tariffs reduce imports, which negatively affects productivity and technology transfer (Bas and Berthou, 2017 and Martinez-Zarzozo et al., 2021) and might reduce exports as well if they are dependent on imports (which affects the learning by exporting channel). While GVCRD controls the effect of tangible and intangible trade, tariffs control tangible merchandise only. Likewise, oil exports are negatively associated with domestic innovation due to concentrating on low-value-added extracting activities that are not sensitive to the quality of institutions and not technology-intensive (Mhuru et al., 2022).

Table 1. Baseline results

	WTO X	WTO +	ALL
Log(R&D Stock)	0.238***	0.236***	0.239***
	(0.0619)	(0.0617)	(0.0619)
Log(GDP per capita)	0.553***	0.500***	0.544***
	(0.0866)	(0.0873)	(0.0869)
Log(Population)	0.538***	0.448**	0.540***
	(0.172)	(0.175)	(0.172)
Tariffs	-0.0112***	-0.0106***	-0.0112***
	(0.00118)	(0.00119)	(0.00119)
Fuel Exports	-0.00307***	-0.00292***	-0.00306***
	(0.000881)	(0.000880)	(0.000881)
GVCRD	0.252**	0.264***	0.258**
	(0.100)	(0.0998)	(0.100)
Provisions	-0.000464	0.00725***	0.000191
	(0.000751)	(0.00233)	(0.000615)
Observations	2,490	2,490	2,490
R-squared	0.921	0.921	0.921

*Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include a constant, country and year dummies. (iii) The provision type is mentioned in the first row. (iv) The dependent variable is log patents per capita.*

4.2. Extensions

4.2.1. Does the Agreement Depth Matter?

Besides analyzing the effect of the breadth of different types of provisions on domestic innovation, it is important to study the role of the provisions' depth. As the literature suggests, the depth of provisions in trade agreements enhances global integration and matters for fostering innovation (Mattoo et al., 2020; Dang et al., 2024). In this analysis, we measure the horizontal depth by the share of provisions included in the agreement. Table 2 shows the effect of RTA depth on resident patents per capita. Whereas all the control variables remain with the same level of significance and the same sign, more heterogeneity is observed for different provisions.

First, our results show that deepening existing WTO commitments (WTO+) fosters domestic innovation. While WTO+ matters for both the horizontal and vertical depth, the former has a higher magnitude. In particular, as the share of horizontal depth of WTO+ provisions increases by one unit, resident patents per capita increase by 10.2%. This aligns with the literature emphasizing that the depth measure of trade provisions matters more for technology spillover, particularly for North-South and South-South trade (Jinji et al., 2019). The vertical depth of WTO+ provisions is also positively and statistically significantly associated with patents, though with a lower magnitude.

As per provisions that go beyond the WTO mandate, and in contrast with Jinji et al. (2019), showing a positive association between deep WTO-X provisions and patent applications, our results show that WTO-X does not matter either in the horizontal or the vertical depth[5]. Besides the corresponding compliance costs effect, the silence of the WTO-X and the aggregated measure in incentivizing innovation is analyzed for a twofold reason. First, through the "spaghetti-bowl" effect, provisions targeting innovation promotion -like R&D and IPRs in WTO-X- can lose effectiveness when applied differently across multiple trade agreements (Coelli et al., 2022; Akcigit et al., 2018). Second, policies promoting innovation through trade agreements are negated with unapt domestic industrial and institutional policies that hinder competition and free market access (Melitz and Reding, 2021). Accordingly, fragmentation of trade agreements and domestic regulatory frameworks can overshadow the effect of innovation-related provisions that go beyond the WTO obligations.

Finally, aggregating the two types dilutes the positive effect of deep WTO + provisions on domestic patenting, as shown by the insignificance of the combined measure in both the horizontal and the vertical depth. In a nutshell, the more WTO-related provisions are included and the more they are legally enforceable, the more a country is likely to innovate.

[5] The effect turns insignificant when including a dummy for RTAs in the model (Jinji et al., 2019).

