

# WTO Trade Cost Index: Evolution, Incidence and Determinants

Background Note<sup>1</sup>

March 24, 2021

---

<sup>1</sup> Disclaimer: This note reflects research in progress. The data and materials published serve a purely informative purpose, and have no official or legal status. They are not intended to represent the positions or opinions of the WTO or its Members, and are without prejudice to Members' rights and obligations under the WTO. Any representation, aggregation or interpretation of the data and results is meant to facilitate the understanding of the research. References to geographical or other territories and groupings are based on terms provided to the WTO Secretariat by WTO Members and Observers, or terms used by relevant international organizations. The use of such terms, and the colours, boundaries and designations used in maps do not constitute or imply any judgment, official endorsement or acceptance by the WTO Secretariat concerning the status of any territory, the delimitation of its frontiers, or sovereignty.

:

## CONTENTS

1	Introduction .....	3
2	Global trade costs.....	5
3	Sectoral trade costs.....	8
4	Economy-level trade costs .....	10
5	Trade costs by types of individuals and firms .....	12
	5.1 Household income .....	12
	5.2 Skills.....	13
	5.3 Gender.....	15
	5.4 Firm size .....	16
6	Determinants of trade costs .....	17
7	References.....	19
8	Annex 1: Methodology.....	21
	8.1 Gravity estimation.....	21
	8.2 Aggregation .....	21
	8.3 Decomposition by types of individuals and firms .....	23
	8.4 Determinants of trade costs .....	23
9	Annex 2: Comparison of our results with previous studies .....	26

## 1 INTRODUCTION

How much are overall trade costs? How have they evolved over time? How much do trade policy barriers matter in overall trade costs? Who bears most of the burden of trade costs?

Answering these questions is extremely important. Policy makers need insights on the incidence of trade policy barriers in overall trade costs to assign adequate priorities in policy debates. Understanding whether trade costs fall more on women than men, small firms than large firms or skilled than unskilled workers is essential to make progress on a more inclusive trade policy.

A key function of WTO is to provide transparency and monitor trade policy. WTO collects and shares information on a variety of trade policy measures. Trends in trade costs are typically evaluated aggregating up this information. For example, WTO provides statistics on average tariffs by country and over time as well as a timely account of the number of new non-tariff barriers countries introduced since the 2008 financial crisis. This approach is very data intensive, it does not give a sense of the degree of restrictiveness of some of these measures, nor measures how trade policy barriers compare to other trade costs, nor who bears these costs.

The objective of this research is to contribute to the transparency function of the WTO, by building a WTO Trade Cost Index. This index allows Members to monitor the evolution of global trade costs, understand what the main components of trade costs are and who faces the largest trade costs. Our approach is top down. That is, we start from an indirect estimation of overall trade frictions and we then break these down into specific trade cost components.

We infer trade costs by comparing international to domestic trade flows. Hence our measure of trade costs reflects the cost of trading internationally relative to trading domestically. This top down approach to estimate trade costs is conceptually close to the trade cost index initially proposed by Head and Ries (2001) and then elaborated in several subsequent studies.<sup>2</sup> These top-down measures of trade costs include all costs that burden foreign sales more than domestic sales: transportation costs, trade policy barriers, costs to comply with foreign regulations, communication costs, transaction costs or information costs. A great advantage of using these indirect measures of trade costs is that they allow to estimate total trade costs without the need to gather an immense amount of information. The disadvantage of such indirect approach is that the estimates of trade costs may also reflect a broader set of factors. The home bias (that is, an individual preference for goods produced at home) is a clear example of what is being captured by this overall measure of trade costs.<sup>3</sup> However, to the extent that this component does not change systematically over time, or across countries or across groups of consumers or producers, it is also clear that it is not going to affect trends. Moreover, in our analysis of the determinants of trade costs, we show that measurable demand and supply factors account for only a minor share of our estimated trade costs variation.

Our results are based on a new methodology introduced in Egger, Larch, Nigai and Yotov (2021) [ELNY]. This methodology builds a unified theory-based framework to estimate trade costs and their incidence on different economic agents. One novel contribution of this methodology is that it delivers *sector-specific* elasticities of trade flows to trade costs for *both goods and services*. This is a more realistic feature of our methodology compared to previous top down studies of trade costs that typically use the same elasticities for each sector. In fact, an agricultural product is likely to be more sensitive to an increase in trade costs than a customised manufacturing input into a production chain (factors such as, market conditions of competition, relations-specificity, homogeneous/differentiate product matter). Because of sector-specific elasticities, we estimate different patterns of trade costs across sectors than

---

<sup>2</sup> See for instance Anderson and van Wincoop (2004), Chen and Novy (2011), Novy (2013), Miroudot et al. (2013), Arvis et al. (2016).

<sup>3</sup> In general, any demand shifter, such as taste dissimilarity, or supply side determinants such as pricing strategies that vary across destination markets will be captured in top down measures of trade costs (Gervais, 2019).

previous studies. For example, as it has to be expected, we get more significant differences between services and agriculture trade costs than had trade costs been estimated with a single elasticity.

Note also that in terms of levels, our estimates of trade costs are higher than previous estimates.<sup>4</sup> This is mainly driven by our lower estimates for the elasticities used to infer trade costs from trade flows. From a methodological perspective, our estimates represent an improvement compared to the past. In fact, while previous studies borrowed figures of elasticities estimated by yet other studies, our estimates rely on a unified theory-consistent framework and are estimated on the same sample of countries and sectors as our trade costs indicators.

Second novel contribution of ELNY's methodology is that it allows the estimation of *directional* trade costs. This is also a big step toward a more realistic estimation of trade costs. It is well known that the cost of shipping a good from A to B may not be the same as shipping it from B to A. Not only tariffs to import a good may be different, but also transportation costs may vary for the same route in different directions. If a large boat is empty on its return trip, shipping prices fall in moving goods back from B to A.

Last but not least, beyond offering more realistic estimates of trade costs, directional trade costs also allow us to estimate the incidence of trade costs on different groups of consumers and producers. This is a major achievement of this work. We are the first to estimate trade costs for different income groups, by gender, firms size and skill groups comparable across a large group of countries.

In this research, we use the estimates of bilateral trade costs for 43 countries and 33 sectors between 2000 and 2018 to illustrate the evolution of global trade costs as well as to understand who faces the largest trade costs and what are their main components.

Compared to the study by ELNY, we introduce three major innovations: (i) we focus on a more recent time-period, (ii) we complement the analysis of who bears trade costs with a gender dimension, and (iii) we decompose overall trade costs into components that are relevant for policy discussions.

To deliver these new dimensions in the analysis of trade costs, we undertook a major effort in terms of data and methodological approach. ELNY methodology to estimate trade costs requires international input-output data. First, to obtain the broadest possible country coverage and extend the analysis to the most recent years, we combine the 2016 edition of the World Input Output Database (WIOD) with an experimental dataset from the Asian Development Bank. This requires translating the WIOD database from ISIC rev.4 classification to ISIC rev. 3.1. Second, in order to have disaggregated estimates of trade costs by gender, skill level and firms size, we also use the WIOD Socio Economic Accounts for data on sectoral employment and employment by skill groups, ILO data on sectoral employment by gender and OECD data on the number of firms by size. However, not all these data are yet available for the most recent years and therefore the estimates of trade costs by household income, skill group, gender and firm size cover a shorter time-period, mostly up to 2014. Third, in order to decompose overall trade costs into their determinants, we gather data on determinants of trade costs from various sources and use the most up to date methodology. We focus on measures of trade costs components that have been found pertinent in the literature and at the same time have sufficient country and year coverage.

What are our main findings?

- Global trade costs have declined by 15 per cent between 2000 and 2018.
- Trade costs for services are higher than trade costs for agricultural goods. Trade costs for manufactured goods are the lowest.
- Overall trade costs are higher for women, SMEs, and unskilled workers.

---

<sup>4</sup> See Annex 2 for a detailed comparison.

- High-income groups face higher trade costs, given their larger share of consumption in services
- Trade policy barriers and regulatory differences are estimated to account for at least 14 per cent of trade costs in all sectors. They include tariff and non-tariff barriers, regulatory differences, as well as other policies covered by trade agreements, such as a lack of investment facilitation or of intellectual property protection.
  - Trade policy barriers are relatively the most important component of trade costs for trade among low income countries.
  - Transport and travel costs together with information and transaction costs explain the largest share of trade costs between high-income economies.

What's next? This research is work in progress. The first set of results that we outline in this note refers to partial equilibrium estimations. These are the most comparable to existing studies, as they are a mere comparison of international to domestic trade costs. In a second note we will present general equilibrium trade costs. This next set of indexes takes into account that trade between two countries depends not only on their bilateral trade costs, but also on their trade costs with other countries. For instance, even if trade costs between country A and B remain unchanged, their bilateral trade may decline if their trade costs with other countries decline. This second set of trade costs will allow to capture how trade costs between two countries in a certain sector evolve relative to other countries and sectors. Future steps of our research will aim at extending the breakdown of trade costs to better capture the role of uncertainty. We will expand the coverage by country, sector and years as well explore new gender, firm and household datasets. Finally, we will explore ways in which to produce timely estimates of trade cost to account for real time update of trade measures.

## 2 GLOBAL TRADE COSTS

In order to allow a comparison of the levels of trade costs across country groups, broad sectors and over time we build trade cost indexes. A summary of the methodology to estimate these trade cost indexes and how we aggregate bilateral estimates of trade costs to global indices is presented in Annex 1: Methodology.

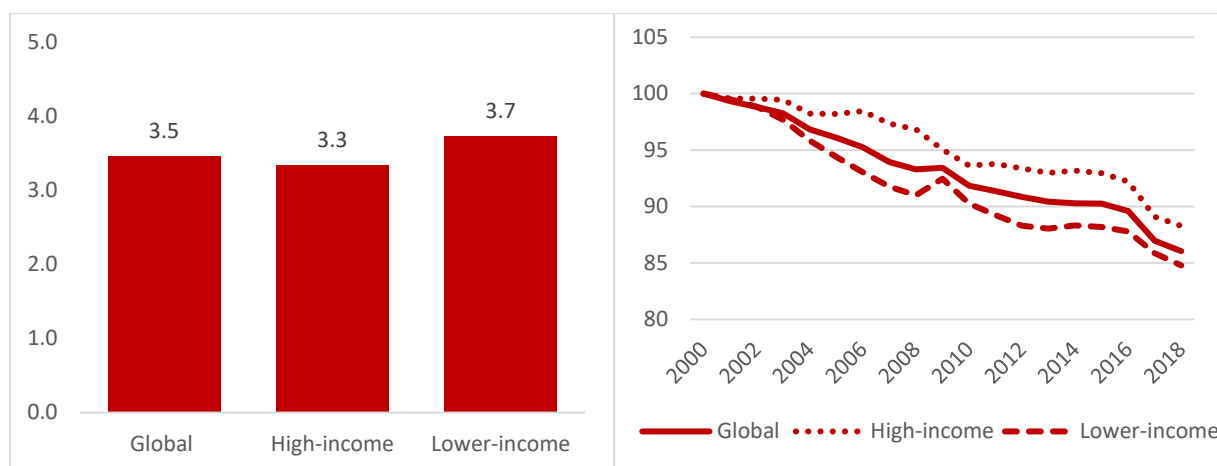
Our estimates suggest that global trade costs are around 3.5 times higher than domestic trade costs (Figure 1). They are higher for lower-income economies than for high-income economies.<sup>5</sup> Figure 1 also shows that overall trade costs have declined between 2000 and 2018. Globally, the cumulative decline was 15 per cent. While high-income economies' trade costs declined throughout the entire period, trade costs in lower-income economies saw an uptick during the Great Financial Crisis of 2008/2009. Moreover, low-income countries' trade costs declined faster than those of high-income countries before 2008, but the two series moved in parallel after 2012.

