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The Impact of Services Trade Restrictiveness on Trade Flows

FIRST ESTIMATES

Hildegunn Kyvik Nordås,

Dorothée Rouzet



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Abstract

THE IMPACT OF SERVICES TRADE RESTRICTIVENESS ON TRADE FLOWS: FIRST ESTIMATES

by

Hildegunn Kyvik Nordås and Dorothée Rouzet, OECD Trade and Agriculture

This paper uses newly released OECD data on services trade restrictions (STRI) to analyse the relationship between services trade restrictions, cross-border trade in services and trade in downstream manufactured goods. A standard gravity model is enhanced by the STRI indices in a cross-section regression analysis. Services trade restrictions are negatively associated with both imports and exports of services. The surprisingly strong effect on services exports is probably explained by a negative relationship between the STRIs and sector performance indices. Consequently, services suppliers are less competitive abroad. A negative relationship is also found between the STRI indices and exports, imports and intra-industry trade in manufactured goods. The statistical significance and the elasticities vary across services and goods sectors in ways that intuitively make sense.

Keywords: Trade in services, services trade restrictions, regulatory spillovers

JEL classification: F13, F14, F68

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Executive summary

This paper provides a first analysis of the impact of services trade restrictiveness as measured by the STRIs on cross-border trade in services. It also takes a first stab at estimating regulatory spillovers from services to manufacturing. Highlights from this analysis were published in the STRI Policy Note on the OECD STRI website. The purpose of this paper is to provide the technical details behind the policy note for interested readers.

But first the STRIs are related to some readily available data on different aspects of how services markets perform. We show that countries with more restrictions in telecoms tend to have fewer telephone lines and internet subscribers. For example, a five basis points lower STRI index, for instance from 0.22 to 0.17, is associated with 5 more internet subscribers per 100 people.

In financial services, countries with less trade-restrictive regulations in the banking and insurance sectors have more developed credit markets and higher penetration rates for life and non-life insurance. For instance, domestic bank credit to the private sector as a share of gross domestic product (GDP) is more than twice as high in low STRI countries than in high STRI countries. High STRI indices in banking and insurance are also associated with lower efficiency in the provision of financial services as evidenced by higher ratios of operating expenses to income.

By the same token, a higher STRI index for maritime and road transport is associated with longer time for a container to make the domestic leg of an export or import journey. The difference between countries with a low score and those with a high score on the STRI for road transport is equivalent to a tariff rate between 5 and 17%, depending on the product transported.

The paper goes on to analyse the impact of services trade restrictions on trade in services using the gravity model. Cross-border services trade data are available for 12 of the 18 sectors covered by the STRI. These are computer services, construction, accounting, legal services, telecoms, transport (air, maritime, road and rail), courier services, commercial banking and insurance.

Starting from a broad approach analysing all these services sectors together, we find that more restrictive countries clearly import less services. The finding survives all robustness checks. Interestingly, we also find that more restrictive countries export less services. Again the finding passes all robustness checks. Moreover, the detrimental impact of services trade restrictions on services exports is about twice as large as for imports. We attribute this finding to the fact that services trade restrictions are mainly behind the border and affect the competitiveness of local firms as well. As noted, the STRIs are indeed related to the performance of local telecoms, finance and transport services.

Sector-by-sector analysis produced robust results in air and maritime transport services, accounting, legal services, insurance, commercial banking and computer services. The largest impact of restrictions on services trade is found for commercial banking and insurance. For example, a modest reform bringing down the STRI index by five basis points is associated

with about 5% higher imports and 9% more exports in banking services. A similar reform in the insurance sector would raise imports by about 2.5% and exports by more than 5%.

Services are essential for global supply chains, connecting the links in the chain as well as providing inputs in the manufacturing process. The paper finds that trade restrictions in computer services, distribution services, telecoms, transport services, courier services, commercial banking and insurance services have a negative effect on trade in manufactured goods.

Restrictions in telecoms and maritime transport affect almost all manufacturing sectors' exports, imports and intra-industry trade. Air transport and courier services affect products that are particularly sensitive to lead time, while restrictions in banking and insurance services have a relatively large impact on exports and intra-industry trade in motor vehicles, non-durable consumer goods and electronics.

These first estimates show beyond reasonable doubt that the STRIs capture important restrictions on trade in services. Moreover, they also appear to capture sector-specific variation in trade restrictiveness well. This can be gauged from the fact that the individual indices have very different effects on trade in goods and the differences make intuitive sense.

The STRI database reveals few explicit restrictions on cross-border trade in most sectors, with the exception of transport and finance. Rather, the index reflects restrictions on movement of people and on commercial presence. It is therefore not surprising that the most robust relationship between the STRI and cross-border trade are found in the services sectors that lend themselves more easily to cross-border trade. Going forward, the analysis can be extended and deepened as more information on services trade through all modes of supply becomes available.

Introduction

Services account for about 75% of GDP, 80% of employment and two thirds of foreign direct investment (FDI) inflows in OECD countries. Competitive services sectors are an engine of job creation and an enabling condition for manufacturing growth. Yet, while the impact of tariffs and non-tariff measures on manufacturing trade has been extensively studied, little is known about the costs of barriers to trade in services. Impediments to the entry and operations of foreign services providers are likely to hinder competition and hold back efficiency gains in the targeted sectors, but also to raise costs for downstream sectors using services as key inputs. As a third of the value added in goods exports is now services value-added, access to cost-effective world-class services is needed to maintain and improve the competitiveness of firms throughout the economy.

Until recently, the main hurdle to such analysis has been a dearth of data on services trade restrictions. Most regulations impeding the free flow of trade and investment in services are of a "behind the border" nature. For instance, discriminatory licensing conditions applying to foreign investors, the recognition of qualifications earned abroad, or unnecessary red tape are prominent hindrances to services trade, but their identification often requires a comprehensive understanding of each country's laws. The nature of trade restrictions in services therefore makes them more difficult to record in a consistent and comparable manner across countries than when dealing with tariffs and other costs imposed on goods imports at the border. Quantifying their impact is an even more challenging task, which cannot be undertaken without reliable and consistent data on the relevant laws and regulations.[1]

In May 2014, the OECD released the Services Trade Restrictiveness Index (STRI), which provides a comprehensive regulatory database on measures affecting trade in 18 services sectors and 40 countries as of end-2013.[2] For each sector, it covers five policy areas: restrictions on foreign entry, restrictions to the movement of people, other discriminatory measures, barriers to competition and regulatory transparency. The information was collected by looking into each country's laws and regulations currently in force and identifying the relevant restrictions. It was then verified and peer-reviewed by government officials of OECD countries. The qualitative information has been converted into quantitative indices by sector, ranging from zero to one (where 0 is the absence of any restriction, and 1 is a completely closed sector).[3] This newly available, high-quality data opens the way for evidence-based analysis of the economic costs of impediments to trade in services.

Several previous studies, rather than starting from observed trade restrictions to assess their impact, have proceeded to infer the magnitude of trade costs from observed patterns of trade in services compared to a free trade benchmark (e.g. Gervais and Jensen, 2013; Miroudot et al., 2013; Fontagné et al., 2011; Guillin, 2013; Anderson et al., 2013). This

1. A few previous attempts have been made at creating internationally comparable indices on services trade restrictions, but with limited country and sector coverage, and/or based on less reliable survey methods or on GATS commitments rather than current legal texts. A recent World Bank project offers services trade restrictiveness indices for a large number of countries in some of the sectors covered by the OECD STRI. See http://iresearch.worldbank.org/ServiceTrade/aboutData.htm

2. Sectors: computer services, construction, telecommunications, legal services, accounting, architecture, engineering, distribution, motion pictures, broadcasting, sound recording, air transport, maritime transport, road transport, rail transport, courier services, insurance, commercial banking. Countries: all 34 OECD Members, Brazil, People's Republic of China, India, Indonesia, the Russian Federation and South Africa.

3. For more information on the scoring methodology, see: www.oecd.org/tad/services-trade/STRI_scoring_methodology.pdf.

indirect approach reveals that trade costs in services are large and overall significantly higher than in goods. However by design, such methods cannot distinguish between natural barriers – such as cultural and geographical differences – and policy-induced barriers, or relate the estimated costs to specific restrictions and actionable policies. Other papers have used indices limited to a few measures and a few sectors and try to assess their impact through general equilibrium modelling (e.g. Dee et al, 2003) or econometric analysis (e.g. Walsh, 2006; Fontagné and Mitaritonna, 2013).

We draw on a gravity model to assess more directly the impact of regulatory barriers to trade in services as measured by the sector-level STRI indices. Although the gravity equation was developed for goods trade, a small body of literature has applied it to services and has found it to provide a good fit to trade in services (Kimura and Lee, 2006; Head et al., 2009). A few studies have assessed the impact of domestic regulation and regulatory heterogeneity on services trade in a gravity framework using the OECD Product Market Regulation index (Kox and Lejour, 2005; Kox and Nordås, 2007; Schwellnus, 2007) and the World Bank's services trade restrictions database (van der Marel and Shepherd, 2013). Marti et al. (2014) also apply a gravity model to gauge the impact on trade flows of an index capturing the "trade-friendliness" of the importer and the exporter's policies, but they focus on trade facilitation using the World Bank's Logistics Performance Index. Using the OECD STRI enables us to improve on existing estimates by considering a more accurate and comprehensive measure of restrictions to trade in a wider range of services sectors.

Our first results highlight the large potential costs of regulations that restrict trade and investment in services. In a majority of services sectors, a higher STRI index is associated with lower imports, indicating that the costs for foreign suppliers of entering and serving the host market are raised by trade-restrictive regulations as expected. Interestingly, we uncover an even stronger relationship between a higher STRI score and lower exports in computer services, legal services, air transport, maritime transport, commercial banking and insurance. This second finding emphasises the importance of having an open and pro-competitive regulatory regime to strengthen the international competitiveness of service exporters.