Table 2. Results with the agreement depth

	Horizontal			Vertical		
	WTO +	**WTO X**	**ALL**	**WTO +**	**WTO X**	**ALL**
Log(R&D Stock)	0.236***	0.239***	0.238***	0.226***	0.246***	0.236***
	(0.0617)	(0.0619)	(0.0619)	(0.0618)	(0.0620)	(0.0620)
Log(GDP per capita)	0.500***	0.544***	0.553***	0.494***	0.576***	0.538***
	(0.0873)	(0.0869)	(0.0866)	(0.0870)	(0.0876)	(0.0878)
Log(Population)	0.448**	0.540***	0.538***	0.578***	0.465***	0.561***
	(0.175)	(0.172)	(0.172)	(0.172)	(0.178)	(0.175)
Tariffs	-0.0106***	-0.0112***	-0.0112***	-0.0111***	-0.0110***	-0.0112***
	(0.00119)	(0.00119)	(0.00118)	(0.00118)	(0.00119)	(0.00118)
Fuel Exports	-0.00292***	-0.00306***	-0.00307***	-0.00295***	-0.00305***	-0.00306***
	(0.000880)	(0.000881)	(0.000881)	(0.000879)	(0.000880)	(0.000881)
GVCRD	0.264***	0.258**	0.252**	0.248**	0.263***	0.254**
	(0.0998)	(0.100)	(0.100)	(0.0997)	(0.100)	(0.100)
Depth	0.102***	0.00992	-0.0176	0.00747***	-0.00226*	0.000510
	(0.0327)	(0.0320)	(0.0285)	(0.00192)	(0.00130)	(0.000856)
Observations	2,490	2,490	2,490	2,490	2,490	2,490
R-squared	0.921	0.921	0.921	0.921	0.921	0.921

*Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include a constant, country, and year dummies. (iii) The depth type is presented in the first row. (iv) The dependent variable is log patents per capita.*

4.2.2. Which provisions matter?

After showing that, generally, WTO+ provisions matter more than WTOX provisions for the spillover effect on knowledge, we move to scrutinize the effect of specific provisions in incentivizing innovation. To disentangle the effect of the groups of WTO+ provisions, we move to estimate each group (NTMs, services, and institutions) in separate regressions[6]. As the literature endorses, NTMs negatively affect domestic innovation (Eissa and Zaki, 2023). Hence, provisions targeting standardization and enhanced protections are expected to significantly foster innovation. As for service provisions, we expect a positive impact on innovation due to facilitating digital trade and knowledge spillovers (He at al., 2025 and de Araújoet al., 2025). Likewise, institutional provisions enhance trade interlinkages (Ezzat and Zaki, 2021) and influence innovation dynamics by shaping the broader ecosystem in which firms operate. Consistent with related literature showing that ecosystem configurations play a critical role in shaping technology adoption and learning processes (Müller and Steinhauser, 2025).

As presented in Table 3, NTMs and institutional provisions have the highest magnitude and significance in incentivizing domestic innovation. Starting with NTMs (provisions related to SPS, TBT, countervailing measures, etc.), the significant effect shows that enforcing provisions targeting reducing non-tariff barriers improves access to imported technology by reducing trade costs. Even when we control direct trade costs (tariffs), decreased indirect costs of trade show a positive effect on domestic innovation. As for institutional provisions, our results show that a one-unit increase corresponds to a 2.47% increase in resident patents per capita. Aligning with the literature, better rule of law (Eissa and Zaki, 2023) and legal frameworks foster an innovation-friendly environment where firms are more encouraged to register patents. Improved institutions encourage the formalization of intellectual properties for trading firms as a substitute for engaging

[6] Appendix 4 provides the topics of each group.

in trade secrets. Hence, innovation measurements improve. This is also in line with Donges et al. (2022) who argue that inclusive institutions are a first-order condition of innovation.

As for service provisions, the coefficient is positive but weakly significant. This suggests that while provisions targeting services markets encourage innovation, the effect is less direct than NTMs or institutional provisions. Services provisions may benefit sectors indirectly linked to patenting, such as logistics or professional services, rather than directly stimulating patent filings. Despite the positive association between service provisions and resident patents per capita, the coefficient is weakly significant.

Table 3. Results with WTO+ groups of provisions

	NTM	Services	Institutions
Log(R&D Stock)	0.232***	0.237***	0.240***
	(0.0617)	(0.0618)	(0.0618)
Log(GDP per capita)	0.500***	0.516***	0.507***
	(0.0868)	(0.0876)	(0.0873)
Log(Population)	0.402**	0.505***	0.466***
	(0.176)	(0.173)	(0.174)
Tariffs	-0.0104***	-0.0110***	-0.0107***
	(0.00120)	(0.00119)	(0.00119)
Fuel Exports	-0.00301***	-0.00305***	-0.00268***
	(0.000878)	(0.000880)	(0.000891)
GVCRD	0.266***	0.260***	0.265***
	(0.0997)	(0.0999)	(0.0999)
Provisions	0.0207***	0.0118*	0.0247***
	(0.00540)	(0.00610)	(0.00901)
Observations	2,490	2,490	2,490
R-squared	0.921	0.921	0.921

*Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include a constant, country, and year dummies. (iii) The provisions type is presented in the first row. (iv) The dependent variable is log patents per capita.*