---

<sup>5</sup> Lower-income economies are those classified by the World Bank in the year 2000 as low and middle income; High-income economies are those classified as high income. In our sample, lower-income economies are represented by Brazil, Bulgaria, China, Croatia, the Czech Republic, Estonia, Hungary, India, Indonesia, Latvia, Lithuania, Korea, Malta, Mexico, Russia, Turkey, Romania, Poland and Slovakia. High-income economies are Australia, Canada, Chinese Taipei, Cyprus, EU15 countries, Japan, Norway, Slovenia, Switzerland and the United States.

**Figure 1: Global trade costs**

Levels in 2018 (left panel) and growth index, 2000=100 (right panel)

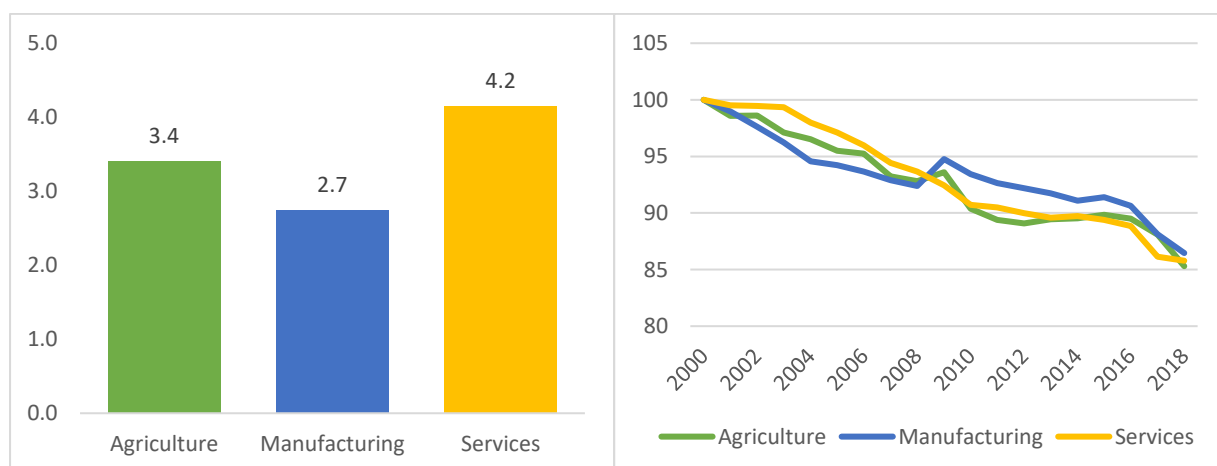


Note: The level of global trade costs can be interpreted as how many times higher are international trade costs compared to domestic trade costs. Hence, global trade costs in 2018 (3.5) correspond to an ad valorem equivalent of 250 per cent.

Breaking global trade costs down by broad sector, Figure 2 shows that they are the highest in services and the lowest in manufacturing.<sup>6</sup> Between 2000 and 2018 all three broad sectors have registered a cumulative decline in trade costs of around 15 per cent. Notably, manufacturing, and to a smaller extent agriculture, registered an increase in trade costs during the Great Financial Crisis of 2008/2009. The declining trend in trade costs in services continued during the crisis but slowed down afterwards (and this is despite the increase in trade cost that we estimate in financial intermediation services, as we will show below).

**Figure 2: Global trade costs by broad sector**

Levels in 2018 (left panel) and growth index, 2000=100 (right panel)



Note: The level of global trade cost can be interpreted as how many times higher is international trade cost compared to domestic trade cost. Hence, trade cost in services in 2018 (4.2) corresponds to an ad valorem equivalent of 320 per cent. Trade cost in manufacturing in 2018 (2.7) corresponds to an ad valorem equivalent of 170 per cent.

The ranking of trade costs in the three broad sectors is the same for lower-income and high-income economies (Figure 3). However, all costs are higher for lower-income economies' trade. In 2018, the estimated trade costs in lower-income economies were 9 per cent higher in manufacturing, 10 per cent higher in agriculture, and 16 per cent higher in services compared to high-income economies.

The overall estimated decline in trade costs was larger in lower-income economies in agriculture and manufacturing than in high-income countries. In high-income economies the cumulative decline

<sup>6</sup> The trade costs index does not capture trade in services through commercial presence (mode 3).

between 2000 and 2018 was between 10 and 14 per cent in agriculture and manufacturing, respectively. In lower-income economies, it was 18 per cent for both broad sectors.

The estimated evolution of trade costs was notably different between the two income groups during and after the Great Financial Crisis. In high-income economies, trade costs in agriculture and services continued declining throughout the crisis but their decline slowed down afterwards. Trade costs in manufacturing, on the other hand, increased during the crisis and started coming down only after 2015. In lower-income economies, all broad sectors saw an uptick in trade costs during the crisis in 2009, but they quickly returned to the pre-crisis decline. Nevertheless, the decline flattened after 2012.

**Figure 3:** Global trade costs by broad sector and income per capita level

High-income (upper panels) and lower-income economies (lower panels), levels in 2018 (left panels) and growth index, 2000=100 (right panels)



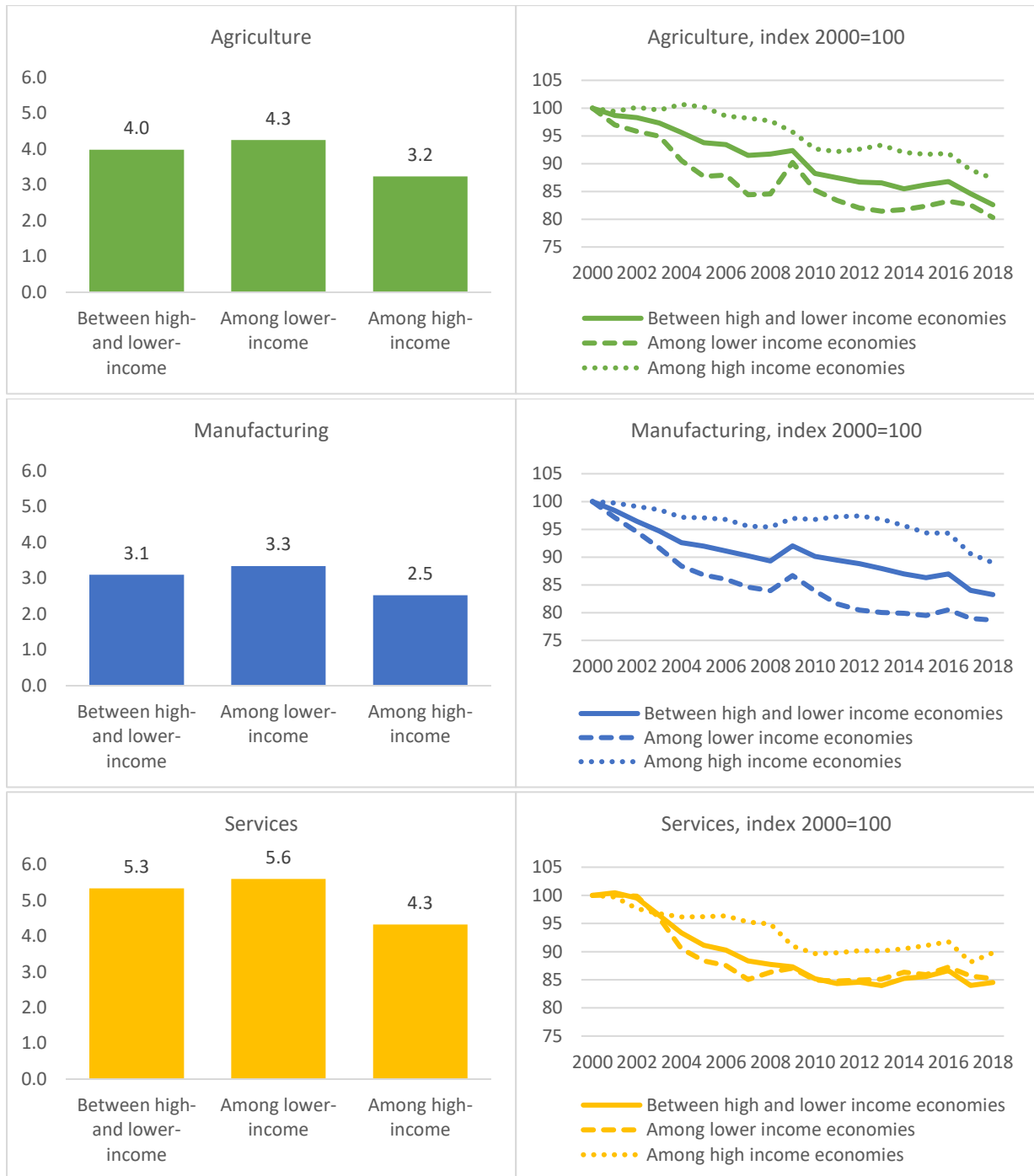
Breaking down trade costs further according to the direction of trade shows that flows among lower-income economies face the highest cost, followed by flows between lower-income and high-income economies (Figure 4). Trade flows among high-income economies face the lowest cost. In 2018, the smallest difference among these groups was in manufacturing and the largest difference in services.

The decline in trade costs has been the fastest among lower-income economies and the slowest among high-income economies, leading to convergence in trade costs in both agriculture and manufacturing. This was the case also in services until the crisis of 2009. After the crisis, the evolution of trade costs in services became similar among all the income groups.<sup>7</sup>

<sup>7</sup> Figure 3 is not directly comparable with Figure 2. This is because the latter includes the aggregate "Rest of the World" as partner while in Figure 3 this aggregate, that consists of both high-income and lower-income economies, is not considered.

**Figure 4:** Global trade costs by broad sector and direction of trade

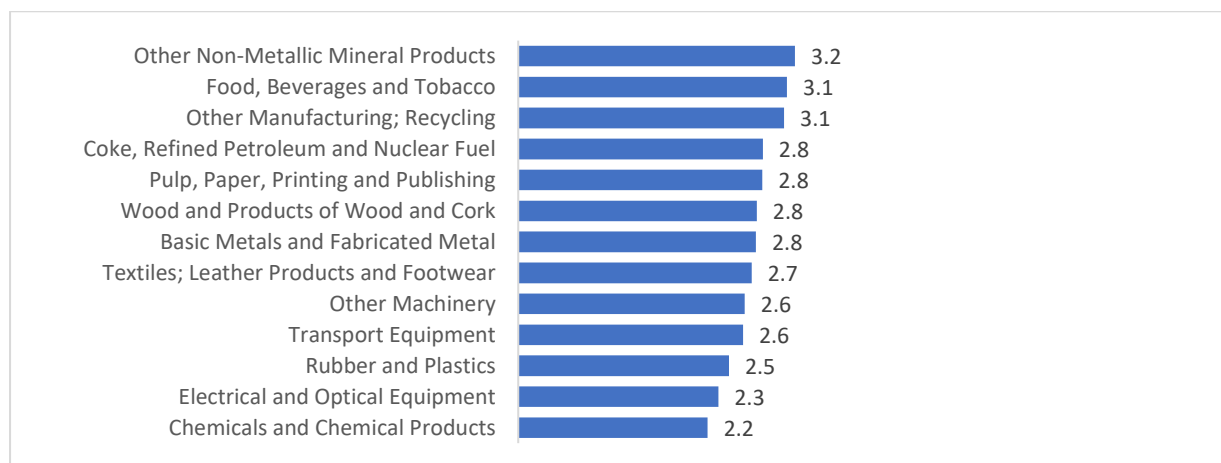
Levels in 2018 (left panels) and growth index, 2000=100 (right panels)