Competitive services sectors matter beyond services providers' ability to gain market share at home and abroad. As many services are essential inputs into the production of a wide range of traded goods, the efficiency of services sectors feeds into the competitiveness of domestic exporters in other sectors as well. We show that services trade restrictions in the transport sectors, courier services, telecoms, distribution services, computer services and financial services are associated with less trade in manufactured goods. Exports of parts and components as well as non-durable consumer goods are particularly sensitive to restrictions in all these services sectors.

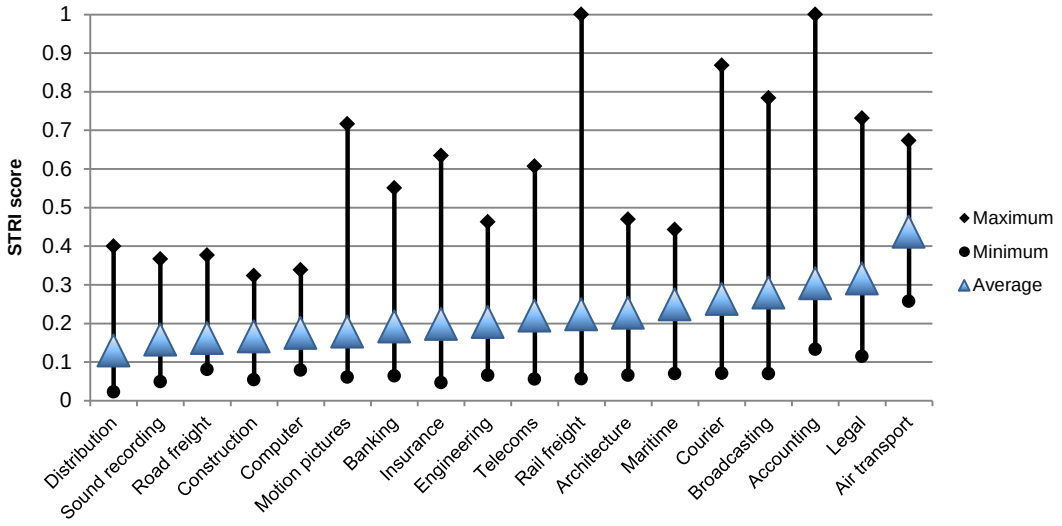
Furthermore, we find indications that a country's ability to trade in differentiated goods is negatively associated with services trade restrictions in transport, courier, finance, telecoms and computer services. Finally we find that trade restrictions in the distribution sector are associated with higher import prices on consumer goods. This suggests that a less open and competitive distribution sector reduces the incentives for retailers to source their merchandise from the lowest cost suppliers.

Services trade restrictiveness and service sector performance

Restrictions on market access for foreign services providers protect local firms from competitive pressure. The STRI also covers behind the border barriers to competition and burdensome regulatory procedures and processes, which affect local and foreign firms alike. Therefore, a high score on the STRI is expected to have a negative impact on the performance of the sector in question.

Looking first at the STRI indicators by sector, what is most striking is the large dispersion in regulatory restrictiveness both within and between sectors. Figure 1 shows the average, minimum and maximum index values for each of the 18 sectors included in the database. Three sectors stand out as having the highest average levels of restrictiveness: air transport, legal services and accounting and auditing services. At the other end of the scale, few restrictions are recorded on average in distribution and sound recording services. Yet in all sectors there is a large gap between the highest and the lowest score, suggesting that the index does capture meaningful differences in regulatory regimes across countries. This variation is expected to affect performance measures such the development of the services sectors in question or the efficiency of service provision. Of particular interest are sectors such as transport, telecoms and business services, which have strong linkages with manufacturing sectors and also exhibit a large degree of dispersion in the indices, indicating potentially large gains from regulatory reform in the more restrictive countries.

Figure 1. STRI average, minimum and maximum scores by sector



Source: OECD Services Trade Restrictiveness database (2014). The indices cover 40 countries. Air transport and road freight currently cover only commercial establishment (with accompanying movement of people).

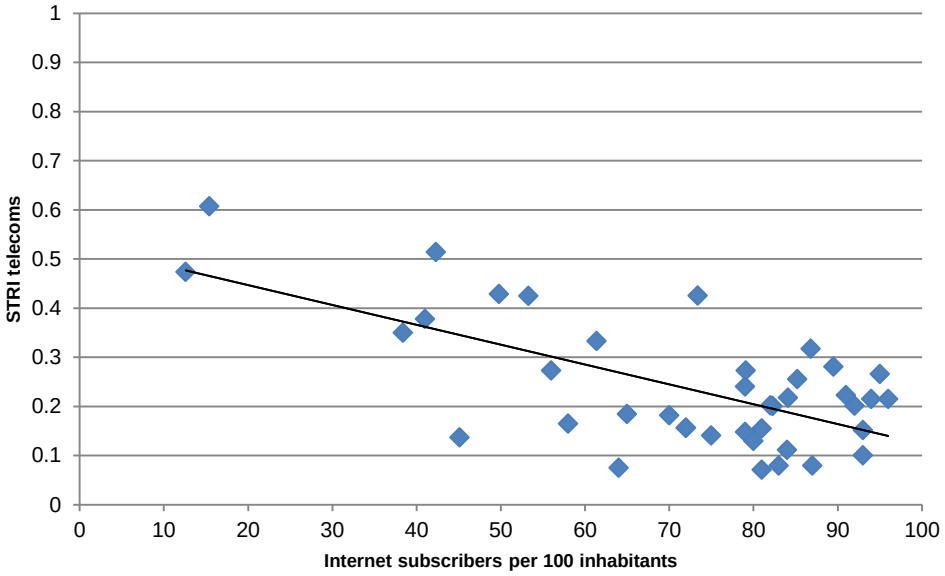
For some services sectors there are readily available indicators of sector performance. In telecoms, the World Bank publishes information on the number of telephone lines, mobile and internet subscribers per 100 people. We find a significant negative association with the score on the STRI for all these measures, and the relationship is strongest for broadband internet subscriptions. This is not surprising since the mobile market seems to be saturated with subscription rates per 100 inhabitants close to, or even exceeding, 100 in most of the 40 countries included in the STRI database.

Figure 2 plots the STRI and the number of broadband internet subscribers per 100 inhabitants together with a trend line. The estimated correlation suggests that five basis points lower STRI in telecoms is associated with 5 additional internet subscribers per 100 inhabitants.[4]

4. The regression line reflects the following equation: internet subscribers per 100 inhabitants= 96.8-106*STRI score for telecoms. The regression line explains 43% of the variation in internet subscriptions across countries (i.e. the R square is 0.43).

Figure 2. STRI in telecoms and performance in the sector

Internet subscriptions per 100 inhabitants, 2012



Source: OECD and World Bank WDI

One may argue that GDP per capita is the main determinant of broadband penetration and that the correlation may be spurious as the STRI for telecoms is also higher for the non-OECD members included. An OLS regression linking the log of internet penetration to the STRI for telecoms and controlling for the log of GDP per capita reveals that the relationship between internet penetration and the STRI is robust to controlling for income per capita. Interacting the STRI with GDP per capita shows, however, that the marginal impact of the STRI is smaller in rich countries where broadband penetration is already high. These results are depicted in Table 1.

Table 1. Fixed Broadband per 100 inhabitants and STRI for telecoms (2013)

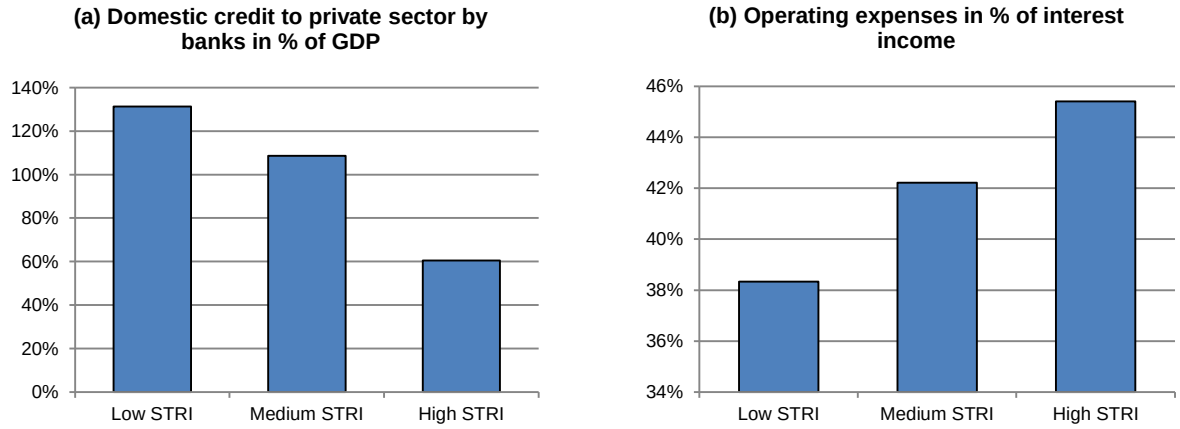
Variable	GDP per capita	With interaction term
Log GDP per capita	0.68***	0.21
	(0.08)	(0.15)
STRI telecoms	-1.36**	-16.63***
	(0.55)	(4.02)
STRI telecoms x log GDP per capita		1.59***
		(0.43)
N	40	40
Adjusted R^2	0.80	0.85

Note: Standard deviation in parenthesis. *** and ** denote 1% and 5% significance levels respectively.