Table A3 in the appendix presents the detailed effects of trade-related provisions within the areas of NTMs, services, and institutions. Within the institutions, customs, and state aid show positive and highly significant associations with knowledge spillovers. Although state and trade enterprises (STE) provisions focus on fair competition and limiting distortions, some literature shows that in many countries, state-owned enterprises are less dynamic in R&D investment and innovation due to bureaucracy and lack of incentives (Shleifer and Vishny, 1994). Nevertheless, STE provisions show an unpronounced effect on innovation. In contrast, the effect of customs and state aid provisions aligns with our intuition. Indeed, customs provisions facilitate trade integration by reducing tariff and non-tariff costs to trade and hence facilitate foreign spillovers of innovation (Eissa and Zaki, 2023). Furthermore, state aid provisions allow subsidies aimed at promoting R&D, directly fostering patenting (Akcigit et al., 2022). Although the services show weak significance, detailed provisions of government procurement and TRIMs show higher significance than the overall measure. Likewise, within NTMs, the relevant provisions to innovation are sanitary and phytosanitary measures (SPS), technical trade barriers (TBT), anti-dumping, and countervailing provisions. SPS depicts the largest magnitude and stimulates innovation by encouraging firms to meet higher standards related to health and safety. In this respect, firms adopt

new technologies to meet stringent regulations. This result matches the literature showing that SPS leads to the technological upgrading of exports (Jaffe and Hanson, 2005; Maskus et al, 2005).

Because WTO-X provisions include innovation-related policy areas, we are interested in disentangling the effect of different provisions to understand the shadowing of the overall insignificance of the WTO-X measure. Table A4 in the appendix presents the results of selected areas within the economic institutions' dimension. As presented, competition policy and research and technology provisions have the largest positive magnitude within the non-trade-related provisions. In addition, at a lower significance, innovation policy and SMEs are positively associated with domestic innovation. Our results indicate that both research and technology policies, as well as innovation policy provisions, serve as direct drivers of innovation, as evidenced by their positive and significant association. When it comes to the role of competition policy in incentivizing innovation, the literature shows multiple effects. First, competition policy encourages market entry by addressing anticompetitive practices. Hence, it enhances the knowledge diffusion of new entrants investing in innovation to sustain their market position (Melitz and Redding, 2021). Second, increased competition reduces market power, forcing reluctant firms to improve efficiency, differentiate products, and engage in new processes (Vives, 2008). Yet, this competition-induced innovation is evident at the medium level of innovation. In fact, at excessive levels of innovation, higher competition reduces innovation due to decreased expected returns. This inverted U-shaped relationship guarantees the positive effect of competition up to a certain threshold of competition (Aghion et al., 2005), after which higher competition can reduce innovation. Hence, competition policy needs to be applied with caution.

4.2.3. Heterogeneity across income groups

Despite the positive association between WTO+ provisions and resident patents per capita, this effect can be heterogeneous across different income levels. As the literature suggests, knowledge spillovers through global value chain participation are more relevant to lower-middle-income countries (Eissa and Zaki, 2023) because the fewer domestic inputs to innovate, the higher the effect of foreign knowledge transmission. In this respect, we scrutinize the impact of provisions across income groups in Table 4. As presented, the WTO+ provisions preserve the positive and highly significant effect. Yet, when interacting provisions with income levels, we observe varying associations. In reference to high-income countries, WTO+ provisions positively interact with lower-middle-income countries. As for the low-income countries, both WTO+ and the aggregated measure show a positive and highly significant effect. Accordingly, we show that provisions are more relevant to lower-income countries with middling absorptive capacity and minimal innovation output. As a substitute for domestic capacity, enhancing provisions in regional trade agreements can boost innovation performance in low-income countries. Yet, to capitalize on this positive association, investments in human capital and labor upskilling are essential to low- and middle-income countries to avoid the middle-income trap that is always associated with slower technology adoption (Arezki et al., 2021). Indeed, being a substitute for domestic capacity,

enhancing provisions in regional trade agreements can boost innovation performance in low-income countries.