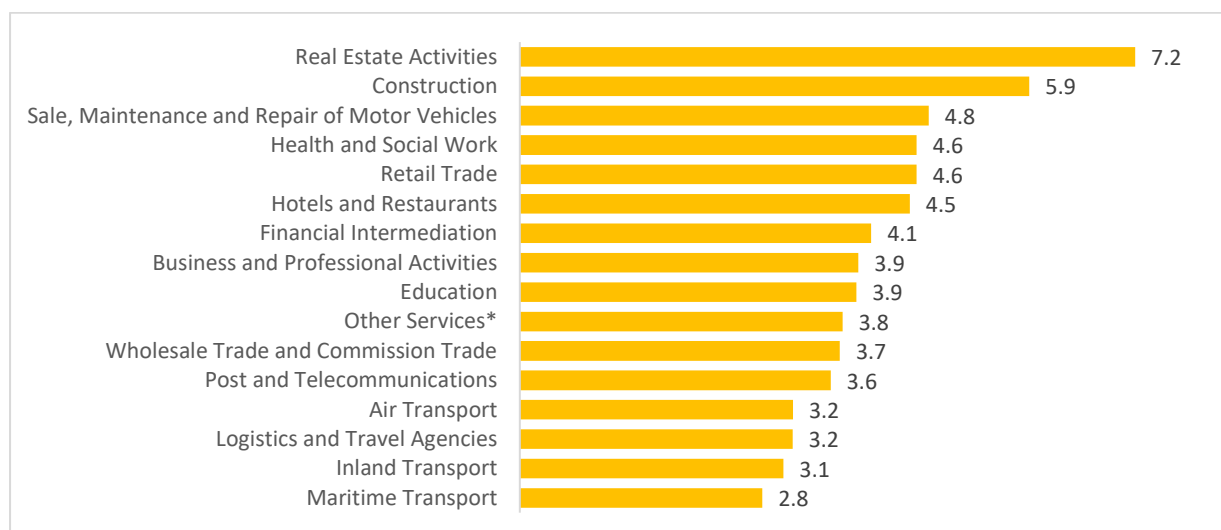
### 3 SECTORAL TRADE COSTS

Within manufacturing, we estimate the lowest trade cost sectors are Chemicals and Chemical Products, and Electrical and Optical Equipment (Figure 5). Rubber and Plastics, and Transport Equipment also face relatively low costs. Other Non-Metallic Mineral Products, and Food, Beverages and Tobacco, on the other hand, face relatively high trade costs compared to other goods.



**Figure 5: Global trade costs in manufacturing sectors in 2018**

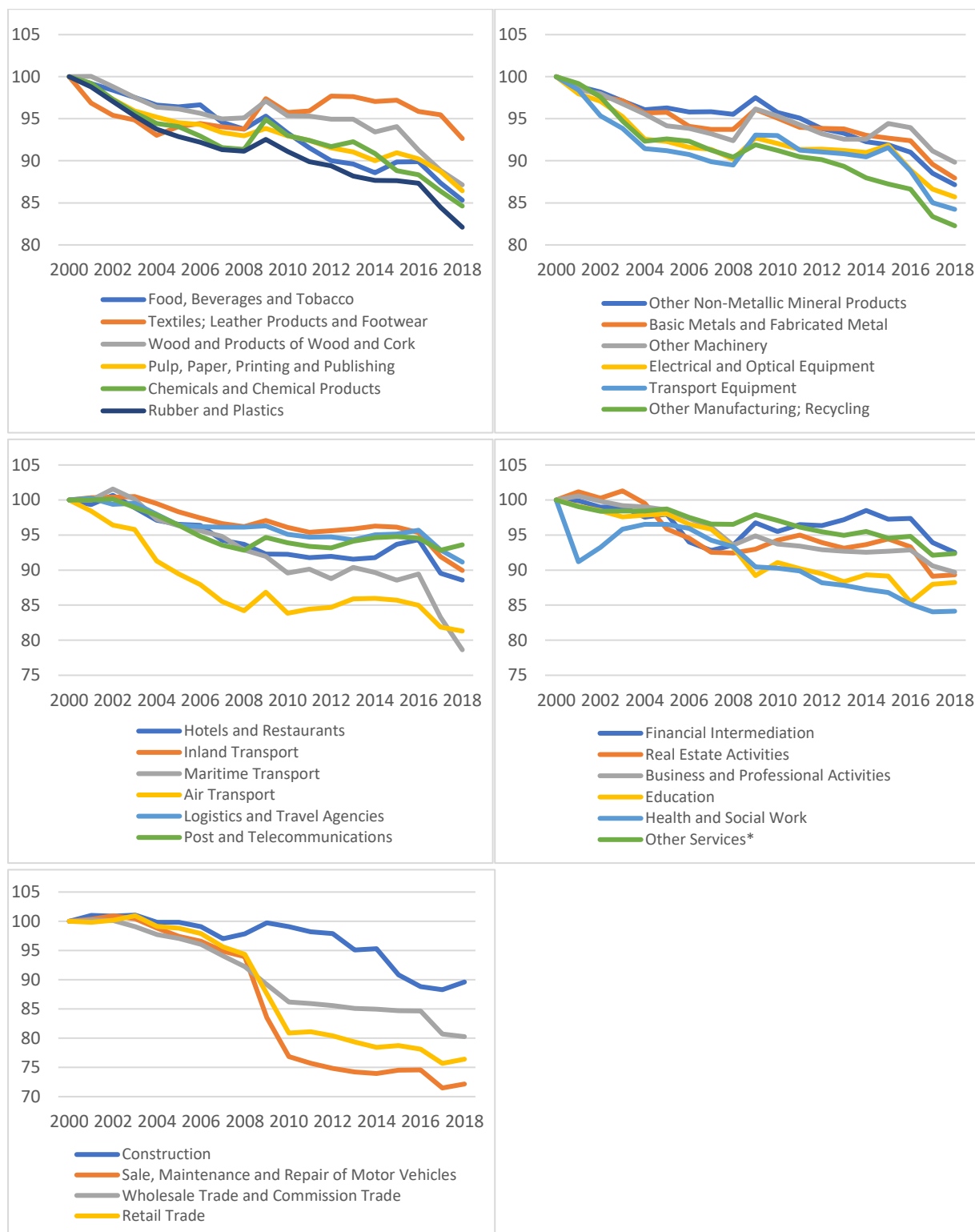
In the service sector, Transport and Logistics sectors have the lowest trade costs and are comparable with some manufacturing sectors (Figure 6). Post and Telecommunications, Wholesale Trade, and Other Services face higher trade costs, followed by Education, Business and Professional Activities, and Financial Intermediation. Finally, the highest trade costs are in Real Estate Activities, and Construction.

**Figure 6: Global trade costs in service sectors in 2018**

\*Other Services include Community, Environmental, Cultural and Personal services

Among sectors that saw a sustained decline in trade costs over the whole period was Maritime Transport, Business and Professional Activities, Other Services, and Education (Figure 7). Trade costs in Wholesale and Retail Trade sectors saw a very rapid decline between 2003 and 2010 but a flat evolution afterwards, like several other services sectors. Financial Intermediation even saw a notable increase in trade costs after the Great Financial Crisis. Trade costs in most sectors started declining again after 2016.

**Figure 7: Evolution of global trade costs by sector, 2000=100**



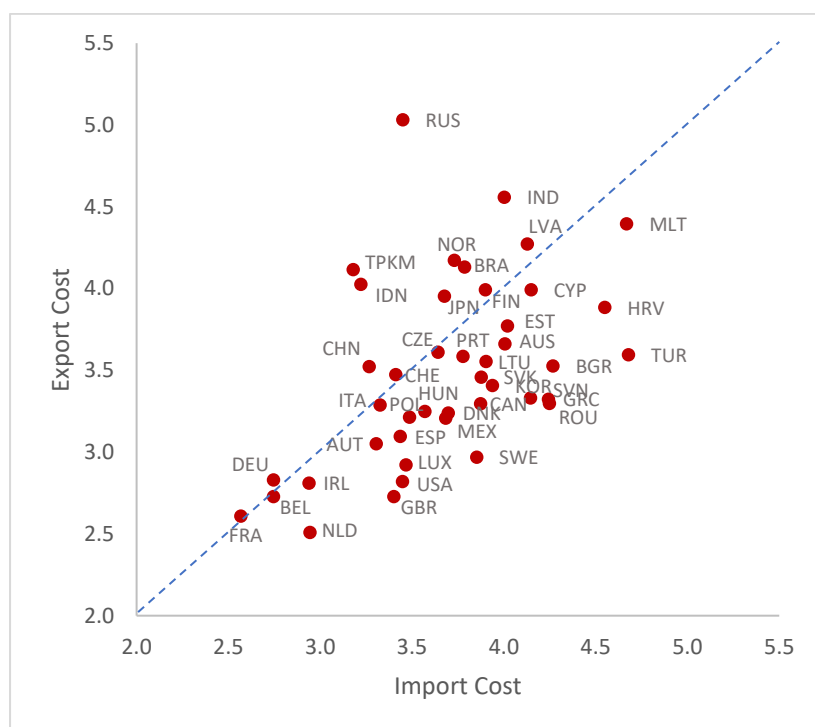
#### 4 ECONOMY-LEVEL TRADE COSTS

Countries may face different levels of trade costs for their imports and exports. While many obstacles to trade are symmetric (distance between two countries matters in the same way for their bilateral exports as it does for their bilateral imports), some, especially policy, barriers may be asymmetric. For instance, non-reciprocal preferential trade regimes may create asymmetry between import costs and export costs between LDCs and the granting economies. Moreover, there are policies that affect predominantly import costs, such as technical barriers to trade, and policies that affect predominantly

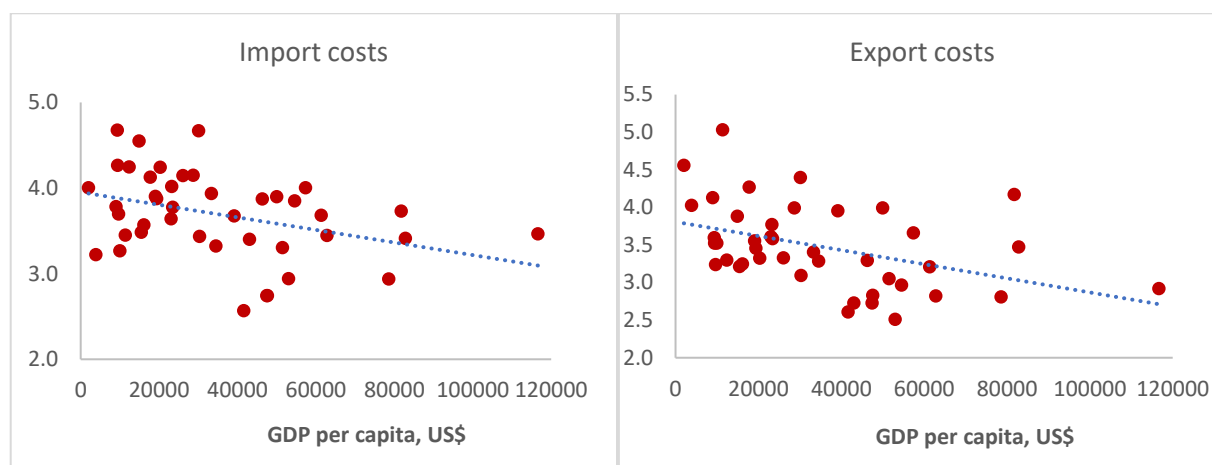
export costs, such as the access to trade finance. These factors may thus create asymmetry between a country's costs to import and its costs to export.

Figure 8 plots for each economy the export cost on the vertical axis and the import cost on the horizontal axis. The dashed line goes through points where import and export costs are the same. The figure shows that there is a strong correlation between export and import costs, suggesting that most barriers to trade are in fact symmetric. For some economies like Turkey, Romania, or Sweden, import costs are higher than export costs. For others, like Russia, India or Chinese Taipei the opposite is the case. Large EU countries, such as the Netherlands, France, Belgium and Germany are among those with the lowest trade costs as both importers and exporters.