In financial services, Figures 3 and 4 show the average of several performance indicators for countries sorted into three categories of restrictiveness. Looking at the size of total bank credit to the private sector relative to GDP (Figure 3a) reveals that countries which are less restrictive according to the STRI for commercial banking have more developed credit markets to meet the financing needs of the private sector. This correlation suggests that openness in financial services is associated with a better ability of the banking sector to fund domestic firms' investments. Similarly, the depth of the life and non-life insurance markets as measured by the size of total gross premiums relative to GDP is greater in countries with low STRI

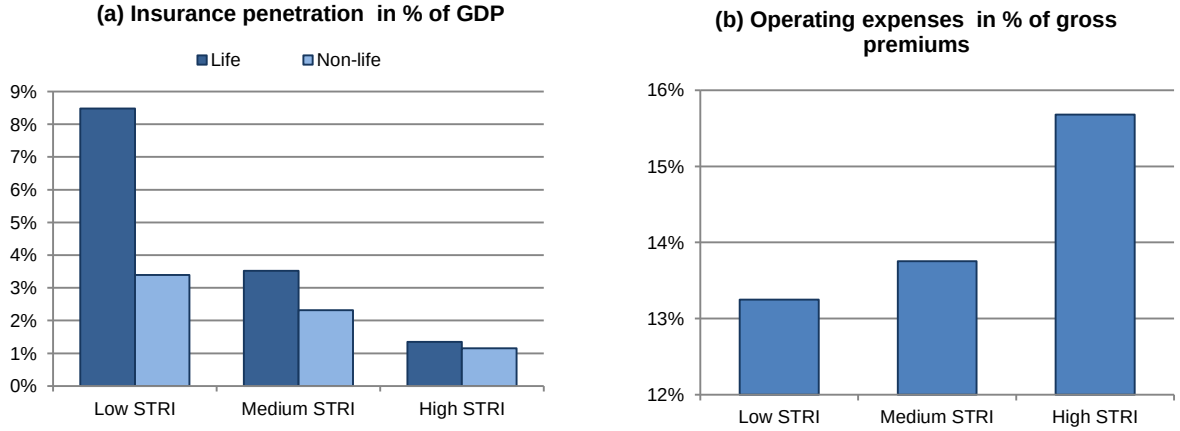
scores (Figure 4a), indicating that households and firms in these economies are better equipped to deal with common risks and to engage in long-term planning.

Figure 3. STRI in commercial banking and performance in the sector



Source: World Development Indicators (2012) for domestic credit to private sector, and OECD Bank Profitability Statistics (2009) for ratio of operating expenses. The bars show simple averages across countries within each category. Low STRI represents values from the lowest score to the mean less 0.5 standard deviations. Medium STRI ranges between the upper limit of the low category to the average plus 0.5 standard deviations. High STRI ranges from the upper limit of the medium to the highest score.

Figure 4. STRI in insurance and performance in the sector



Source: OECD Insurance Statistics, 2012 for insurance penetration and 2011 for operating expense ratio. Subfigure (b) covers the total insurance sector (life and non-life). The bars show simple averages across countries within each category. Low STRI represents values from the lowest score to the mean less 0.5 standard deviations. Medium STRI ranges between the upper limit of the low category to the average plus 0.5 standard deviations. High STRI ranges from the upper limit of the medium to the highest score.

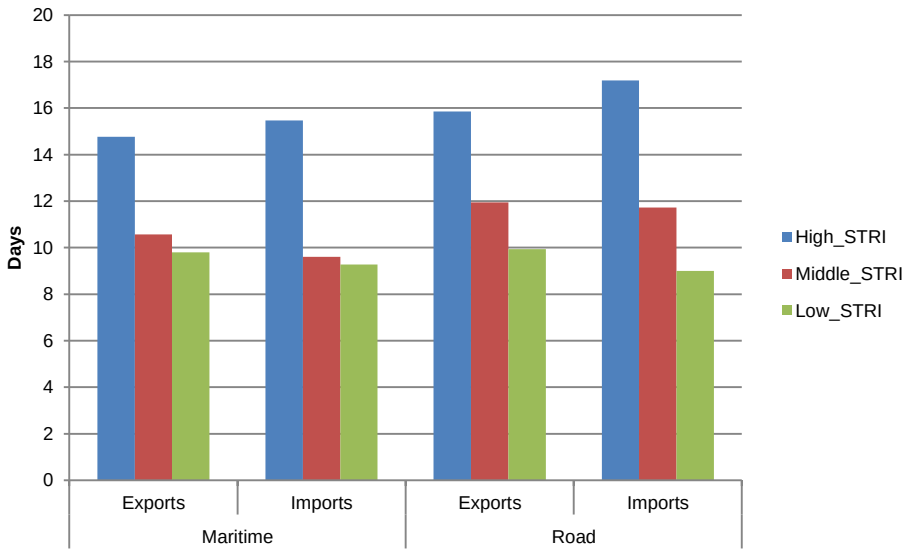
The efficiency of credit and insurance provision can be gauged by the cost/income ratio of banks (Figure 3b) and insurance companies (Figure 4b). These indicators deliver a consistent message: the higher the score on the STRI, the higher the operating expenses per unit of income earned by financial institutions. Even though in high STRI countries, limited competition is likely to allow incumbents to charge more expensive fees, the higher operating costs trump this rent-creating effect. This indicates that countries with higher levels of restrictiveness also have less efficient and less competitive credit and insurance markets.

Restrictions on entry, in particular, are likely to protect inefficient incumbents from more competitive domestic or foreign financial institutions, therefore resulting in higher cost-income ratios than could be achieved in a more open environment. Through this channel, restrictive conditions in the financial services sector are likely to affect a wide range of economic activities as they curtail firms' ability to finance their investments and mitigate losses, in particular financing for exporting activities which typically entail higher uncertainty and higher sunk costs than domestic sales.

A number of studies have found that time for exports and imports have a strong impact on both the volume and the composition of trade in goods (Hummels and Schaur, 2013; Geloso Grosso et al., 2006). Information on the time it takes to get a container from the factory gate to a ship, or from the ship to its final destination in the importing country is provided by the World Bank Development Indicators. The services most involved in the domestic leg of an international transport journey are road transport, logistics and port services. As illustrated in Figure 5, a higher score on the STRI in road and maritime transport is associated with a more time-consuming domestic leg of the transport route of a container. Note that the maritime services STRI covers port services directly related to the operations of the ship.[5]

Figure 5. STRI and time for exports and imports

Averages 2013



Source: OECD and World Bank WDI. Note that the STRIs for maritime services exclude land-locked countries and averages for time for exports and imports are calculated on a smaller sample of countries for maritime transport.

Hummels and Schaur (2013) estimated that one day in transit incurs a cost equivalent to between 0.6 and 2.1% ad valorem tariff, depending on the product. The average difference in time for imports between countries that have a high and low score on the STRI for road transport is 8 days – which is equivalent to a tariff rate between 5 and 17%, depending on the

5. The STRI for logistics services is currently under development and could not be included in the analysis.

product. Needless to say, this is well above the average tariff rate on manufactured products for most of the countries included in the STRI database.[6]

Services trade restrictiveness and cross-border trade in services

In this section, we relate the STRIs for each service sector to the volume of imports and exports of services in that sector. This provides a test of how well the STRIs measure import restrictions. It is also one more step in the analysis of the link between services regulation and domestic competitiveness suggested by sector performance indicators.

Possible channels

The STRI indices measure the prevalence of regulatory impediments to international trade and foreign investment in services sectors. It is straightforward to expect that policy measures targeting cross-border service imports should be associated with lower imports of those same services. As for restrictions on foreign investment, their predicted impact on services imports is more ambiguous. If cross-border trade and FDI are complements, restrictions such as foreign equity limits or burdensome licensing procedures for foreign affiliates are expected to have a detrimental impact on imports. This will be the case, in particular, if foreign-owned services providers are intensely engaged in intra-firm trade with their parent companies – for instance subsidiaries of foreign banks obtaining financing from the parent bank.

If cross-border trade and FDI are substitutes, however, barriers to foreign investment could lead to higher cross-border imports. This can occur where a motive to establish locally is to circumvent regulatory barriers in a manner akin to the "tariff jumping" rationale for FDI in manufacturing sectors. As the STRIs encompass measures affecting both trade and investment, we expect a more negative relationship between the STRIs and service imports in sectors where cross-border trade is more prevalent and technically feasible and in sectors where FDI and trade are more complementary.

Why we should expect a relationship between the STRI indices and service exports is at first glance less intuitive. However, more liberal regulatory regimes are likely to impact on domestic providers as they enhance the degree of competition in host markets. We have already illustrated in section 2 a link between the STRIs and performance indicators in telecoms, finance and transport. More generally, there are several channels through which a country's openness to trade and investment in services is likely to influence its export competitiveness in the same sector.

First, service trade barriers are not necessarily discriminatory; in most part, they are of a "behind the border" nature and impose costs on local suppliers as well as on foreign suppliers. Some of the non-discriminatory regulations included in the STRI, such as restrictions on business practices, administrative red tape or the absence of pro-competitive regulation in network industries, are just as costly for domestic firms and can cripple their price competitiveness in export markets.

Second, trade liberalisation exposes domestic firms to international competition, either through increased foreign penetration or merely as the domestic market becomes more contestable. This induces domestic suppliers to become more efficient and increases their incentives to innovate in order to maintain their market shares – or forces the least productive ones to exit. The fact that domestic suppliers must invest in improving competitiveness at home can turn into an edge in their export destinations as well.

6. Five countries in the STRI database had average tariff rates for manufactured products above 5%, but none had average tariff rates above 15% in the latest year for which data are available (Source: WDI).

Third, since service providers use intensively services inputs, their costs of production are directly associated with the availability of high-quality services at the best price. Favourable competitive conditions at home and the ease of foreign sourcing of intermediate services therefore feed into the ability of downstream services firms to compete on price and quality.

Fourth, less restrictive and more similar regulations across countries enable services suppliers to expand the scale of their activities in order to serve various markets, thereby reaping the benefits of scale economies in services sectors where fixed costs are high. Lastly, countries with an open trade and investment regime are likely to be more attractive locations for the establishment of multinational services firms, including as regional hubs serving neighbouring countries through cross-border exports.