Table 4. Heterogeneity across income groups

	WTO X	WTO +	ALL
log(R&D Stock)	.217***	.307***	.32***
	(.069)	(.064)	(.068)
log(GDP per capita)	.539***	.418***	.48***
	(.105)	(.102)	(.103)
log(Population)	.316	.384*	.586***
	(.214)	(.205)	(.208)
Tariffs	-.01***	-.009***	-.009***
	(.001)	(.001)	(.001)
Fuel Exports	-.003***	-.002***	-.003***
	(.001)	(.001)	(.001)
GVCRD	.239**	.338***	.421***
	(.115)	(.099)	(.108)
Provisions	-.001	.008**	.001
	(.003)	(.004)	(.002)
Provisions*Upper-middle	-.015***	-.014***	-.007**
	(.005)	(.005)	(.003)
Provisions*Lower-middle	-.01	.033***	.007
	(.006)	(.007)	(.004)
Provisions*Low	-.009	.057***	.026***
	(.011)	(.013)	(.009)
Observations	2189	2189	2189
R-squared	.931	.933	.931

*Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include a constant, country, and year dummies. (iii) The provision type is presented in the first row. (iv) The dependent variable is log patents per capita.*

4.3. Robustness checks

To ensure a robust association between provisions and innovation, we alternate the dependent variable with another innovation measure. As presented in Table 5, we use a Coe-Helpmann knowledge spillover measure (Eissa and Zaki, 2023) as the dependent variable. Our results show consistency of the effects of different types and areas of provisions with the baseline results. Again, only WTO+ provisions show a positive effect on knowledge spillover, with a diluted effect when aggregated with WTO-X provisions.

Table 5. Changing the dependent variable – Coe-Helpman

	WTO X	WTO +	ALL
Log(R&D Stock)	0.375***	0.372***	0.376***
	(0.0763)	(0.0761)	(0.0762)
Log(GDP per capita)	0.163	0.0990	0.151
	(0.107)	(0.108)	(0.107)
Log(Population)	-0.0890	-0.205	-0.0900
	(0.212)	(0.215)	(0.212)
Tariffs	-0.00454***	-0.00379***	-0.00445***
	(0.00146)	(0.00147)	(0.00146)
Fuel Exports	-0.00742***	-0.00724***	-0.00741***
	(0.00108)	(0.00108)	(0.00108)
GVCRD	0.0508	0.0640	0.0575
	(0.123)	(0.123)	(0.123)
Provisions	-0.000347	0.00918***	0.000402
	(0.000925)	(0.00287)	(0.000757)
Observations	2,460	2,460	2,460
R-squared	0.910	0.910	0.910

*Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. All regressions include a constant, country, and year dummies. The dependent variable is R&D-weighted imports.*

As per the endogeneity between provisions and innovation, we use an instrumental variable estimation method where the instrument is the quality of institutions of the main trade partner. As it was mentioned before, the rationale behind this is as follows. High-quality institutions are associated with deeper trade agreements, as effective legal enforcement and the inclusion of non-trade provisions require strong institutional frameworks. Since the institutional quality of a country's main trading partner is exogenous to the country under consideration, it satisfies the exogeneity assumption from an economic perspective. Consequently, improvements in the institutional environment of the main trade partner can induce institutional upgrading in the country itself, increasing the likelihood of entering into deeper trade agreements and, in turn, fostering innovation. The results are presented in Table 6, where WTO+ provisions show a positive effect on knowledge spillover. Interestingly, once we control for the reverse causation, the effect of WTOX provisions becomes positive with a lower magnitude than WTO+. Yet, from an econometric perspective, it is important to note that the F statistic of the first stage in the case of WTOX is low, making the instrument invalid. In contrast, it is sufficiently high in the case of WTO+ provisions, confirming our initial result of the importance of WTO+ provisions.

Table 6. Controlling for endogeneity

	WTO+	WTOX	All
Provisions	0.159***	0.112**	0.0658***
	(0.0470)	(0.0539)	(0.0247)
Controls	YES	YES	YES
Country FE	YES	YES	YES
Time FE	YES	YES	YES
Observations	2,047	2,047	2,047
R-squared	0.828	0.547	0.722
Durbin (score) chi2(1)	28.91	31.07	30.49
	(p = 0.0000)	(p = 0.0000)	(p = 0.0000)
Wu-Hausman	27.69	29.80	29.23
	(p= 0.0000)	(p= 0.0000)	(p = 0.0000)
F test of first stage	15.55	4.70	8.36
	(p=0.0001)	(p=0.0302)	(p= 0.0039)

*Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. All regressions include a constant, country, and year dummies. The dependent variable is R&D-weighted imports.*

5. Conclusion and policy implications

By empirically examining the effects of trade agreement provisions on domestic innovation, this paper contributes to the existing literature in two ways. First, we assess how both the breadth and depth of different types of provisions shape innovation outcomes measured by resident patents. In that sense, we provide evidence that trade-related provisions are more effective in fostering innovation than non-trade-related provisions, and that both the horizontal and vertical depth of trade-related commitments matter. Second, by disentangling the types of trade-related provisions, we show that provisions targeting non-tariff-measures and institutional reforms play a significant role in enhancing innovation. In particular, facilitating foreign collaboration through customs procedures and technical standards harmonization is key to flourishing the innovation ecosystem, especially in lower-middle and low-income countries. In this respect, foreign collaboration is critical for technology diffusion, learning, and capacity building.