**Figure 8:** Comparison of import and export costs

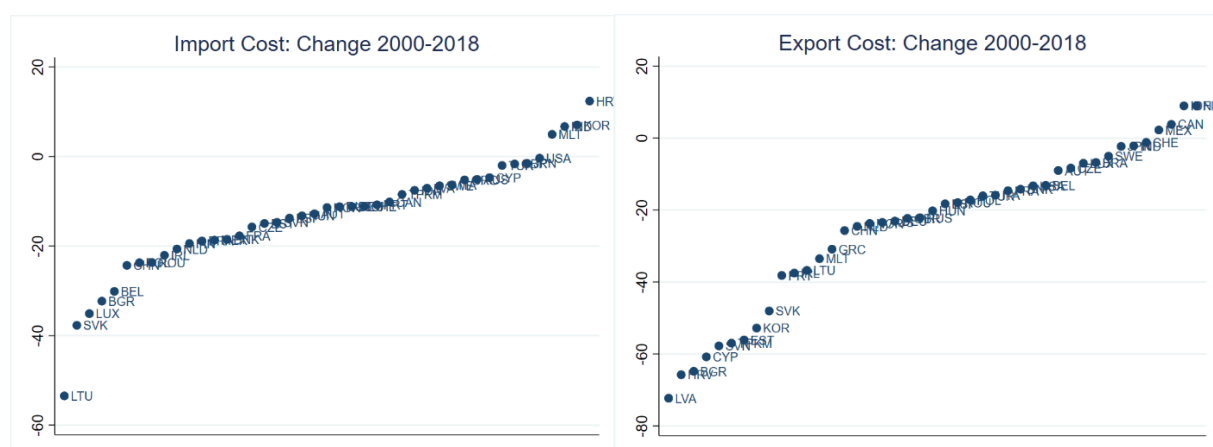


We have already shown above that, on average, lower-income countries exhibit higher trade costs than high-income countries. Figure 9 further corroborates that both import and export costs are correlated with income per capita; richer countries tend to have lower trade costs.

**Figure 9:** Trade costs are negatively correlated with income per capita

Consistent with the evolution over time of global aggregate trade costs, we also estimate that both export and import costs declined between 2000 and 2018 for most countries. On the exporter side, the most pronounced fall happened in some of the new EU Member States (Latvia, Croatia, Bulgaria, Cyprus and Slovenia). On the importer side, Lithuania, Slovakia, Luxembourg, Bulgaria and Belgium saw the largest declines.

A few countries registered an increase in trade costs between 2000 and 2018. On the exporter side it was Finland, Indonesia, Canada and Mexico. On the importer side it was Croatia, Korea, India and Malta.

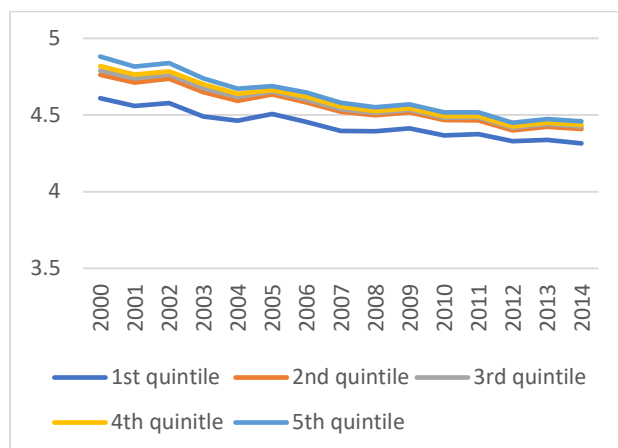
**Figure 10:** Changes in import and export costs between 2000 and 2018

## 5 TRADE COSTS BY TYPES OF INDIVIDUALS AND FIRMS

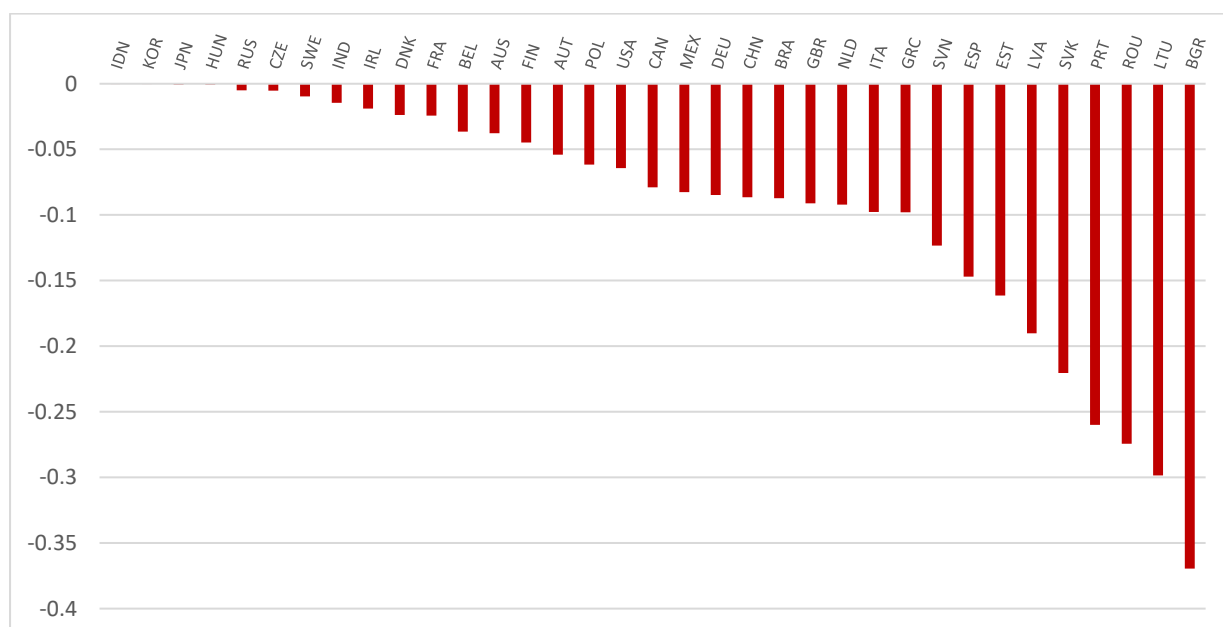
In order to estimate trade costs by income group, firm size, skill and gender, we combine economy-sector estimates of trade costs with data on economy-sector differences in consumption between different income groups and differences in labour and firm-size composition. This helps us gauge whether some groups of consumers and workers bear a larger burden of trade costs.

### 5.1 Household income

Figure 11 plots average import costs faced by households at different levels of income, showing (i) that the cost to import increases with household income and (ii) that the disparity has narrowed over time. These results can be explained by that higher-income households spend a larger share of their budget on services which in turn face higher trade costs than goods. We estimate a negative difference between average import costs faced by lowest-income and highest-income households for all economies in our sample (Figure 12).

**Figure 11:** Global import costs by household income

Note: The 1st quintile represents the 20 per cent lowest income group, the 5th quintile represents the group of households with an income above the 80% of all households.

**Figure 12:** Difference between import costs faced by the lowest-income and the highest-income households

Note: A negative difference implies that import costs for lowest-income households are lower than for highest-income households. The former is defined as being in the lowest quintile of the household income distribution, the latter is defined as being in the highest quintile.

## 5.2 Skills

Depending on the sectors where they are predominantly employed, workers with different skill-levels face different costs to export. Figure 13 shows that on average low-skill workers face lower export costs than mid- and high-skill workers.<sup>8</sup> This is because in many economies low-skill workers are predominantly employed in goods-producing sectors which exhibit lower trade costs than service sectors. However, the right panel of Figure 13 also shows that both within goods and within services, low-skill workers are employed in activities that face higher trade costs than activities where mid-skill and high-skill workers are predominantly employed.

<sup>8</sup> Skill levels in our data are defined by educational attainment. Low-skill workers have primary education, mid-skill workers have secondary education and high-skill workers have tertiary education.

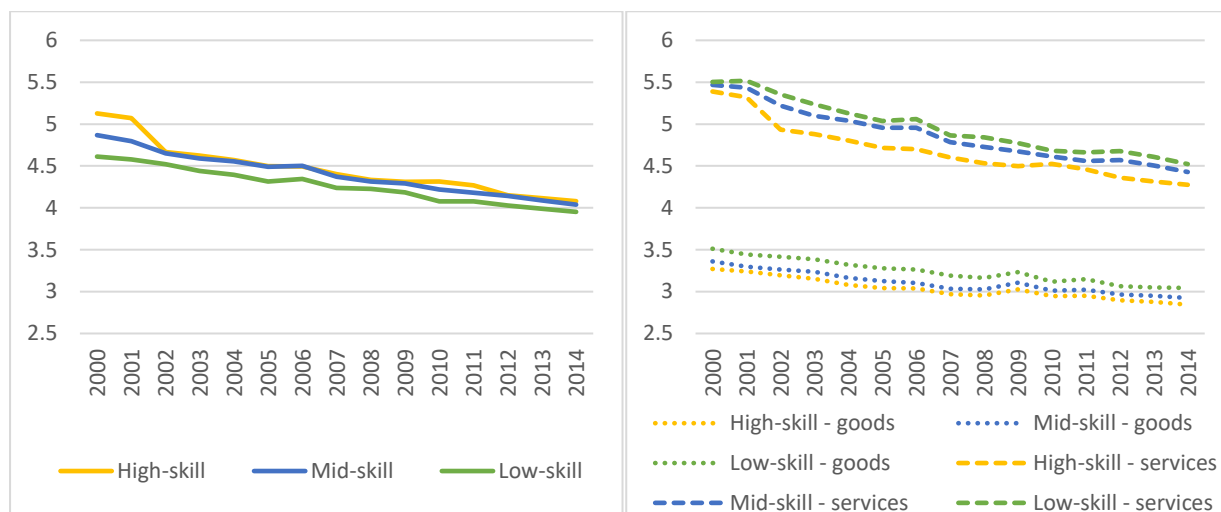
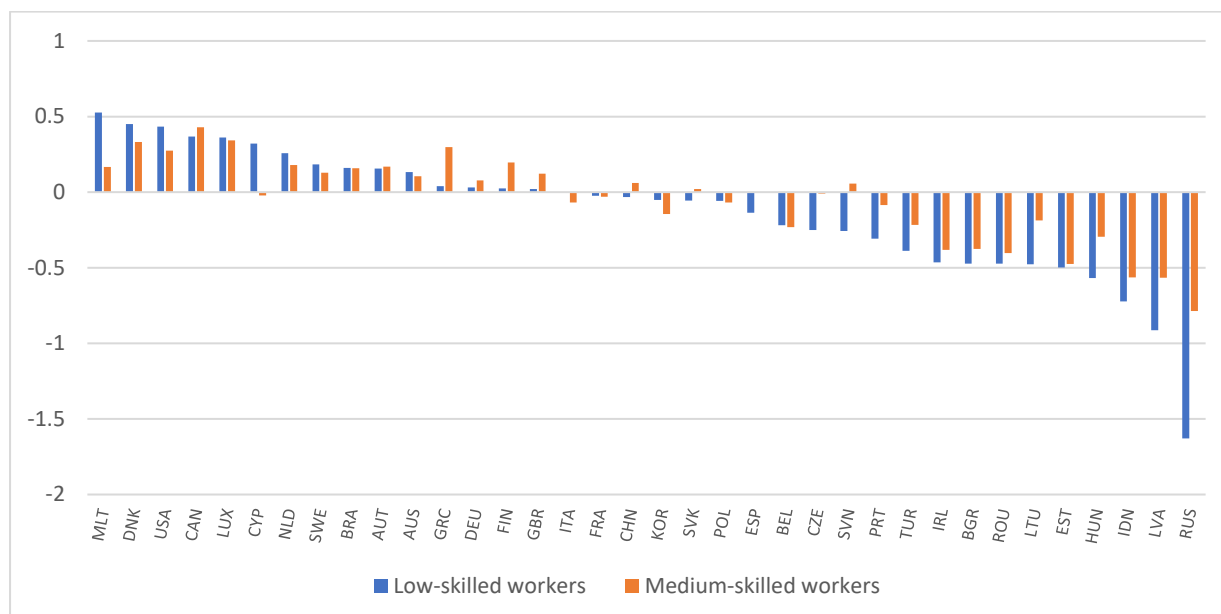
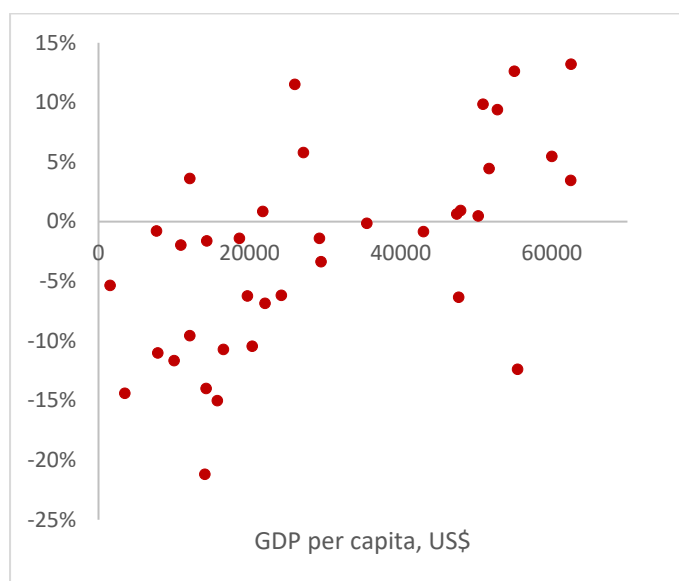
**Figure 13:** Global export costs by workers' skill level