Methodology

Gravity equations

Our first estimations of the impact of services restrictiveness on the services imports and exports rely on the gravity model. Gravity equations, pioneered by Tinbergen (1962), have become the workhorse model for the empirical trade literature. In its simplest form, the estimation of a gravity model relates bilateral trade patterns to the size of the trading partners and the distance between them. The predicted value of exports X_{ij} from a country i to a country j is expressed as:

$$X_{ij} = \alpha \frac{Y_i E_j}{D_{ij}}$$

In this equation, Y_i is country i's output, E_j is country j's expenditure (both often proxied by GDP), D_{ij} is the distance between i and j and α is a multiplicative term. The equation can be estimated at the aggregate level or by sector, usually in log-linear form. The impact of policy measures restricting trade is then assessed by adding various sources of trade costs to the equation and estimating the resulting deviations from the benchmark predicted trade.

The main argument that has sustained the reliance of empirical trade studies on the gravity model is its very good fit to the data and robust results for trade in goods, since size and distance explain a large share of the variance in bilateral trade flows. It also has strong theoretical underpinnings as a wide class of trade models predict that trade flows should follow gravity-like patterns. Most notably, Anderson and van Wincoop (2003) laid out general theoretical foundations for the gravity equation based on differentiated products and homothetic preferences, and Eaton and Kortum (2002) derived a similar prediction from a Ricardian model with perfect competition. Heterogeneous firms models are also compatible with gravity, as in Helpman et al. (2008) and Melitz and Ottaviano (2008). More recently, Chaney (2013) proposed a theory of gravity where the effect of distance is accounted for by informational frictions between firms and their network of potential suppliers, rather than physical transport costs and trade barriers, and that is therefore well suited for services sectors.

Two main issues arise for a consistent estimation of the coefficients in a gravity equation. First, bilateral trade in services data contains many zero flows which may reflect either the actual absence of trade, or imports or exports below reporting thresholds, or missing data. Coefficients obtained from ordinary least squares (OLS) gravity regressions are biased in the presence of a high frequency of zeroes (Helpman et al., 2008). As shown by Santos Silva and Tenreyro (2006), an effective method to obtain consistent estimates is to use

Poisson pseudo-maximum likelihood (PPML) estimators.[7] Second, gravity models consistent with theory emphasise relative sizes and trade costs rather than absolute ones; specifically, their estimation should take into account not only bilateral distance and trade costs but also "multilateral resistance" (Anderson and van Wincoop, 2003). Inward and outward multilateral resistance summarise trade costs between the importer or the exporter and all their trading partners.[8] Empirically, the issue has been addressed in the literature by including importer-year and exporter-year fixed effects in the estimations. This route is not feasible for our purpose given that the STRI is only measured at one point in time: country fixed effects would absorb the effect of the STRI and preclude us for disentangling its impact from that of other country-specific features. We describe in more detail below several robustness tests that were conducted to ensure that our results are not biased by this issue.

Data

The outcome variable of interest is bilateral trade flows (imports and exports) measured in gross terms, broken down by service sector. These data come from the OECD-WTO TiVA Trade in Services database.[9] The database measures trade between residents and non-residents of countries under three modes of supply (cross-border supply, consumption abroad and movement of people)[10] and is reported within the framework of the *Manual on Statistics of International Trade in Services*. Where data are missing in OECD and WTO primary data, mirror flows are used. To match as closely as possible the period in which the STRI captures the relevant laws and regulations, the regressions cover the period 2008-12.

The Trade in services database follows the Extended Balance of Payment Statistics (EBOPS) 2002 classification of services sectors. A concordance can be established between the EBOPS classification and STRI sector definitions for 12 sectors: computer services, construction, legal services, accounting, telecommunications, air transport, maritime freight transport, road freight transport, rail freight transport, courier services, banking and

7. In addition, PPML estimators are robust to heteroskedasticity in log-linear gravity equations, where the scale of the residuals is likely to be correlated with the countries' GDPs.

8. Specifically, if overall bilateral trade costs are t_{ij}, the structural gravity model of bilateral exports is $X_{ij} = \left(Y_i E_j / \mathrm{Y}\right)\left(t_{ij} / \Pi_i P_j\right)^{1-\sigma}$ where outward multilateral resistance is $\Pi_i = [\sum_k (t_{ik}/P_k)^{1-\sigma} (E_k/\mathrm{Y})]^{\frac{1}{1-\sigma}}$, inward multilateral resistance is $\mathrm{P}_j = \left[\sum_k \left(t_{kj}/\Pi_j\right)^{1-\sigma} (Y_k/\mathrm{Y})\right]^{\frac{1}{1-\sigma}}$, and σ is the elasticity of substitution between services within a sector.

9. The OECD Trade in Services by Partner Country (TISP) database covers the 34 OECD Member countries, the Russian Federation and Hong Kong, China as reporting countries. The extended database uses additional primary data from Eurostat, IMF, UNSD and national sources to reach wider country coverage. Only data from primary sources and mirror flows are used in our empirical exercise; estimated trade flows are treated as missing data.

10. The GATS terminology distinguishes between four modes of supply of a service: cross-border supply (mode 1); consumption abroad (mode 2); commercial presence (mode 3); and the movement of natural persons (mode 4). Trade through commercial presence is not covered in the trade in services data reported in the balance of payments. The database reports combined trade through modes 1, 2 and 4 by service sector, without further breakdown between modes of supply.

insurance.[11] For the remaining STRI sectors, bilateral gross trade data is not available at the appropriate level of aggregation.[12] The detailed sector coverage of the STRI and the corresponding EBOPS sectors are listed in Annex Table A.1.

Several standard determinants of bilateral trade flows are included in the estimations. Reporter and partner country GDP (in millions of current USD) are drawn from the World Bank's World Development indicators. Variables capturing natural trade barriers and cultural or historical proximity come from the CEPII Gravity dataset: distance, contiguity, common language, former colonial links, common legal system and time difference. Lastly, a variable measures whether the importer and exporter are part of a bilateral or regional trade agreement (RTA) covering trade in services and/or covering foreign direct investment in services sectors. This information is provided by the WTO RTA database as extended by the OECD in 2013. As the European Economic Area (EEA) has implemented a significantly deeper integration in services than other RTAs, an additional dummy variable is introduced for intra-EEA transactions. Annex Table A.2 presents summary statistics for the main variables.

Results for gross services trade flows

Benchmark estimates

We estimate the gravity model on the 12 services sectors using PPML regressions. The results are presented in Table 2. The coefficients on the importer's and the exporter's STRI indices are negative in almost all sectors. Although not all estimates are significantly different from zero, they suggest a negative association between services trade restrictiveness and import penetration in services, as well as between services trade restrictiveness and export competitiveness.

The estimated impact of the importer's STRI is significant at least at the 10% level in the pooled sample as well as in accounting services, legal services, air transport, commercial banking and insurance. Countries that impose restrictive regulations in these sectors discourage imports of the targeted services. Interestingly, the coefficients on the exporting country's STRI are systematically of larger magnitude and more precisely estimated than those on the importing country's STRI. A more restrictive regime correlates with significantly lower exports in computer services, legal services, air transport, maritime transport, commercial banking and insurance.[13] These first findings show that where services sectors are open to foreign firms and are regulated in a pro-competitive manner, domestic services providers (including domestic affiliates of foreign multinationals) are also more competitive in export markets. Accounting services are an exception, where only the importer's STRI is significant. This can be explained by the role of the recognition of foreign qualifications by the host country as one of the main barriers to – or facilitator of – trade in professional

11. Although the concordance aims to match the EBOPS and STRI sector definitions as closely as possible, it should be kept in mind that some discrepancies remain due to the level of aggregation of the balance of payments data. In particular, health insurance and pension funding are included in EBOPS 253 but not in the insurance STRI. Financial services other than insurance and commercial banking are included in EBOPS 260 but not in the banking STRI.

12. Architecture and engineering services are combined (EBOPS 280), audio-visual and related services are bundled together (EBOPS 288), and distribution services are not recorded as such in trade in services statistics except merchanting and other trade-related services.

13. Very similar results (not reported) were obtained in a cross-sectional sample for the year 2012 only.

services, whereas a more stringent regulatory framework in the home country needs not be an obstacle to obtaining foreign accreditation.

The absence of meaningful results in construction is not surprising given that cross-border trade in construction services is relatively small and trade through commercial establishment is only partially measured in these data.[14] Similarly for telecoms, cross-border trade is poorly measured and the balance of payment statistics for the sector may bear little relationship to effective cross-border activity. For other sectors, only one of the two STRI coefficients displays a significant effect, indicating that the relative importance of the importer's regulations and the exporter's regulations appears to differ according to sector specificities. Only exports of rail transport services unexpectedly yield a positive coefficient on the STRI index.

As for other determinant of trade flows, the coefficients on the distance variable are negative as expected and significant at the 1% level. The volume of trade increases with both importer GDP and exporter GDP, with coefficients in line with the existing literature and highly significant.[15] Having a common language raises bilateral trade in 8 of the 12 sectors, while historical colonial links or a common legal origin only have a significant positive effect in a few sectors. Other gravity variables do not exhibit consistent sign patterns after controlling for distance.

14. In the Balance of Payments statistics, construction services cover work performed on construction projects and installations by employees of an enterprise in locations outside the economic territory of the enterprise. Projects of duration up to one year are generally counted, but large-scale projects requiring several years to complete and works performed by foreign subsidiaries or branches of non-resident enterprises and site offices are excluded.

15. In regressions controlling for GDP per capita (not reported), the coefficients on GDP per capita were not significant and the main results were not affected.