Our evidence that trade agreements serve as an important channel for connecting lower-income countries to foreign knowledge networks, accelerating domestic innovation point to a threefold policy recommendation. First, trade agreement negotiations should prioritize deep, enforceable, trade-related provisions, particularly those that reduce non-tariff measures and lower the costs of cross-border exchange. Second, trade policy in low- and lower- middle-income countries should place a greater emphasis on institutional and regulatory provisions that facilitate foreign collaboration. Commitments like customs modernization, technical standards harmonization, and regulatory transparency play an effective role in strengthening technology diffusion and foreign learning. Finally, to complement trade policy, domestic investments in human capital is key in enhancing the benefits from increased integration by strengthening firms' capacity to absorb foreign knowledge. These policies together aim at promoting an innovation-friendly ecosystem in developing countries through trade agreements.

References

Aboushady, N., Harb, G., & Zaki, C. (2024). Aid for trade and export performance of recipient countries: The moderating role of institutions. *The Journal of International Trade & Economic Development*, 1-29.

Aghion, P., Bergeaud, A., Gigout, T., Lequien, M., & Melitz, M. (2019). Spreading knowledge across the world: Innovation spillover through trade expansion. *manuscript, Harvard University*.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., & Howitt, P. (2005). Competition and innovation: An inverted-U relationship. *The quarterly journal of economics*, *120*(2), 701-728.

Akcigit, U., Hanley, D., & Stantcheva, S. (2022). Optimal taxation and R&D policies. *Econometrica*, *90*(2), 645-684.

Akcigit, U., Ates, S. T., & Impullitti, G. (2018). *Innovation and trade policy in a globalized world* (No. w24543). National Bureau of Economic Research.

Aly, F., & Zaki, C. (2025). On deep trade agreements, institutions, and global value chains: evidence from Egypt. *Review of World Economics*, 161(1), 49-87.

Anderson, J. E., & Marcouiller, D. (2002). Insecurity and the pattern of trade: An empirical investigation. *Review of Economics and statistics*, 84(2), 342-352.

Arezki, R., Fan, R. Y., & Nguyen, H. (2021). Technology adoption and the middle-income trap: Lessons from the Middle East and East Asia. *Review of Development Economics*, *25*(3), 1711-1740.

Audretsch, D. B., Belitski, M., Caiazza, R., & Siegel, D. (2025). Knowledge spillovers and public investment in innovation: empirical evidence from the United Kingdom. *Economics of Innovation and New Technology*, 1–32. https://doi.org/10.1080/10438599.2025.2608039

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

Bhagwati, J. N. (1995). US trade policy: The infatuation with FTAs.

Bas, M., & Berthou, A. (2017). Does input-trade liberalization affect firms' foreign technology choice?. *The World Bank Economic Review*, 31(2), 351-384.

Bastiaens, I., Lechner, L., & Postnikov, E. (2024). Non-trade issues in preferential trade agreements and global value chains. *Review of International Political Economy*, 1-28.

Berman, E., Bound, J., & Machin, S. (1998). Implications of skill-biased technological change: international evidence. The quarterly journal of economics, 113(4), 1245-1279.

Branstetter, L. (2006). Is foreign direct investment a channel of knowledge spillovers? Evidence from Japan's FDI in the United States. *Journal of International Economics*, *68*, 325–344. https://doi.org/10.1016/j.jinteco.2005.06.006.

Bloom, N., Draca, M., & Van Reenen, J. (2016). Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity. *Review of economic studies*, 83(1), 87-117.

Chen, Z., Zhang, J., & Zheng, W. (2017). Import and innovation: Evidence from Chinese firms. *European Economic Review*, 94, 205-220.

Cheung, K. Y., & Ping, L. (2004). Spillover effects of FDI on innovation in China: Evidence from the provincial data. *China Economic Review*, 15(1), 25-44.

Coelli, F., Moxnes, A., & Ulltveit-Moe, K. H. (2022). Better, faster, stronger: Global innovation and trade liberalization. *Review of Economics and Statistics*, *104*(2), 205-216.

Dakhli, M., & De Clercq, D. (2004). Human capital, social capital, and innovation: a multi-country study. *Entrepreneurship & regional development*, 16(2), 107-128.

Dang, X., Zhao, Y., Yin, F., & Lv, K. (2024). Bilateral value chain reshaping through regional trade agreements deepening: Evidence from belt and road countries. *The Journal of International Trade & Economic Development*, 1–26. https://doi.org/10.1080/09638199.2024.2420226

de Araújo, J. D., Franco, C. W., de Sousa, P. R., & Frank, A. G. (2025). Redefining work in the supply chain: combining digital technologies and knowledge sharing for a smart working environment. *International Journal of Production Economics*, 109860.