Figure 14 shows that the average gap between export costs faced by low-skilled and high-skilled workers in fact varies across economies. Low-skill workers in high-income economies are predominantly employed in services sectors. On the other hand, low-skill workers in lower-income economies are concentrated in agriculture and manufacturing sectors. Combined with the fact that service sectors exhibit relatively larger costs, this employment pattern results in a positive correlation between the relative export costs faced by low-skill workers and per capita income level. In high-income economies, low-skill workers tend to face larger export costs than high-skill workers while in lower-income economies the opposite holds (see Figure 15).

**Figure 14:** Difference between export costs faced by low-/medium-skill and high-skill workers in total economy

Note: A positive difference implies that export costs for low-/medium-skilled workers are higher than for high-skilled workers.

**Figure 15:** Percentage difference between export costs faced by low-skill workers and high-skill workers correlates positively with economy's income per capita

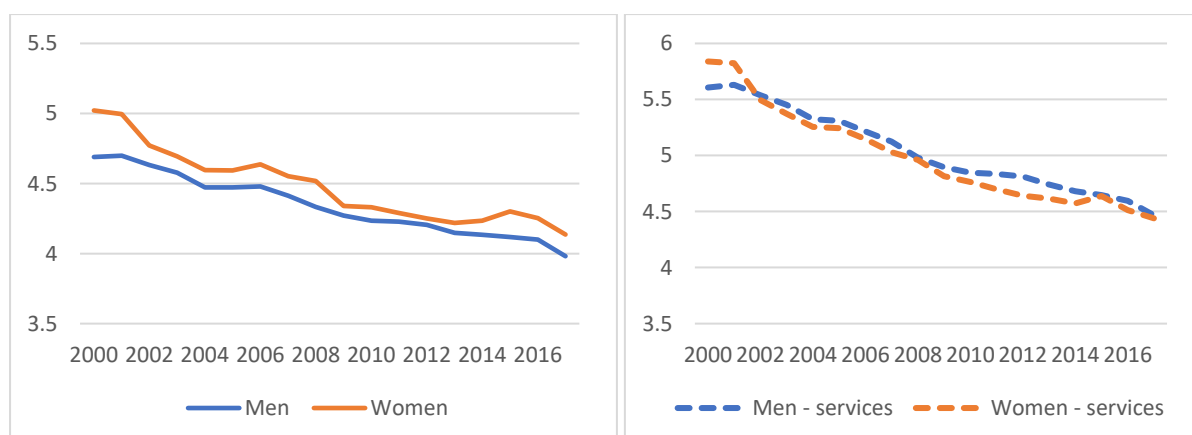


### 5.3 Gender

As with high-skill and low-skill workers, export costs differ between male and female workers because they concentrate in different sectors. Manufacturing is the largest employer for men, accounting for more than 20 per cent of male employment. It is followed by construction, and transport and logistics services that each account for around 14 per cent. For women, manufacturing, distribution services, health and social work and education each account for 12 to 17 per cent of their employment globally.<sup>9</sup>

Figure 16 shows that this employment structure results in higher export costs for women than for men. While the average disparity was narrowing until 2012, it started to grow again afterwards. This pattern is driven by trends in trade costs in the services sectors where women work. As shown in the right panel of Figure 16, services where women were predominantly employed faced in fact lower export costs, and a faster export costs decline, than services which accounted for most men's employment. However, after 2014 this trend was reversed, and the average export costs faced by women increased to the levels of costs faced by men.

**Figure 16:** Global export costs by workers' gender

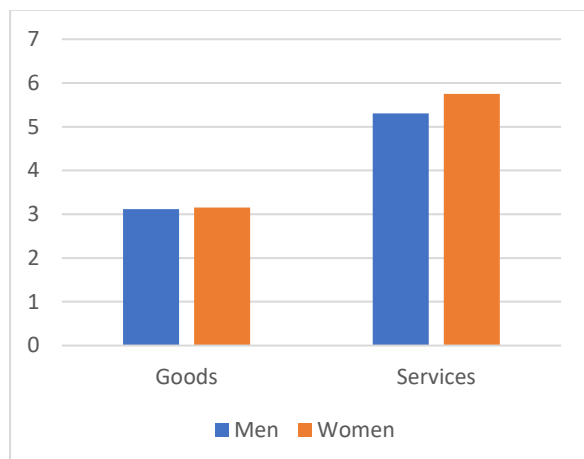


Note: Based on a sample of 31 countries for which available data covers at least 75 per cent of total employment in each year.

<sup>9</sup> Calculations based on ILO statistics on employment by sex and economic activity for 2017.

When it comes to the employment structure in manufacturing, we have information only for a cross-section of a few economies. Figure 17 shows the average percentage difference between export costs faced by women and men by broad sector in those economies. While female workers are estimated to face higher export costs than men in services, there is on average almost no difference between men and women within the manufacturing sector.

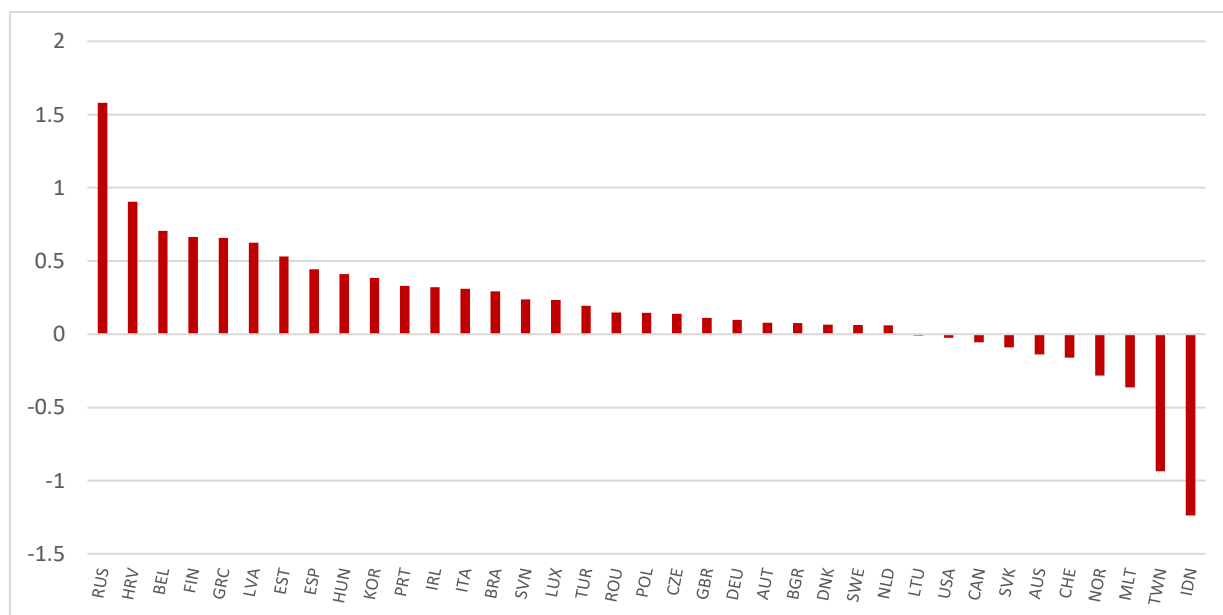
**Figure 17:** Export costs faced by women and men, by broad sector



Note: A positive difference implies that women face larger export costs than men. The estimates are an average for six economies where data on gender employment by 2-digit ISIC sector are available.

Figure 18 shows that the average difference between export costs faced by women and men also varies across economies. In more than half of our sample it is positive, while in other economies it is in fact negative.

**Figure 18:** Difference between export costs faced by women and men



Note: A positive difference implies that export costs faced by women are higher than by men.

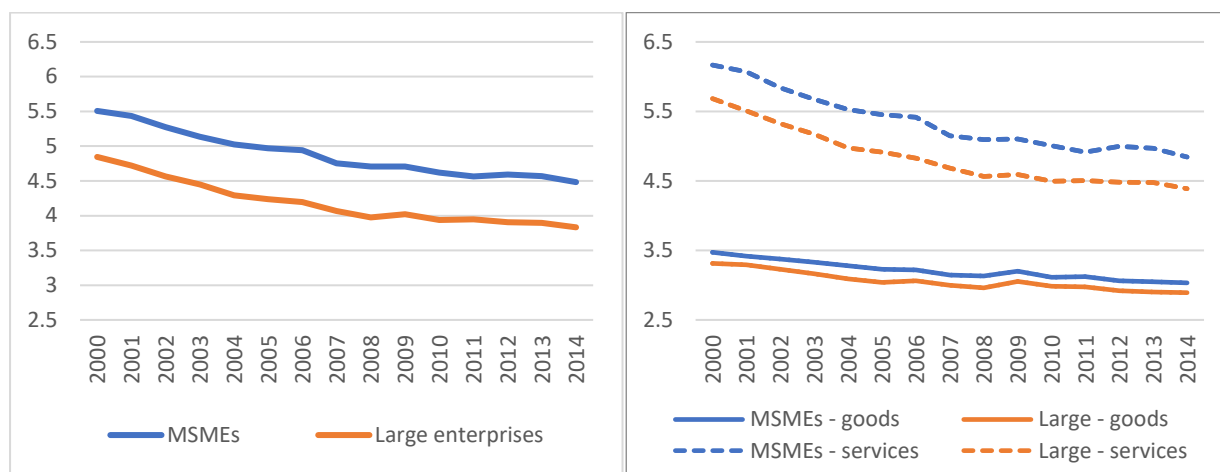
#### 5.4 Firm size

Looking at export costs by firm size, MSMEs tend to face higher average cost to export than large enterprises. In the total economy, MSMEs face on average 18 per cent higher export costs. In goods sectors the difference is just 5 per cent. The difference in export costs for different categories of firms is driven by the types of sectors where MSMEs are concentrated.