Table 2. STRI and cross-border exports of services: PPML estimations

	(1) Pooled	(2) Computer	(3) Construction	(4) Accounting	(5) Legal	(6) Telecoms	(7) Air	(8) Maritime	(9) Rail	(10) Road	(11) Courier	(12) Banking	(13) Insurance
Ln(Distance)	-0.270***	-0.274***	-0.275***	-0.468***	-0.434***	-0.370***	-0.200***	-0.092*	-0.350***	-0.366***	-0.499***	-0.248***	-0.292***
	(0.031)	(0.052)	(0.069)	(0.056)	(0.056)	(0.054)	(0.040)	(0.056)	(0.040)	(0.059)	(0.093)	(0.051)	(0.054)
Contiguity	-0.025	-0.121**	0.164***	-0.153**	-0.197***	-0.116***	-0.188***	-0.026	0.463***	-0.028	0.038	-0.042	-0.068
	(0.028)	(0.055)	(0.058)	(0.074)	(0.075)	(0.035)	(0.041)	(0.046)	(0.076)	(0.065)	(0.084)	(0.046)	(0.064)
Common language	0.250***	0.389***	-0.056	0.216**	0.464***	0.238***	0.180***	0.039	-0.039	-0.000	0.304**	0.357***	0.444***
	(0.038)	(0.084)	(0.059)	(0.087)	(0.075)	(0.039)	(0.061)	(0.077)	(0.086)	(0.039)	(0.123)	(0.053)	(0.092)
Time difference	0.022***	0.025*	0.022	0.054**	0.058***	0.022	-0.005	0.002	0.018	-0.008	0.101***	0.043***	0.023***
	(0.008)	(0.014)	(0.019)	(0.021)	(0.014)	(0.014)	(0.010)	(0.013)	(0.017)	(0.017)	(0.034)	(0.013)	(0.008)
Colonial history	0.078**	0.044	0.027	0.048	0.071	0.129**	0.180***	0.080	0.092	0.116**	-0.158	-0.008	0.050
	(0.031)	(0.049)	(0.080)	(0.070)	(0.073)	(0.054)	(0.054)	(0.060)	(0.150)	(0.054)	(0.192)	(0.022)	(0.056)
Common legal	0.018	-0.087	0.078	-0.043	-0.094	0.056	0.086*	-0.016	-0.023	0.063	0.068	0.005	0.006
	(0.026)	(0.055)	(0.057)	(0.095)	(0.082)	(0.044)	(0.045)	(0.059)	(0.032)	(0.045)	(0.119)	(0.040)	(0.051)
Services RTA	0.037	-0.019	0.040	-0.042	0.174**	0.005	-0.039***	0.047	0.057	0.001	0.013	0.101*	0.085
	(0.055)	(0.061)	(0.101)	(0.238)	(0.088)	(0.059)	(0.012)	(0.128)	(0.271)	(0.016)	(0.434)	(0.055)	(0.069)
Intra-EEA	0.012	0.157	-0.065	0.179	-0.108	0.108*	-0.011	-0.056	-0.263	0.116***	0.249	-0.187***	0.012
	(0.058)	(0.105)	(0.136)	(0.311)	(0.101)	(0.059)	(0.055)	(0.176)	(0.280)	(0.030)	(0.442)	(0.072)	(0.123)
Ln(Importer GDP)	0.190***	0.174***	0.204***	0.238***	0.297***	0.256***	0.236***	0.128***	0.091***	0.160***	0.264***	0.124	0.264***
	(0.022)	(0.034)	(0.029)	(0.039)	(0.042)	(0.022)	(0.022)	(0.042)	(0.024)	(0.034)	(0.058)	(0.087)	(0.046)
Ln(Exporter GDP)	0.203***	0.211***	0.200***	0.291***	0.264***	0.252***	0.242***	0.160***	0.142***	0.209***	0.247***	0.137***	0.221***
	(0.015)	(0.020)	(0.025)	(0.029)	(0.027)	(0.019)	(0.014)	(0.021)	(0.024)	(0.019)	(0.046)	(0.049)	(0.018)
STRI exporter	-0.628**	-1.300**	-0.416	0.104	-0.768***	-0.281	-0.670***	-1.179**	0.382**	0.103	-0.050	-1.722**	-1.081***
	(0.259)	(0.608)	(0.708)	(0.350)	(0.246)	(0.208)	(0.224)	(0.529)	(0.152)	(0.942)	(0.607)	(0.673)	(0.378)
STRI importer	-0.308***	-0.399	0.535	-0.442***	-0.732**	0.051	-0.213*	-0.217	-0.244	-0.633	0.212	-1.037***	-0.511***
	(0.111)	(0.320)	(0.514)	(0.152)	(0.309)	(0.196)	(0.115)	(0.294)	(0.158)	(0.529)	(0.435)	(0.326)	(0.143)
STRI bil. agr. exp.							-0.017						
							(0.207)						
STRI bil. agr. imp.							-0.200						
							(0.171)						
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector fixed effects	Y												
Observations	36 614	4 395	3 019	2 223	2 535	3 588	4 412	3 064	1 615	3 239	1 488	3 529	3 507

Notes: The dependent variable is Ln(Exports). Standard errors clustered by importer and exporter are in parentheses. ***, ** and * signify statistical significance at 1%, 5% and 10% levels respectively.

Interpreting the results

The estimates shown in Table 2 highlight a negative relationship at the sector level between services trade restrictiveness, as measured by the STRI indices, and both imports and exports of services. A striking finding is that where countries impose more restrictive regulations to foreign services suppliers and foreign investors, the detrimental impact on export performance is larger than the discouraging impact on imports. The results hold on aggregate and for most individual service sectors. A higher STRI is correlated with significantly lower exports and with a more negative coefficient on exports than on imports for computer services, legal services, air transport, maritime transport, commercial banking and insurance. If interpreted causally the coefficients imply, for instance, that a relatively modest liberalisation bringing about a reduction in the STRI index for commercial banking services by 5 basis points would boost a country's imports of those services by 5.3% and its exports by 9%. In the insurance sector, a similar reform would be expected to raise imports by 2.6% and exports by 5.6% (Figure 6). Note that a 5 basis point reduction in the STRI score (0.05 on a scale of 0 to 1, where the average STRI by sector ranges between 0.13 in distribution to 0.44 in air transport) typically corresponds to lifting a few restrictive regulations, though it would be premature at this stage to link the trade response to specific policy measures. Our first estimations also point to the benefits of joint liberalisation in a large number of countries, as the gains from trade are maximised when both the importer and the exporter adopt more liberal regimes.

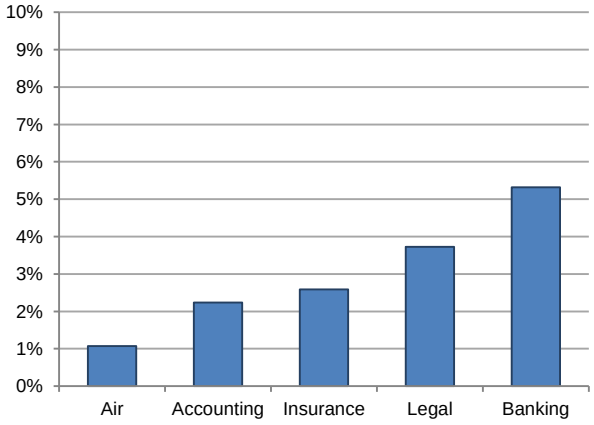
The measures included in the STRI are a comprehensive set of regulations hindering the entry and operations of foreign suppliers in each sector. The negative relationship between STRI indices and imports of services is therefore straightforward. It merely confirms that the STRI effectively captures the type of regulations it is meant to capture, and that *de jure* restrictive regulations are *de facto* enforced. The fact that the STRI indices also exhibit a negative relationship, and even more so, with service exports is a novel result. It supports the hypothesis of a competitiveness channel linking services regulations and the export performance of domestic services suppliers. These findings suggest that trade liberalisation can have strong pro-competitive effects in services sectors. At this stage, however, we cannot determine whether enhanced international competitiveness at the sector level works through the entry of more efficient foreign-owned affiliates or through domestic firms' learning and innovation.

It might appear surprising that the sectoral STRI indices are so strongly related to cross-border trade flows, considering that the bulk of the regulatory measures included in the STRI database in most sectors (with the exception of professional services) affect the provision of services through foreign investment (mode 3) rather than cross-border trade (mode 1) or the movement of people (mode 4). A possible explanation for this finding is that there may be a complementary relationship between FDI and cross-border trade in services. Whether FDI replaces existing imports or creates additional imports is ultimately an empirical question, the answer to which may differ by sectors. Previous studies have uncovered a complementarity effect from FDI to service imports, in particular in financial services, communications and business services (e.g. Fillat-Castejón et al., 2009; Buch and Lipponer, 2004).

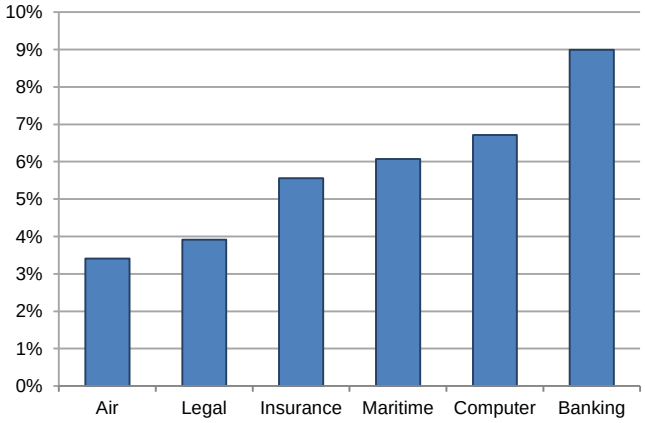
Lastly, we have focused on international trade flows though the STRI encompasses not only discriminatory measures but also non-discriminatory barriers to entry and competition. It is worth noting that while only the former explicitly target foreign suppliers, both are relevant for the ability of foreign firms to enter and serve a market profitably and even non-discriminatory regulations may also have discriminatory effects (Crozet et al., 2013).