Donges, A., Meier, J. M., & Silva, R. C. (2023). The impact of institutions on innovation. *Management Science*, 69(4), 1951-1974.

Eissa, Y., & Zaki, C. (2023). On GVC and innovation: the moderating role of policy. *Journal of Industrial and Business Economics*, *50*(1), 49-71.

Elshaarawy, R., & Ezzat, R. A. (2023). Global value chains, financial constraints, and innovation. *Small Business Economics*, *61*(1), 223-257.

Ezzat, A., & Zaki, C. (2022). On the political economy of trade agreements: A de jure and de facto analysis of institutions. *International Economics*, *172*, 143-156.

Govindaraj, R. (2023). Role of Mega-Regional Trade Agreements in Fostering Global Economic Governance. *Ramanujan International Journal of Business and Research*, *8*(1), 52-58.

Guillin, A., Rabaud, I., & Zaki, C. (2023). Does the depth of trade agreements matter for trade in services?. *The World Economy*, *46*(12), 3616-3653.

Hall, B. H., Jaffe, Adam. B., & Trajtenberg, M. (2005). Market value and patent citations. *Rand Journal of Economics*, *36*, 16–38.

He, H., Wang, H., & Wang, J. (2025). Unlocking innovation potential: the non-linear effect of digital transformation on firms' innovation breadth. *Economics of Innovation and New Technology*, 1–26. https://doi.org/10.1080/10438599.2025.2610337

Horn, H., Mavroidis, P. C., & Sapir, A. (2010). Beyond the WTO? An anatomy of EU and US preferential trade agreements. *The World Economy*, *33*(11), 1565-1588.

Jaffee, S. M., & Henson, S. (2005). Agro-food exports from developing countries: the challenges posed by standards. *Global agricultural trade and developing countries*, 91-114.

Jinji, N., Zhang, X., & Haruna, S. (2019). Do deeper regional trade agreements enhance international technology spillovers?. *The World Economy*, *42*(8), 2326-2363.

Khan, M. S. (2022). Absorptive capacities and economic growth in low-and middle-income economies. *Structural Change and Economic Dynamics*, *62*, 156-188.

Kiriyama, N. (2012). Trade and Innovation: Synthesis Report. OECD Trade Policy Working Papers No. 135.

Larch, M., & Yotov, Y. V. (2023). Estimating the effects of trade agreements: Lessons from 60 years of methods and data. *The World Economy*.

Loecker, J. D. (2013). Detecting learning by exporting. *American Economic Journal: Microeconomics*, *5*(3), 1-21.

Martínez-Zarzoso, I., & Chelala, S. (2021). Trade agreements and international technology transfer. *Review of World Economics*, *157*(3), 631-665.

Martínez Zarzoso, I., Said, M., & Zaki, C. (2021). Trade policy and input liberalization: the effect on Egyptian firms' productivity. *Review of Development Economics*, *25*(3), 1305-1325.

Maskus, K. E., Otsuki, T., & Wilson, J. S. (2005). *The cost of compliance with product standards for firms in developing countries: An econometric study* (Vol. 3590). World Bank Publications.

Mattoo, A., Rocha, N., & Ruta, M. (Eds.). (2020). *Handbook of deep trade agreements*. World Bank Publications.

Melitz, M. J., & Redding, S. J. (2021). *Trade and innovation* (No. w28945). National bureau of economic research.

Mhuru, R. M., Daglish, T., & Geng, H. (2022). Oil discoveries and innovation. *Energy Economics*, *110*, 105997.

Müller, M. L., & Steinhauser, S. (2025). Re-visiting innovation ecosystem S-curves: disentangling network effects and complementarity in technology diffusion. *Industry and Innovation*, 1–21. https://doi.org/10.1080/13662716.2025.2596038

North, D. C., & Weingast, B. R. (1989). Constitutions and commitment: the evolution of institutions governing public choice in seventeenth-century England. *The Journal of Economic History*, 49(4), 803-832.

Nickell, S. J. (1996). Competition and corporate performance. *Journal of political economy*, *104*(4), 724-746.

Puri, L. (2005). Towards a New Trade 'Marshall Plan' for Least Developed Countries: How to Deliver on the Doha Development Promise and Help Realize the UN Millennium Development Goals?. *Available at SSRN 1280887*.

Shleifer, A., & Vishny, R. W. (1994). Politicians and firms. *The quarterly journal of economics*, *109*(4), 995-1025.

Sun, X., Li, H., & Ghosal, V. (2020). Firm-level human capital and innovation: Evidence from China. *China Economic Review*, 59, 101388.