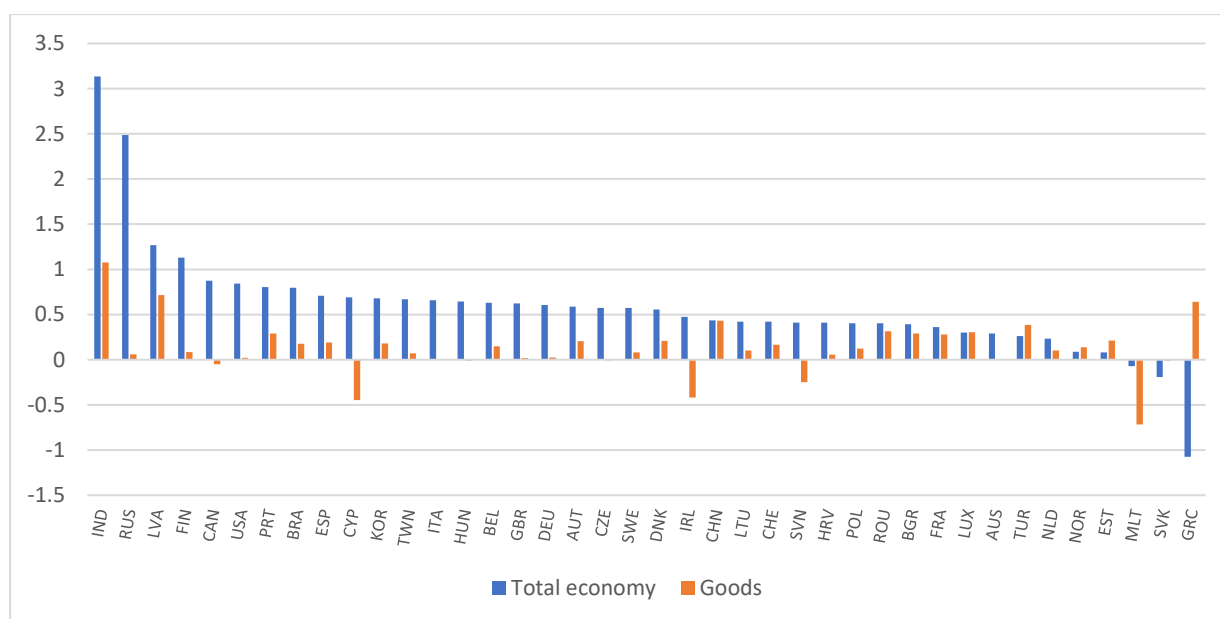


Figure 20 shows that this pattern holds in most economies but there are a few where large firms face higher average export costs than MSMEs. The pattern is also very similar when we focus only on firms in goods-producing sectors.

**Figure 19:** Global export costs by firm size



**Figure 20:** Difference between export costs faced by MSMEs and large enterprises



Note: A positive difference implies that export costs faced by MSMEs are higher than for large firms.

## 6 DETERMINANTS OF TRADE COSTS

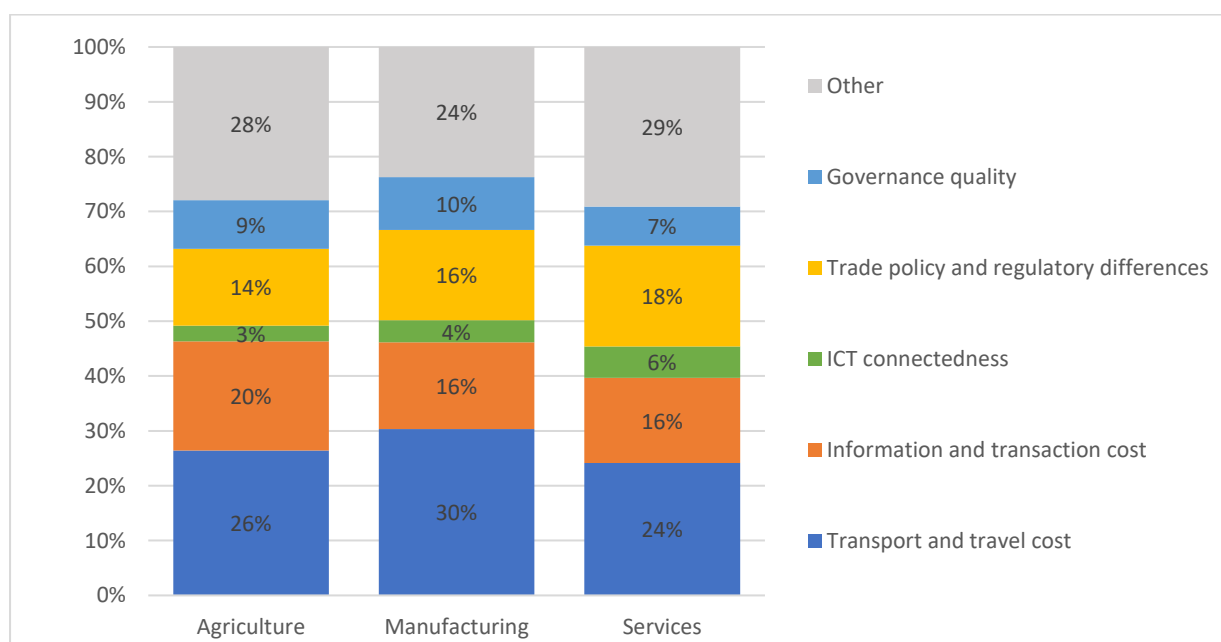
Many different factors affect the ease of international trade. Some of them are related to policies and regulations, others are driven by geography, culture or institutions. In what follows, we decompose the bilateral variation in trade costs in each sector into five main components – transport and travel cost, information and transaction cost, ICT connectedness, trade policy and regulatory differences, and governance quality.

Transport and travel costs are captured by geographical distance, being landlocked and the quality of transport infrastructure. Information and transaction costs are determined by common history, culture or language; all these factors proxy for path-dependent social and political factors that facilitate exchange. ICT connectedness is captured by broadband and mobile coverage. It affects trade costs by facilitating communication and search for foreign partners and products. In that way it plays a similar role to common language, but unlike language it is policy actionable. Trade policy and regulatory

differences are captured by applied tariffs, non-tariff measures, international economic integration through regional trade agreements and deeper agreements such as the European Union or the Eurozone. They also include the level and heterogeneity of services trade restrictiveness. Finally, measures of governance quality capture the impact of formal institutions on transaction costs of doing business with a foreign partner.

Figure 21 shows the decomposition of trade costs by broad sector. This decomposition focuses on what drives differences in trade costs across partners and provides insights into the scope for policy to change trade costs. Our observable determinants do not fully explain the variation in trade costs across partners and hence the figure also includes a category "Other" which represents this unexplained component. Future research will aim to identify additional variables that can help us explain this part of trade costs.

**Figure 21:** Determinants of global trade costs



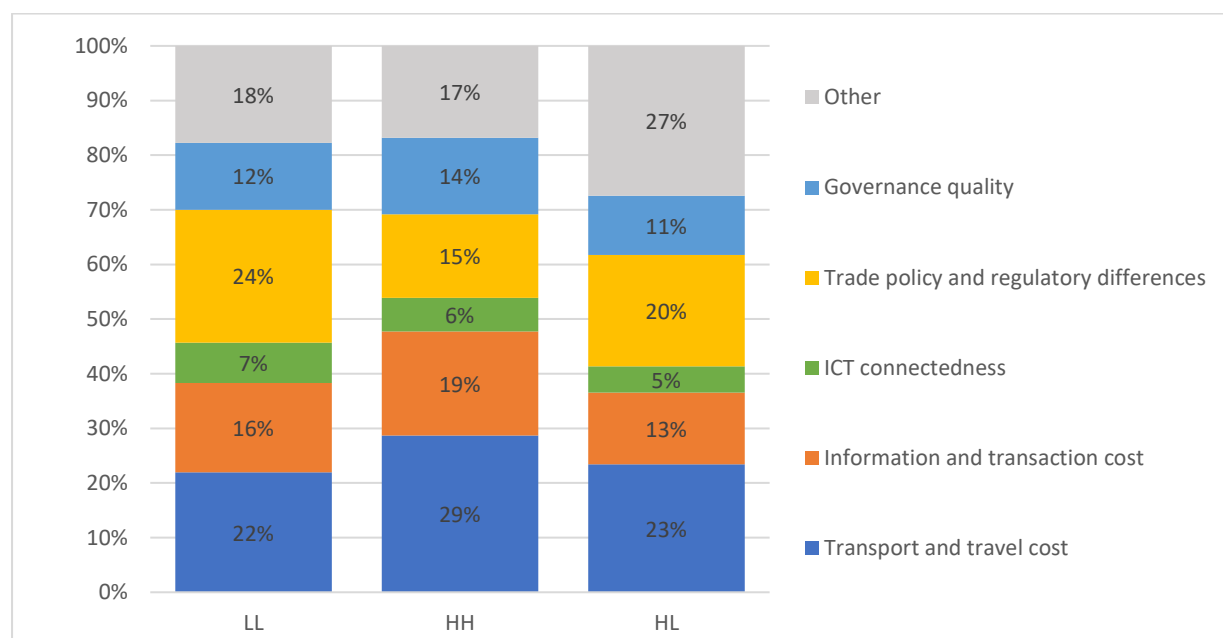
Note: This decomposition shows to what extent various factors contribute to explaining the variation in bilateral trade costs. That is, factors that explain why export costs from a country vary across importers and why import costs to a country vary across exporters. "Other" is the part of trade costs that remains unexplained by observable trade costs determinants. The underlying regressions are based on data for the year 2016. See the Annex 1 and Rubínová and Sebti (2021) for more details.

Transport and travel costs play the most important role among the determinants of trade costs. Even though they play a lesser role in the variance of trade costs in services than in goods, they still explain the largest share (24 to 30 per cent). The reason may be that many services still require face-to-face communication, and thus business travel, even when a large part is delivered cross-border. Trade policy and regulatory differences, and information and transaction costs are also important determinants. They play similar roles for trade in manufactured goods and services (16 to 18 per cent). Trade in agricultural goods is different in that information and transaction costs are estimated to have a higher importance than trade policy. Governance quality accounts for a smaller but non-negligible share of the bilateral variation in trade costs. Finally, ICT connectedness matters the most in services (6 per cent), followed by manufacturing (4 per cent) and the primary sector (3 per cent). This may point towards the importance of digital delivery for cross-border services trade.

Figure 22 presents a decomposition by direction of trade: trade between lower-income economies, trade between high-income economies, and asymmetrical trade between high-income and lower-income economies. The contributions of various factors differ markedly. Transport and travel costs can explain the largest share of trade costs variation among high-income economies and between high- and lower-income economies. For trade among lower-income economies, on the other hand, trade policy

and regulatory differences explain the largest share of trade costs. This highlights the high potential for trade policy to boost trade among developing countries. The same group of determinants also plays an important role for trade between high- and lower-income economies, even though these costs are relatively poorly explained by our observable factors. Finally, the effect of ICT connectedness on trade costs is most substantial when lower-income economies trade amongst themselves.

**Figure 22:** Determinants of global trade costs by direction of trade



Note: LL refers to trade flows between lower-income economies, HH refers to trade between high-income economies, and HL refers to flows between high-income and lower-income economies. The underlying regressions are based on data for the year 2016. See the Annex 1 and Rubínová and Sebti (2020) for more details.