Figure 6. Estimated impact of a reduction in the STRI by 0.05

(a) On imports



(b) On exports



Source: Author's calculations based on the PPML estimations shown in Table 1.

Other specifications

This section delves in more detail into technical issues and robustness checks for the interested reader. Our baseline estimates suggest that restrictive regulations towards foreign suppliers and foreign investors discourage both imports and exports of services. However, as mentioned above, estimates obtained from a gravity framework which does not include importer and exporter fixed effects may suffer from omitted variable bias. We used several alternative methods, described in Box 1, to assess the severity of this issue. We find that our main qualitative results are not affected, though the significance of the coefficients changes in a few sectors when we construct a bilateral restrictiveness measure and include a full set of fixed effects.

The other concern we needed to address is that bilateral service trade data at the sector level exhibit a large share of zeroes. For this reason, Poisson regressions were preferred to OLS. The rationale comes from the fact that by taking logs before running OLS regressions, zero observations are removed from the sample. Given that the probability of zero trade is higher when trade costs are higher, this introduces a selection bias in the OLS-estimated effect of these same trade costs on exports. We check that the results are very similar with an alternative PML

estimator, while OLS bias the coefficients upwards, lending support to our specification choices (see Box 1).

In addition, an examination of the probability of observing positive trade flows confirms that the selection of countries that do or do not trade services with each other is non-random. As shown in Annex Table A.6, the same variables that affect the intensive margin of trade also predict the probability of having positive trade in a given service sector between pairs of countries. In particular, there is a significant relationship between services trade restrictiveness (on the importer or on the exporter's side) and the probability of trade in professional services, telecommunications, air transport and financial services. The differences across sectors may reflect the specificities of individual service industries as well as the most prevalent types of barriers: the probability of trade is likely to be more affected by barriers to entry (as opposed to barriers to operations) than the volume of trade. For instance, in professional services, the majority of the restrictions recorded in the STRI database relate to the ability of foreign nationals to practice, in particular through the recognition of foreign qualifications or absence thereof. Accordingly, the importer's STRI has a strong negative impact on the extensive margin of trade in legal and accounting services, while the impact of the exporter's STRI is more modest. Conversely in commercial banking, the probability of trade is more strongly related to regulatory restrictions in the exporting country than in the importing country. As cross-border banking entails substantial fixed costs, this suggests that a lack of competitiveness deters banks from entering foreign markets even more than unfavourable conditions in the host market.

Box 1. Robustness tests: Description and results

Accounting for multilateral resistance

First, even though it is not possible to identify the effect of the STRI with a full set of importer-year and exporter-year fixed effects, we can test the sensitivity of the importer estimates to the inclusion of exporter fixed effects and vice versa. The results are shown in specifications (2) and (3) of Table 3. The "Importer" columns include the importer's STRI along with a set of exporter fixed effects for each year; and the "Exporter" columns include the exporter's STRI along with a set of importer fixed effects for each year. Specification (2) is estimated on the same sample as the baseline estimation (1), i.e. on the bilateral sectoral exports between the 40 countries included in the STRI database. Specification (3) uses the full sample of available trade flows between the 40 STRI countries and all partners. In both cases, the magnitude and significance of the coefficients of interest are preserved compared to the PPML estimates without fixed effects. The only exception is maritime transport, where the exporter's STRI remains negatively correlated with exports of maritime services but loses its significance, while the negative sign on the importer's STRI becomes significant when exporter fixed effects are included.

Second, another possibility is to include a full set of fixed effects (importer-year and exporter-year) and construct a bilateral measure of trade restrictiveness. The results are reported in column (4) of Table 3, where the bilateral STRI variable is the geometric average of the importer's index and the exporter's index, weighted by their respective shares in joint GDP. The coefficients are significantly negative in the pooled regression and for 6 out of the 12 sectors. The main drawback of such an approach is that it imposes quite a strict functional structure on the relationship between STRI and services trade flows, rendering the interpretation of the point estimates difficult. In particular, it assumes that the impacts of the importer's regulations and the exporter's regulations are symmetric given their relative GDP. This runs counter to the previous finding that when the two indices are entered separately, the exporter's STRI appears to have a larger effect. Nevertheless, these estimates confirm that the relationship between STRI and services trade does not vanish when accounting for other country-specific traits. As the unilateral STRIs are absorbed in the fixed effects, they also indicate that the interaction matters: the more restrictive the importer (respectively, exporter) in a service sector, the more pronounced the effect of the exporter's (respectively, importer's) restrictiveness.

Third, one can use structural methods to control directly for the theoretically-derived multilateral resistance. To this end, we use the structurally iterated least squares (SILS) estimator based on Anderson and van Wincoop (2003) and implemented by Head and Mayer (2015). This method specifies the components of the trade costs function and uses the fact that inward and outward multilateral resistance are derived from trade costs between the importer and all exporting countries, and between the exporter and all importing countries. In each iteration, the parameters are estimated and plugged into the multilateral resistance terms for the next estimation until the coefficients are stable. The dependent variable is the ratio of imports to the product of the countries' GDPs, corrected for the estimated multilateral resistances and expressed in log terms. By exploiting the structure of the model, this approach does not require additional fixed effects. However, its validity depends on the correct specification of the set of variables affecting trade costs. The results for all sectors are shown in Annex Table A.5 (note that because of convergence issues, the sector-level results are not reported). The coefficients on the importer's STRI and the exporter's STRI remain negative and are robust to the inclusion of various sets of covariates. A caveat is that their magnitude is likely to be overstated as the SILS procedure is implemented with OLS (rather than PPML) and therefore does not correct for the bias from observations with zero trade flows.

Alternative methods to deal with zero trade flows

We have dealt with the issues of zeroes and selection bias by relying on the PPML technique, as is most common in the gravity literature. As shown in Annex Table A.3, the share of zero trade flows ranges from around 4% of all bilateral pairs in air transport to a third in rail transport. We further check that the issue warrants the use of a Poisson estimator by running the corresponding OLS regressions. The results are summarized in column (5) of Table 3 and detailed in Annex Table A.4. As expected the OLS coefficients on the STRI indices (as well as on distance and GDP) are significantly larger. However, the effects implied by the coefficients in Table A.4 are implausibly large. This supports our choice of PPML estimates to take into account the bias introduced by the structure of the data when a large share of the bilateral trade relationships record zero trade flows.

However Poisson estimators assume a constant variance-to-mean ratio of the dependent variable and can be biased if the errors have a different (e.g. log-normal) distribution. PPML puts equal weight on all observations, which can be problematic with a mass point at zero. We therefore test the robustness of the results to an alternative PML estimator, the Gamma pseudo-maximum likelihood (GPML) estimator. Like the PPML, the GPML estimator has the desirable feature that its performance is not affected by the presence of a substantial proportion of zero trade flows. Contrary to the PPML, it assigns a lower weight to observations with larger means, which yields efficiency gains if these observations have higher variance. Technically, it is the efficient PML estimator if the standard deviation of imports (rather than their variance) is proportional to the mean. GPML also yields different results than PPML if the elasticities of trade to the variables of interest are not constant. The results in column (6) of Table 3 show that the Gamma PML estimates are very similar to the Poisson PML estimates, and both differ significantly from the OLS estimates. This confirms that PPML or GPML results should be preferred to OLS methods.

Table 3. STRI and cross-border exports of services: Comparison of estimates

	(1) PPML		(2) One-way FE, small		(3) One-way FE, full		(4) STRI pair	(5) OLS		(6) Gamma PML	
	Importer	Exporter	Importer	Exporter	Importer	Exporter	Bilateral	Importer	Exporter	Importer	Exporter
Pooled	-0.308***	-0.628**	-0.409***	-0.552**	-0.409***	-0.536**	-0.607***	-1.529***	-1.766**	-0.287**	-0.518**
	(0.111)	(0.259)	(0.109)	(0.249)	(0.109)	(0.241)	(0.048)	(0.559)	(0.766)	(0.124)	(0.258)
Computer	-0.399	-1.300**	-0.643*	-1.168**	-0.643*	-1.146**	-0.994***	-2.529*	-6.438***	-0.240	-1.388**
	(0.320)	(0.608)	(0.343)	(0.590)	(0.343)	(0.573)	(0.255)	(1.496)	(2.237)	(0.363)	(0.636)
Construction	0.535	-0.416	0.784	-0.194	0.784	-0.174	-0.399	0.415	-1.869	0.568	-0.371
	(0.514)	(0.708)	(0.526)	(0.715)	(0.526)	(0.674)	(0.334)	(2.054)	(2.418)	(0.460)	(0.589)
Accounting	-0.442***	0.104	-0.506**	0.164	-0.506**	0.140	0.148	-0.497	0.248	-0.422***	0.057
	(0.152)	(0.350)	(0.220)	(0.333)	(0.220)	(0.327)	(0.144)	(0.427)	(0.935)	(0.123)	(0.320)
Legal	-0.732**	-0.768***	-0.742***	-0.768***	-0.742***	-0.776***	-1.216***	-2.343***	-1.864**	-0.912**	-0.889***
	(0.309)	(0.246)	(0.282)	(0.257)	(0.282)	(0.245)	(0.192)	(0.788)	(0.764)	(0.384)	(0.321)
Telecoms	0.051	-0.281	-0.137	-0.188	-0.137	-0.140	-1.716***	-1.256	-1.780*	0.133	-0.353
	(0.196)	(0.208)	(0.220)	(0.228)	(0.220)	(0.216)	(0.158)	(0.880)	(0.908)	(0.244)	(0.245)
Air	-0.213*	-0.670***	-0.190*	-0.670***	-0.190*	-0.694***	-1.248***	-1.725**	-3.046***	-0.188	-0.599**
	(0.115)	(0.224)	(0.115)	(0.232)	(0.115)	(0.239)	(0.182)	(0.876)	(1.156)	(0.152)	(0.303)
Maritime	-0.217	-1.179**	-0.572**	-0.906	-0.526*	-0.835	-1.244***	-2.317	-5.122*	-0.191	-1.140**
	(0.294)	(0.529)	(0.277)	(0.607)	(0.285)	(0.590)	(0.183)	(1.894)	(2.632)	(0.328)	(0.551)
Rail	-0.244	0.382**	-0.140	0.170	-0.140	0.204	0.169	-1.284	-0.957	-0.270***	0.346***
	(0.158)	(0.152)	(0.218)	(0.209)	(0.218)	(0.211)	(0.349)	(0.927)	(0.991)	(0.072)	(0.121)
Road	-0.633	0.103	-0.382	-0.161	-0.382	-0.200	0.040	-6.838**	-2.683	-0.671	0.034
	(0.529)	(0.942)	(0.508)	(1.002)	(0.508)	(0.975)	(0.645)	(2.752)	(3.351)	(0.569)	(0.804)
Courier	0.212	-0.050	-0.139	-0.049	-0.139	-0.113	-0.426	-2.157	-2.110	0.046	-0.259
	(0.435)	(0.607)	(0.439)	(0.638)	(0.439)	(0.644)	(0.478)	(1.551)	(1.342)	(0.450)	(0.499)
Banking	-1.037***	-1.722**	-1.189***	-1.736***	-1.189***	-1.571***	-0.494***	-3.828***	-5.224***	-1.012***	-1.617***
	(0.326)	(0.673)	(0.344)	(0.657)	(0.344)	(0.583)	(0.161)	(1.250)	(1.649)	(0.282)	(0.480)
Insurance	-0.511***	-1.081***	-0.656***	-0.963**	-0.656***	-0.878**	-0.151	-2.462***	-2.853**	-0.464***	-1.079***
	(0.143)	(0.378)	(0.136)	(0.378)	(0.136)	(0.342)	(0.210)	(0.555)	(1.173)	(0.162)	(0.370)
Year FE	Y	Y						Y	Y	Y	Y
Importer-year FE				Y		Y	Y				
Exporter-year FE			Y		Y		Y				
Standard errors	Imp, Exp	Imp, Exp	Imp	Exp	Imp	Exp	Robust	Imp, Exp	Imp, Exp	Imp, Exp	Imp, Exp