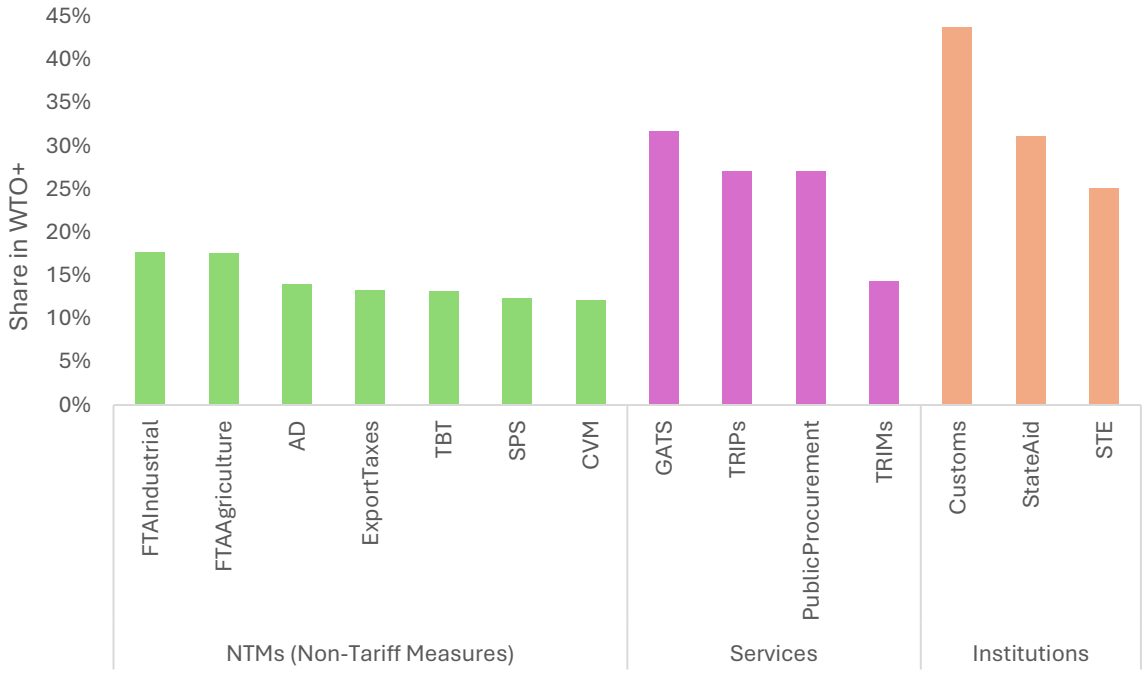
Tojeiro-Rivero, D., Moreno, R., & Badillo, E. R. (2019). Radical innovations: The role of knowledge acquisition from abroad. *Review of Industrial Organization*, 55(2), 173-207.

Vives, X. (2008). Innovation and competitive pressure. *The Journal of Industrial Economics*, *56*(3), 419-469.

White, H. (1992). The macroeconomic impact of development aid: A critical survey. *The Journal of Development Studies*, 28(2), 163-240.