## 7 REFERENCES

- Anderson, J.E. and van Wincoop, E. (2004). Trade costs. *Journal of Economic Literature* 42(3): 691-751.
- Arvis, J.-F., Duval, Y., Shepherd, B., Utoktham, Ch. and Raj, A. (2016). Trade Costs in the Developing World: 1996-2010. *World Trade Review* 15(3): 451-474.
- Chen, N. and Novy, D. (2011). Gravity, trade integration, and heterogeneity across industries. *Journal of International Economics* 85 (2011): 206-221.
- Egger, P. and Larch, M. (2008). Interdependent Preferential Trade Agreement Memberships: An Empirical Analysis. *Journal of International Economics*, 76(2):384-399.
- Egger, P. and Nigai, S. (2015). Structural gravity with dummies only: Constrained ANOVA-type estimation of gravity models. *Journal of International Economics* 97(1): 86-99.
- Egger, P., Larch, M., Nigai, S. and Yotov, Y. [ELNY] (2021). Trade Costs in the Global Economy: Measurement, Aggregation and Decomposition. ERSD Staff Working Paper no. ESRD-2021-2. World Trade Organization.
- Gervais, A. (2019). Indirect measures of trade costs: Limitations and caveats. *Economics Letters* 176: 96-102.
- Ghodsi, M., J. Grübler, O. Reiter and R. Stehrer (2017). The Evolution of Non-Tariff Measures and their Diverse Effects on Trade. WIIW Research Report, No. 419. The Vienna Institute for International Economic Studies.

Head, K. and Ries, J. (2001). Increasing returns versus national product differentiation as an explanation for the pattern of US–Canada trade. *American Economic Review* 91 (4), 858–876.

Huettner, F. and Sunder, M. (2012). Axiomatic Arguments for Decomposing Goodness of Fit According to Shapley and Owen Values. *Electronic Journal of Statistics* 6 (2012): 1293-1250.

Miroudot, S., Sauvage, J. and Shepherd, B. (2013). Measuring the cost of international trade in services. *World Trade Review* 12(4): 719-735.

Novy, D. (2013). Gravity Redux: Measuring International Trade Costs with Panel Data. *Economic Inquiry* 51 (1): 101-121.

Rubínová, S. and Sebti, M. (2021). The WTO Trade Cost Index and Its Determinants. ERSD Working Paper n.ERSD-2021-6. World Trade Organization.

## 8 ANNEX 1: METHODOLOGY

### 8.1 Gravity estimation

For each sector and year, we estimate a constrained gravity model proposed by ELNY, from which we obtain the coefficients on directional country-pair dummies ( $\widehat{a}_{ij}$ ).<sup>10</sup> Compared to ELNY we focus on a more recent time-period; we use international and domestic trade data from the 2016 edition of the World Input-Output Database (WIOD) for 2000-2014, and from an experimental dataset by the Asian Development Bank (ADB-MRIO) for 2015-2018.<sup>11</sup>

The basis for all applications is the estimated trade openness index ( $\widehat{a}_{ij}$ ) at the **exporter-importer-sector-year level**. It reflects all factors that increase sales to foreign partners relative to domestic sales. From here we do two types of analysis.

### 8.2 Aggregation

First, we estimate the evolution of global trade costs over time, by country groups, broad sectors and sectors. We also calculate the incidence of trade costs on different types of economic agents.

For these purposes we aggregate the estimated trade openness index<sup>12</sup> to a country-sector-year level using a theory-consistent weighted average. We generate three measures at the **country-sector-year level**:

1. **Export index** =  $\widehat{a}_{ij}$  averaged over all importers and weighted by the estimated importer fixed effects from the gravity model.
2. **Import index** =  $\widehat{a}_{ij}$  averaged over all exporters and weighted by the estimated exporter fixed effects from the gravity model.
3. **Trade index** =  $\sqrt{\widehat{a}_{ij} \cdot \widehat{a}_{ji}}$  averaged over all importers and weighted by the geometric average of importer's importer and exporter fixed effects.

To obtain trade costs ( $TC_i$ ) we transform these indices using a sectoral trade costs elasticity ( $\theta$ ):

$$TC_i = (\text{Trade index}_i)^{-1/\theta}$$

The parameter  $\theta$  is estimated according to the methodology introduced in ELNY. A higher  $\theta$  means a higher responsiveness of trade to trade frictions. Table 1 shows that for many services sectors  $\theta$  takes on lower values than for goods, implying that trade in services reacts less to changes in trade costs.

The use of sector-specific elasticities also means that the estimated size of trade costs differs from conventional estimates that typically use one uniform elasticity of substitution for all sectors. Figure 23 presents a comparison of global trade costs computed with our sector-specific elasticities and with a uniform elasticity (8 is a number often used in the literature). It shows that the value of trade elasticity is an important determinant of the level of estimated trade costs. On the other hand, the choice of elasticity does not have an impact on the estimated evolution over time, as shown in the right pane of Figure 23 (while the decline is more pronounced for the estimates that use sector-specific elasticities, the pattern is the same for both).

<sup>10</sup> For simplicity, we omit the subscripts for sector and year in what follows.

<sup>11</sup> WIOD 2016 data use ISIC revision 4 classification while ADB data are in ISIC revision 3.1 classification. We use a correspondence table from WIOD ([http://www.wiod.org/protected3/data16/SEA/SEA16\\_Sources.pdf](http://www.wiod.org/protected3/data16/SEA/SEA16_Sources.pdf)) to convert WIOD 2016 data to ISIC rev 3.1. with two modifications: E37-39 and J59-60 are allocated to Other Community, Environmental, Cultural and Personal Services (not to Electricity, gas and water supply and Pulp, paper, printing and publishing, respectively).

<sup>12</sup> The estimated trade openness index is trimmed at 1% and 99%.

**Table 1:** Estimated trade costs elasticities

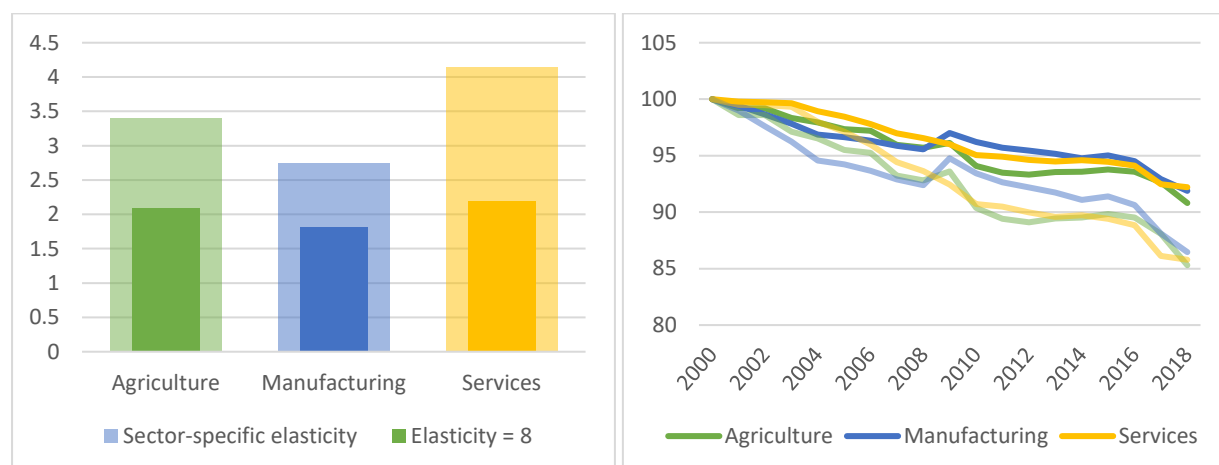
Sector	Elasticity $\theta$
Agriculture, Hunting, Forestry and Fishing	4.86
Mining and Quarrying	5.06
Food, Beverages and Tobacco	4.93
Textiles; Leather Products and Footwear	4.79
Wood and Products of Wood and Cork	4.87
Pulp, Paper, Printing and Publishing	4.89
Coke, Refined Petroleum and Nuclear Fuel	4.52
Chemicals and Chemical Products	5.09
Rubber and Plastics	4.79
Other Non-Metallic Mineral Products	4.49
Basic Metals and Fabricated Metal	4.68
Other Machinery	4.61
Electrical and Optical Equipment	4.85
Transport Equipment	4.71
Other Manufacturing; Recycling	4.59
Construction	3.91
Sale, Maintenance and Repair of Motor Vehicles and Fuel	4.18
Wholesale Trade and Commission Trade	4.37
Retail Trade; Repair of Household Goods	4.10
Hotels and Restaurants	4.39
Inland Transport	5.27
Maritime Transport	4.40
Air Transport	3.66
Logistics and Travel Agencies	5.04
Post and Telecommunications	5.30
Financial Intermediation	4.84
Real Estate Activities	4.40
Business and Professional Activities	4.42
Education	4.91
Health and Social Work	4.24
Other Community, Environmental, Cultural and Personal Services	5.01

Note: These elasticities correspond to the parameter  $\theta$  in Egger et al. (2021).

We further aggregate the country-sector trade costs measures to global, country-group, country and sector level. These aggregations use a simple average.

**Figure 23:** Global trade costs computed with a sector-specific elasticity and with a constant elasticity

Levels in 2018 (left panel) and growth index, 2000=100 (right panel)



### 8.3 Decomposition by types of individuals and firms

We follow the ELNY methodology in decomposing export costs by firm size and workers' skills and import costs by household income. That is, we use information on sectoral allocation of firms, workers and household expenditure and match this information with our estimates of sectoral trade costs. Additionally, we decompose the incidence of export costs by workers' gender. The data required for most of these decompositions are sourced from WIOD Socio-Economic Accounts and are available until 2014. The underlying data for decompositions by gender are available until 2017 (ILO statistics by sex and economic activity at the ISIC 1-digit level).

### 8.4 Determinants of trade costs

In the third part of the analysis, we investigate what drives trade costs variation across partners.<sup>13</sup> To this purpose, we regress the log of bilateral trade cost estimates in each sector on their observable determinants.<sup>14</sup> We then use the results to decompose bilateral variation in trade costs in each sector into five main categories – transport and travel cost, information and transaction cost, ICT connectedness, trade policy and regulatory differences, and governance quality. Computing the contribution of each group of variables to R-squared is not straightforward when explanatory variables are correlated (as is very likely in our case). We employ a method proposed by Huettner and Sunder (2012) that takes into account possible correlation among explanatory variables by averaging incremental R-squared over all possible orderings through which one could add variables to a specification. The resulting values provide an R-squared decomposition with some good intuitive properties.<sup>15</sup>

Our main decomposition results are based on OLS regressions with importer and exporter fixed effects run for each sector on a cross-section of 37 countries in 2016, which is the year with the maximum available observations for all explanatory variables. The decomposition results are aggregated to the broad sector level using weighted averages with weights proportional to the variance of sector's trade costs.

The use of importer and exporter fixed effects precludes identification of factors that do not vary across partners. However, we are still able to include several country-specific variables in a form that is likely

<sup>13</sup> For detailed methodology as well as additional results see Rubínová and Sebtí (2021).

<sup>14</sup> This two-step approach to the identification of partial effects of observable gravity variables on total trade costs is akin to the method proposed in Egger and Nigai (2015).

<sup>15</sup> This method has been used in a similar context by Gervais (2019).

to drive bilateral trade costs. For instance, even if my internet connection is fast, the quality of our call over the internet will be poor if your connection is slow. Hence bilateral communication costs will be determined by the minimum between the importer's and the exporter's internet connection. Furthermore, previous literature suggests that formal institutions tend to be more important for partners with very different culture, language or informal institutions. As these differences tend to increase with distance, this would imply that the impact of formal institutions on trade costs increases with distance. We find a similar amplifying effect for the role of transport infrastructure.

The estimated equation is

$$\ln(TC_{ij}) = \alpha + \beta \cdot \text{Transport and travel}_{ij} + \gamma \cdot \text{Information and transaction costs}_{ij} + \delta \cdot \text{ICT connectedness}_{ij} + \varphi \cdot \text{Trade policy and regulatory differences}_{ij} + \rho \cdot \text{Governance quality}_{ij} + v_i + \theta_j + \epsilon_{ij}.$$

### Transport and travel costs

To capture the impact of transportation and travel costs on bilateral trade frictions, the set of variables in *Transport and travel*<sub>ij</sub> includes the log of population-weighted bilateral distance, a binary variable indicating if the trading partners share a border and a binary variable indicating if either of the trading partners is landlocked.<sup>16</sup> Additionally, it includes the interaction between importer's quality of transport and trade-related infrastructure and bilateral distance, and the interaction between exporter's quality of transport and trade-related infrastructure and bilateral distance.