Notes: The estimates shown are the coefficients on the STRI indices, with standard errors in parentheses. ***, ** and * signify statistical significance at 1%, 5% and 10% levels respectively. The dependent variable is ln(exports). All regressions include as additional independent variables: ln(importer GDP), ln(exporter GDP), ln(distance), contiguity, common official language, common legal framework, time difference, former colonial links, RTA in services and intra-EEA dummy. The pooled regressions include sector fixed effects. Standard errors: "Imp, Exp" means clustered by both importer and exporter; "Imp" and "Exp" mean clustered by respectively importer and exporter; "Robust" means Huber-White heteroskedastic-consistent standard errors. The specifications of column (2), (3) and (4) are estimated by PPML method. The sample for (3) covers the bilateral flows between the 40 STRI countries – same sample as (1). The sample for (4) covers the bilateral flows between the 40 STRI countries and all partner countries where trade data is available. The bilateral STRI variable in (4) is $(STRI_i^{(GDP_i/GDP_{i+j})})*(STRI_j^{(GDP_j/GDP_{i+j})})$.

Services trade restrictiveness and performance in downstream manufacturing sectors

Services connect people, companies, villages and countries so that information, ideas, finance, goods, services and people can flow between them to the benefit of all. Notwithstanding how obvious the linkages between services and trade in goods are, rigorous analyses of such linkages are few and far between.

The role of services in production of goods has, however, attracted considerable attention in the global value chains literature. A well-known illustration is the so-called smile curve which shows that pre-production R&D, design and engineering as well as post-production distribution and marketing services add more value to a manufactured product than its fabrication. Furthermore, the pre- and post-production services are increasingly connected through electronic feed-back loops where sales performance is automatically fed into the product design process (e.g. Marsh, 2012). Thus, the end points of the value chain are often connected, transforming it into a feed-back loop.

The competitive environment in many manufacturing sectors leaves no room for error in the production of final goods, let alone the parts and components from which they are assembled. Close to zero defects and delivery on time – all the time – require sophisticated process design, supply chain management software, high-speed telecoms networks, and effective transport and logistics services. Finally, capital goods and durable consumer goods are increasingly bundled with services such as maintenance and performance monitoring through internet connected electronic sensors.

Global value chains have emerged as a result of falling transport and transaction costs that have made it possible to separate functions and tasks in time and space (e.g. Baldwin and Lopez-Gonzalez, 2014). We have seen in the previous section that more competitive services markets are associated with higher services exports. One would also expect that more competitive services contribute to comparative advantage in services-intensive manufacturing sectors (Nordås, 2010).

Against this backdrop one would envisage that infrastructure services (transport, logistics and telecoms) are associated with higher trade volumes as well as more intra-industry trade, everything else equal. On the other hand, competitive business services such as computer services and engineering may also lead to specialisation on the services activities in the value chain, and offshoring of the manufacturing stage of production. Finally, trade activities rely more on financial services than does domestic commerce (Manova, 2012). Competitive financial services are therefore likely to stimulate trade. We present a first attempt at testing these hypotheses below.

The STRIs and exports and imports of manufactured goods

We start with exploring how services trade restrictions are related to exports of manufactured goods. As noted, exports of intermediate inputs may be particularly sensitive to competitive transport and logistics services while capital goods and branded consumer goods are likely to be sensitive to competitive high-speed telecoms. A useful break-down of manufactured goods for the purpose of such analysis is the Broad Economic Categories (BEC) classification. Total exports by BEC category are regressed on the STRI indices for computer services, distribution services, financial services, telecoms, transport services and courier services, controlling for GDP and the real effective exchange rate.[16] The results are summarised

16. The trade data om this analysis are from the World Integrated Trade Solution (WITS) and data on real effective exchange rates are from the Bank of International Settlements. Variation in GDP explains about half of the variation in export value in the sample of 40 countries included here. The STRIs that are statistically significant add about 10 percentage points to the explained variation.

in Table 4, which reports the elasticities of exports to services trade restrictions by BEC category and their statistical significance.[17] Manufacturing trade statistics are from the World Integrated Trade Solution, while information on the control variables is from the World Development Indicators.

Table 4. Relationship between exports of goods and restrictions in services

Elasticities at mean STRI, by BEC category

		Capital goods		Motor vehicles		Consumer goods		
	BEC 2	BEC 41	BEC 42	BEC 51	BEC 53	BEC 61	BEC 62	BEC 63
Computer		-0.655**	-0.883***	-1.067***	-1.095***			-0.777***
Distribution		-0.425**	-0.483**	-0.931***	-0.747***			-0.426***
Bank		-0.415**	-0.580***	-0.934***	-0.662***			-0.607***
Insurance	-0.218***	-0.544***	-0.672***	-0.948***	-0.762***			-0.642***
Engineering				0.774*	0.672***	0.564**	0.635**	
Telecoms	-0.144*	-0.631***	-0.716***	-1.318***	-0.826***	-0.632**	-0.687**	-0.818***
Air	-0.434**			-1.625*	-1.104*		-1.533*	-1.954***
Maritime		-0.806**	-1.057***	-0.835*	-0.893***	-0.689**		-1.324***
Rail		-0.295**	-0.278*	-1.170***	-0.392***	-0.252*	-0.282*	
Road				-0.949**	-0.736*			-0.477*
Courier		-0.574**	-0.675**	-1.192***	-0.880***			-0.784***

Note: The BEC categories refer to: BEC 2, "Industrial supplies not elsewhere classified"; BEC 41, "Capital goods (other than motor vehicles)", BEC 42, "Parts and accessories of capital goods other than motor vehicles", BEC 51, "Passenger motor cars", BEC 53 "Parts and accessories of motor cars", BEC 61 – 63, "Consumer goods not elsewhere specified, durable (61), semi-durable (62) and non-durable (63)". *** , ** and * signify statistical significance at 1, 5 and 10% levels respectively. Empty cells indicate that the STRI did not have a statistically significant impact on export values. Regressions are run using OLS with robust standard errors. The STRIs are entered one by one into the regressions.

One should be cautious about inferring causalities from the correlations depicted in Table 4. Nevertheless the results are interesting and in line with expectations. First, it is noted that the services sectors most strongly associated with exports of goods are telecoms, maritime transport and insurance, where the relationship is negative and statistically significant in all sectors for telecoms and all but two sectors for maritime transport and insurance. The cargo shipping sector carries about 90% of world merchandise trade in volume terms and about half in value terms, so it is natural that restrictions on maritime transport affect exports of most goods. Furthermore, given the shift to the internet of a host of business functions in all sectors, the significance of the telecoms sector is not surprising. Finally insurance is part of the cost-insurance-freight (cif) values of merchandise imports, and essential for trade transactions.

Second, the STRI in air transport is most significantly related to exports in the BEC categories believed to be most time sensitive: intermediate inputs and consumer goods, particularly non-durable. Air transport also takes a relatively high elasticity for finished passenger cars (BEC 51), although obviously cars are rarely transported by air. A possible

17. The regression is run on a cross-section for 2012/13. The equation is $lnx_i = \alpha + lngdp_i + lnree_i + ln\,STRI_i + \varepsilon_i$ and similar for imports. The variable *lnree* represents the log of the real exchange rate. The left hand side variable is total exports for the sector in question to the world. The STRIs were included one by one for each manufacturing category. We also introduced the STRIs into the gravity equation which determines the direction on trade, i.e. who trades how much with whom. A similar pattern emerges, but the coefficients are less robust to clustering and thus less precisely estimated. Since there is only one STRI observation per country it is not surprising that it is difficult to obtain a precise estimate not only how much manufactured goods are exported, but also how exports are distributed among the 40 countries for which information is available.

explanation could be the importance of after-sales services where seamless supply of spare parts is essential. The economic and statistical significance of courier services for this sector supports this hypothesis.