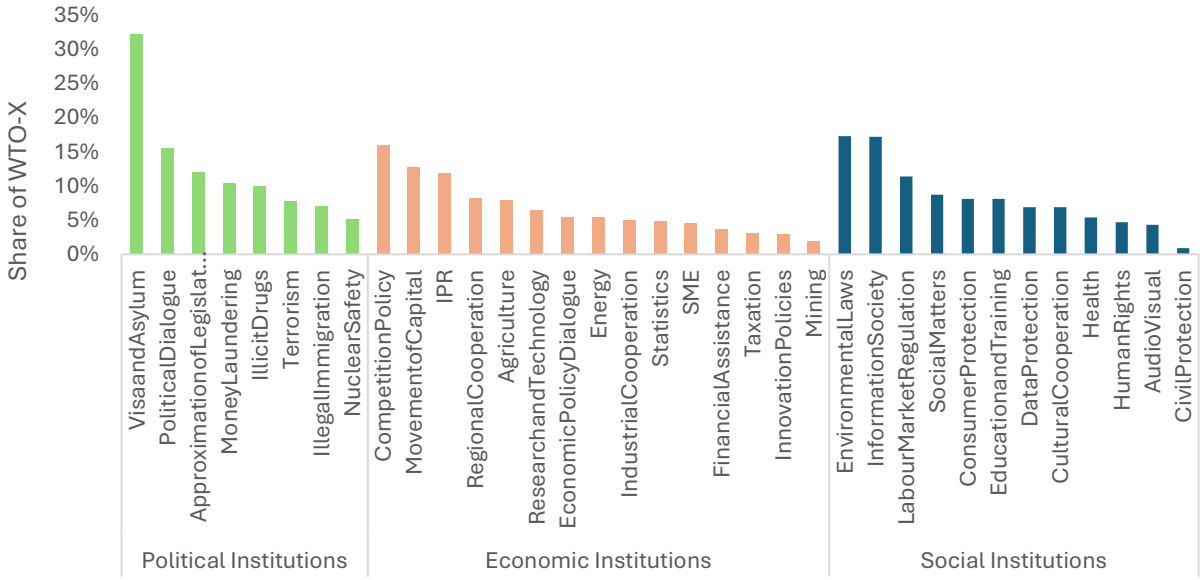
Appendix 1. Descriptive statistics

Figure A.1. Policy areas within WTO+ provisions chapters



Source: Own elaboration based on the World Bank Deep Trade Agreements Dataset.

Figure A.2. Policy areas within WTO-X provisions chapters



Source: Own elaboration based on the World Bank Deep Trade Agreements Dataset.

Table A.1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Log Patents per capita	2490	-4.6	.927	-7.313	-2.479
GVCRD	2490	.591	.295	.018	1
Log RD Stock	2490	2.92	.679	.871	4.917
Log GDP per capita	2490	3.945	.607	2.565	5.321
Log Population	2490	7.224	.732	4.469	9.145
Tariffs	2490	6.646	8.188	0	90.39
Fuel Exports	2490	13.87	21.94	0	98.764
Coe-Helpmann	2460	1.446	1.072	.017	8.17
WTO-X (breadth)	2189	8.18	8.275	0	30.8
WTO+ (breadth)	2189	13.057	6.828	2.462	28
WTO all (breadth)	2189	21.237	14.158	2.462	53.3
Provisions depth	2490	.359	.288	0	1.025
WTO+ depth	2490	.82	.549	0	2
WTO-X depth	2490	.189	.216	0	.811

Source: Authors' own elaboration

Table A.2. Topics within the different types of trade agreement provisions

WTO+	WTO-X		
Non-Tariff Measures	**Political institutions**	**Economic institutions**	**Social institutions**
FTA industrial goods	Approximation of legislation	Regional cooperation	Information society
FTA agricultural goods	Illegal immigration	Economic policy dialogue	Social matters
Countervailing measures	Illicit drugs	Research and technology	Human rights
Anti-dumping	Money laundering	Energy	Health
Export taxes	Nuclear safety	Financial assistance	Education and training
SPS	Political dialogue	Industrial cooperation	Cultural cooperation
TBT	Terrorism	Movement of capital	Audio visual
Institutions	Visa and aslym	Mining	Data protection
Customs administration		Statistics	Environmental laws
State and trading enterprises		IPRs beyond TRIPs	Labor market regulations
State aid		SME	Consumer protection
Services		Innovation policies	Civil protection
Public procurement		Competition policies	
TRIMs		Agriculture	
GATS		Taxation	
TRIPs			

Source: Authors' own elaboration

Table A.3. Results with WTO+ detailed provisions

FTA industrial	-	Public Procurement	0.0494**
	-		(0.0205)
FTA agriculture	-	TRIMS	0.0556***
	-		(0.0188)
Export taxes	-0.0486**	GATS	0.0222
	(0.0243)		(0.0209)
SPS	0.136***	TRIPS	-0.00315
	(0.0218)		(0.0198)
TBT	0.0900***	Customs	0.0895***
	(0.0210)		(0.0242)
Anti-dumping	0.0830***	State and trade enterprises	-0.00267
	(0.0245)		(0.0189)
Counter-veiling	0.0894***	State aid	0.0976***
	(0.0231)		(0.0248)

*Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include the baseline control variable, a constant, country, and year dummies. (iii) The dependent variable is log patents per capita. (iv) FTA agriculture and FTA industrial are dropped due to lack of variability.*

Table A.4. Results with WTO-X detailed provisions

Competition policy	0.125***	Energy	-0.00713
	(0.0232)		(0.0195)
Investment	-0.0515**	Financial assistance	-0.197***
	(0.0203)		(0.0261)
IPR	0.00792	Industrial coop.	0.0181
	(0.0189)		(0.0216)
Movement of Capital	0.0518***	Mining	0.0377**
	(0.0197)		(0.0176)
Agriculture	0.0324*	Regional cooperation	-0.0397**
	(0.0186)		(0.0189)
Innovation policy	0.0480**	Research and Technology	0.124***
	(0.0206)		(0.0186)
Economic pol. Dialogue	0.0143	SMEs	0.0432**
	(0.0212)		(0.0180)

*Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include the baseline control variable, a constant, country, and year dummies. (iii) The dependent variable is log patents per capita.*