### Information and transaction costs

To capture the impact of information and transaction costs, the set of variables in *Information and transaction costs*<sub>ij</sub> includes having common ethnic language, having common religion, having common legal origin, previously being in a colonial relationship, previously being the same country and the log of the 1970 stock of migrants from the importing in the exporting country, and vice versa. These variables proxy for the ease of communication and the similarity of path-dependent institutions.

### ICT connectedness

*ICT connectedness*<sub>ij</sub> consists of the minimum between the exporter's and the importer's broadband coverage per capita and mobile phone subscriptions per capita. This group of variables could be considered part of information and transaction costs, but, unlike variables in the previous group, it is policy actionable and therefore we single it out.

### Trade policy and regulatory differences

To capture trade policy barriers and regulatory differences, the set of variables in *Trade policy and regulatory differences*<sub>ij</sub> includes being in a free trade agreement, being part of the European Union and being part of the Eurozone. It also includes applied bilateral tariffs, specific trade concerns raised at WTO by the exporter on sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) measures imposed by the importer as well as the OECD's Services Trade Restrictiveness Index (STRI) of the importer and its heterogeneity between the importer and the exporter.

Several components of trade policy, such as tariffs, SPS, TBT or services trade restrictiveness are sector specific. However, competitive environment and openness in service sectors such as transport, logistics and telecommunications may have an important impact on the ease of trading goods. Similarly, tariffs

---

<sup>16</sup> Data sources are listed in Table 2.



on goods may affect service sectors that are related to goods trade such as retail and wholesale trade, and transport. Therefore, we allow for cross-sectoral trade policy spillovers. That is, in the goods regressions we include the simple average of the STRI variables across all service sectors. In the services regressions we include the average bilateral applied tariff, SPS and TBT.

### Governance quality

*Governance quality<sub>ij</sub>* includes differences in the control of corruption between the importer and the exporter, as well as the interaction of its level with distance for both the importer and the exporter.

Finally, it is possible that part of our estimated trade costs reflects determinants of bilateral trade flows other than trade frictions per se. For instance, countries with similar preferences are more likely to trade with each other. Differences in factor endowments may also drive bilateral trade in certain sectors. To address this concern, we include in our estimation a measure of income per capita differences and differences in human capital (tertiary education). We partial out the variation accounted for by these determinants and do not include them in the decomposition.<sup>17</sup>

**Table 2: Data sources**

Variables	Source
Population-weighted distance, having common border, being landlocked, having common ethnic language, having common religion, having common legal origin, previously being in a colonial relationship, previously being the same country	Centre d'études prospectives et d'informations internationales (CEPII)
Quality of transport and trade-related infrastructure	World Bank, World Development Indicators
Bilateral stock of migrants in 1970	World Bank, Global Bilateral Migration Database
Broadband coverage per capita and mobile phone subscriptions per capita	International Telecommunications Union
Having a regional trade agreement, being part of the European Union and having common currency	Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008), 2018 update
Services Trade Restrictiveness Index (STRI) and STRI heterogeneity	Organization for Economic Cooperation and Development (OECD)
Applied bilateral tariffs	World Integrated Trade Solution (WITS)
SPS and TBT specific trade concerns	World Trade Organization, Integrated Trade Intelligence Portal (I-TIP) and WIIW, <a href="https://wiiw.ac.at/wiiw-ntm-data-ds-2.html">https://wiiw.ac.at/wiiw-ntm-data-ds-2.html</a> <sup>18</sup>
Control of corruption	World Bank, Worldwide Governance Indicators (WGI)

<sup>17</sup> It is important to include these variables in the regression. This is because they are likely to be correlated with some of the other explanatory variables. For instance, the differences in GDP per capita are correlated with differences in governance quality.

<sup>18</sup> See Ghodsi et al. (2017) for details on the WIIW database.

## 9 ANNEX 2: COMPARISON OF OUR RESULTS WITH PREVIOUS STUDIES

There are two studies that are methodologically close to ours. Miroudot et al. (2013) and Arvis et al. (2016) calculate overall trade costs from trade flows following the trade cost index proposed in Head and Ries (2001).

Several of the trends we estimate are supported by previous studies. For example, Miroudot et al. (2013) calculate trade costs for 61 countries 17 goods sectors and 12 services sectors between 1995 and 2007. They find that global trade costs in 2000 were close to two times higher for services than for goods. Our estimates also suggest higher trade costs for services than for goods, even if this ratio is somewhat smaller (1.5 between services and manufactured goods).

Miroudot et al. (2013) estimate that between 2000 and 2007 global trade costs declined by around 6.5 per cent in goods and increased by around 2 per cent in services. This is very close to our results for goods (around 7 per cent) but quite different from our estimates for services where we find a decline of around 5.5 per cent. This difference appears to be driven by different trends in construction services only.

Arvis et al. (2016) calculate trade costs for 167 countries in manufactured and agricultural goods between 1996 and 2010. In the following table we present a comparison between our estimates and theirs for 2010, in terms of tariff equivalents. The first line of each bloc presents the results from Arvis et al. (2016), the second line present our estimates if we use the same elasticity as them, and the third line presents our baseline results that use our estimated elasticities. Our lower-income category roughly corresponds to their upper-middle income category.

**Table 3:** Comparison of trade costs with results from Arvis et al. (2016)

	Agriculture	Manufacturing
High-income		
Arvis et al.	143	82
Elasticity = 8	113	86
Our elasticity	248	187
Lower-income		
Arvis et al.	167	98
Elasticity = 8	125	95
Our elasticity	281	212

The table shows that the main difference between our results and Arvis et al. (2016) stems from the use of different sectoral elasticities. Our estimates of trade costs for manufactured goods are very similar to Arvis et al. (2016) when we use the same elasticity as they do.<sup>19</sup>

Arvis et al. (2016) also find that between 2000 and 2010 trade costs for manufactured goods declined by around 11 per cent in lower-income economies and by around 5 per cent in high-income economies. This is entirely consistent with our results that suggest also an 11 per cent decline for lower-income economies and a somewhat lower decline of 2.5 per cent for high-income economies.

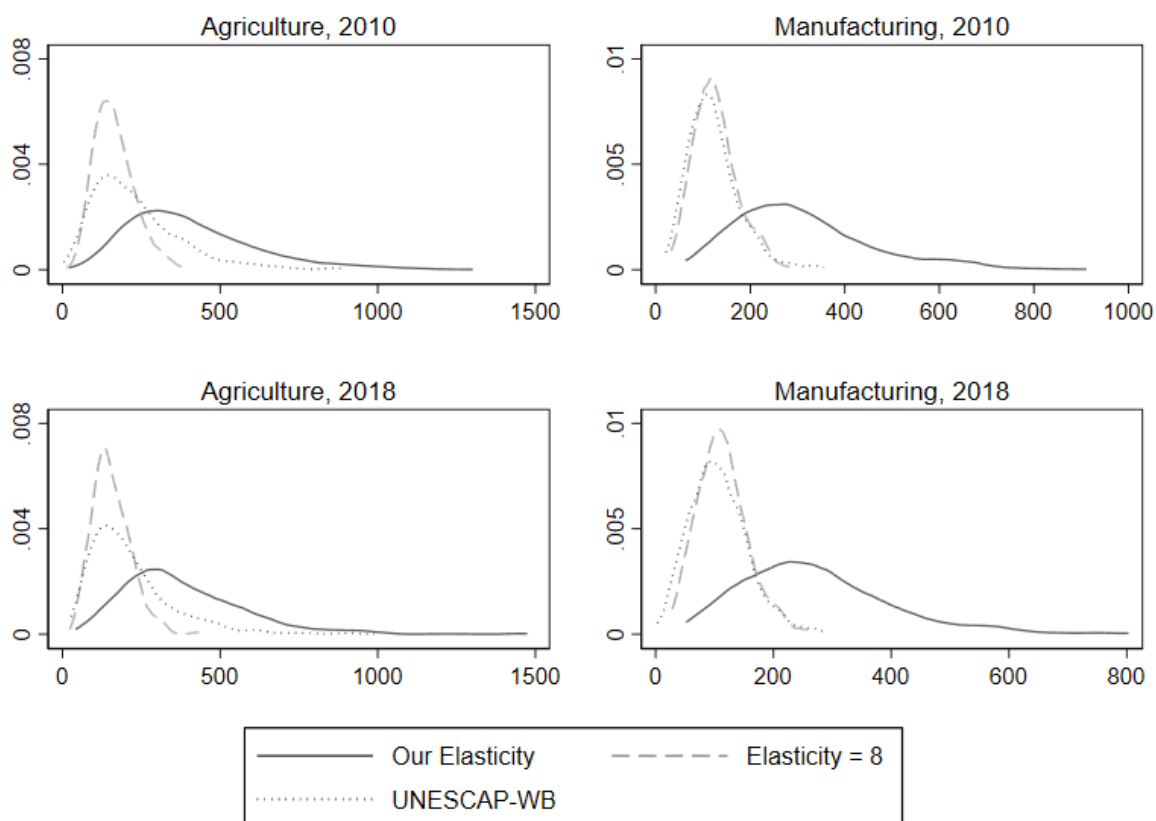
A similar conclusion can be drawn from the most recent UNESCAP-World Bank database (2020) -an update of Arvis et al. (2016). The new release provides trade cost estimates for the agriculture and manufacturing sector of around 180 economies at the bilateral level between 1995 and 2018.<sup>20</sup> Figure

<sup>19</sup> Anderson and van Wincoop (2004) combine information on direct trade costs and estimates from the literature to suggest that international trade costs for goods are equivalent to 74 per cent tariff in high-income economies.

<sup>20</sup> See <https://www.unescap.org/resources/escap-world-bank-trade-cost-database>.

24 shows Kernel density plots for the bilateral trade costs in the UNESCAP-World Bank trade cost database, our estimates based on an elasticity of 8 as well as our trade cost estimates based on our estimated elasticities. In order to ensure a valid comparison of the data, we only keep country pairs which are available in both datasets.

**Figure 244:** Comparison of symmetric bilateral trade costs with the UNESCAP-World Bank trade cost database



In line with Table 3, Figure 24 shows that trade costs of the UNESCAP-World Bank trade cost database largely coincide with our computation of trade costs when an elasticity of 8 is used (see dashed and dotted lines). Regarding the distribution of trade costs based on our elasticity, a glance at the solid line shows that trade costs based on our elasticities cover a wider range. While a majority of trade partners face tariff equivalents of trade costs between 200 and 500 in the agriculture sector as well as between 150 and 400 in the manufacturing sector, there exist some individual cases in which trade partners face a tariff equivalent of more than 1000.<sup>21</sup>

Finally, our work on the decomposition of overall trade costs into their drivers is comparable to Chen and Novy (2011). These authors estimate that 9 per cent of variation in trade costs is attributable to geography and transport costs while 5 per cent is driven by policy-related factors. Their study focuses on manufactured goods in 11 EU countries between 1999 and 2003. In our estimates transport and travel costs account for close to 30 per cent and trade policy-related factors for around 15 per cent. The absolute numbers are not readily comparable, but it is reassuring that the relative contributions are similar.

<sup>21</sup> Regarding the agriculture sector in 2018, the following trade partners faced symmetric bilateral trade costs above 1000: Brazil-Luxemburg, Cyprus-Indonesia, Estonia-Indonesia, Brazil-Lithuania, India-Luxemburg and Cyprus-Mexico.