Third, as is well documented in the literature, supply chains in motor vehicles and heavy industries tend to be regional rather than global, relying more on surface transport. This is borne out in the results where services trade restrictions in maritime services are strongly related to exports and the other surface transport indicators are also highly significant.

Fourth, the only STRI index that took a positive and statistically significant coefficient is engineering for motor vehicles, and durable and semi-durable consumer goods. The result is compatible with the hypothesis that an open and competitive engineering sector may shift trade and production away from fabrication towards design and R&D.

The relationship between imports and services trade restrictiveness is also as expected. All the STRIs included in Table 3 are negatively associated with imports where statistically significant, the elasticities are similar to those for exports. In the interest of space these results are not reported in detail here but the results can be found in Annex Table A.8.

Finally, we note that some of the measures included in the STRI, such as restrictions on board members, movement of people and antitrust regulation apply to all sectors of the economy, so there could also be a direct effect on the competitiveness of manufacturing in addition to the spillovers from services restrictiveness. The STRI for computer services largely reflects restrictions that apply economy-wide, and the negative association between the STRIs for this sector and exports and imports of goods could partly reflect a less attractive business environment in general.

STRIs and intra-industry trade in manufacturing

Trade between countries with similar resource endowments and similar technologies is largely driven by product differentiation in combination with economies of scale (Krugman, 1979). Economies of scale stem from fixed costs of developing and marketing new products and new varieties of existing products. Each country specialises in one or more varieties or brands of a product targeting specific market segments or consumer groups globally, while importing other brands. In this way producers can exploit economies of scale while consumers have a broad variety of products to choose from. It follows that the extent to which a country engages in intra-industry trade reflects the extent to which its manufacturers differentiate their products from competitors.

There is a considerable body of empirical work exploring the determinants of intra-industry trade. First, looking at bilateral intra-industry trade, a larger share of trade is intra-industry between countries that have similar market sizes, levels of income and factor endowments, as predicted by theory (Helpman, 1987). Second, higher trade costs reduce the share of intra-industry trade in total trade (Bergstrand and Egger, 2006).

Distinguishing between differentiated and homogenous goods in practice is not always straight forward. One seminal paper suggested classifying goods into three categories: those traded on organized exchanges, those subject to reference prices and all the others (Rauch, 1999). Reference priced goods and other goods traded on organised exchanges can be bought and sold without knowing the name of the producer and can be considered homogenous. Differentiated goods, in contrast, come in a large number of varieties rendering reference pricing impractical. Using this readily available categorisation, a number of studies have analysed how homogenous and differentiated goods respond differently to changes in trade costs and to recessions. They find that trade relations in differentiated products are more resilient to shocks once established, but entry into new markets is more sensitive to trade costs.

However, nowadays, even homogenous goods can be branded based on the way that they have been produced. Fair trade, carbon footprint or sweatshop-free production comes to mind.

The Rauch classification does not capture this possibility. An alternative measure of product differentiation is the share of intra-industry trade in total trade. A commonly used indicator is the Grubel-Lloyd index, hereafter GL, which takes vales between zero and one, zero representing one-way trade only and unity reflecting fully balanced trade.[18] The GL index can be calculated at different levels of product aggregation. The more aggregated the data, the higher the GL-index. A high level of aggregation may overestimate the extent of product differentiation while a GL-index calculated at a very detailed level of aggregation may underestimate product differentiation. The BEC categories used in the previous section is probably too aggregated, while 6 or 8-digit Harmonised System (HS) classification may be too detailed. Calculating the GL-indices at a 4-digit HS level should strike a good balance.[19]

It is clear that intra-industry trade is driven by product differentiation, but what determines product differentiation? In mass consumer markets firms typically monitor markets closely and adjust products to consumer tastes rapidly to distinguish themselves from competitors. For such short product cycles to function, lead time and real time data flows are essential. In other markets branding is based on product design, the production process or the bundling of services with the product. In either case, a host of services inputs are required. Competitive services markets in transport and logistics, telecoms and business services may therefore be related to branding, product differentiation and intra-industry trade. This was explored empirically and the results are summarised in Table 5. The manufacturing sectors included in the analysis are pharmaceuticals (HS 30), textiles (HS 60), clothing (HS 61), electronics (HS 85) and motor vehicles (HS 87).

Table 5. Intra-industry trade and services restrictiveness

	Pooled	HS 30	HS 60	HS 61	HS 85	HS 87
Computer	-4.474**			-10.600***	-4.026*	-3.979**
Distribution	-4.007***		-3.048*	-10.460***	-3.544**	-3.622***
Banking	-4.999***	-2.000*	-4.613***	-8.968***	-4.568***	-5.081***
Insurance	-3.494***			-7.636***	-3.206**	-3.048***
Engineering						1.752*
Telecoms	-4.209***	-2.216**	-5.427***	-7.874***	-3.795***	-4.459***
Air	-3.105**		-4.991***	-6.281***	-2.598	-2.621*
Maritime	-3.745***	-4.173***		-6.734***	-3.772***	-2.788*
Rail	-1.541**				-1.279*	-2.123**
Road				-7.835**		
Courier	-3.671***	-2.426***	-2.537***	-6.889***	-3.609***	-3.343***
N	10 292	535	518	1 432	4 130	1 370

Note: The table reports the coefficients on the STRI indices. The regressions are estimated by general linearized model (glm) with link logit and family binomial. Robust standard errors clustered around 40 countries are applied. ***, **, * signify statistical significance at 1, 5 and 10% level respectively. 2-digit sector fixed effects are included in the pooled regression reported in the first column. The STRI indices are included one by one.

The first column shows the result of a pooled regression. A coefficient of -2, say, means that a one basis point higher STRI index is associated with 2 basis points lower GL index. The

18. The Grubel-Lloyd index of intra-industry trade is defined as follows: $GL = 1 - \frac{|X-M|}{X+M}$ where X denotes exports and M imports.

19. Rauch (1999) used three or four-digit SITC categories for his classification. Bergstrand and Egger (2006) calculated GL indices based on 3-digit SITC categories for their study, while Crespo and Fontuora (2004), analysing Portuguese data, calculated GL indices on 6-digit NACE categories. Sensitivity tests using 6-digit and 2-digit HS classifications produced similar results as far as the sign and significance of the STRIs are concerned.

differences between the coefficients across services sectors are moderate in the pooled regression, with road transport and engineering being statistically insignificant and banking slightly more important than the others.

The next columns report results from running the regressions by two-digit HS category separately. We note that there is much more variation in the coefficients on the STRIs both within and across individual 2-digit sectors. Pharmaceuticals (HS 30) appear to be the least and clothing, motor vehicles and electronic the most affected by services restrictions. Fast fashion, a high degree of product differentiation, computer-assisted design where point of sales data feed into the design process characterise the clothing sector more than any other. In addition the lead firms in the supply chain are typically retailers (Gereffi, 1999; Stacey and Gereffi, 2011). Electronics and motor vehicles have many of these characteristics, but the product cycle is much longer and particularly the motor vehicle supply chain tends to be regional. The STRIs thus appear to capture important services-related barriers to product differentiation in manufacturing and differences in the importance of the services links.

Large retailers increasingly source their wares directly from suppliers and rank among the largest importers in the economy (Bernard *et al.* 2010). It has been documented in the literature that retailers that face weak competition tend to raise their margins rather than pass on lower import prices to customers in the event of trade liberalisation (Francois and Wooton, 2010). It is also conceivable that lack of competition in the retail sector reduces the incentives to source products from the (quality-adjusted) lowest cost suppliers. If so, there would be a negative relationship between the level of competition in the retail sector and import prices of consumer goods, everything else equal.

We tested this and found that a higher STRI in distribution services is associated with higher import prices of clothing and electronics. In addition lower scores on the STRIs in legal services and courier services are associated with lower import prices for clothing and electronics respectively. More research is necessary to establish the channels through which this works. A hypothesis is that both effects may be related to entering into a contract with suppliers. Access to lawyers well versed in contract enforcement procedures and regulations in the source countries may improve the bargaining power of the importer. Courier services in turn play an important role in the process of negotiating and enforcing a contract, providing rapid and secure transfer of confidential documents, product samples and the like.

Our estimate suggest that a reduction in the STRI index by five basis points from 0.15 to 0.10 in distribution services would lower import prices of electronics (HS 85) by 7.7% and a further reduction of import prices by 4.9% would ensue if the STRI index for courier services was reduced from 0.27 to 0.22.[20]

Taking stock, our preliminary results show that services trade restrictions in transport, telecoms and financial services are negatively associated with exports, imports and product differentiation in manufacturing. The largest effects are found for intermediate inputs, and consumer goods, particularly clothing, electronics and motor vehicles. We have also shown that a less competitive distribution sector is associated with higher import prices notably for electronics and clothing. More research is needed to establish causalities and the channels through which these effects emerge. But the first attempt supports the hypothesis that services

20. The import prices are calculated by dividing import value with import volume and normalizing by the mean for each 4-digit product category. For robustness check we also normalised using min-max. The price index was regressed on the STRIs of relevance. There may be economies of scale that reduces the cost of importing to large markets and richer countries may import relatively more premium products. We therefore controlled for GDP and GDP per capita, using OLS regressions with robust standard errors or clustered around 40 countries.

trade restrictions do have negative spillovers along global value chains. Furthermore, it is demonstrated that the STRIs go beyond capturing the general business environment, but actually distinguishes between restrictiveness in different services sectors and their downstream impact.

Concluding remarks

This paper provides an early test of how well the STRIs measure what they are supposed to quantify, namely restrictions on trade in services and barriers to competition in services markets. The results are reassuring. Coefficients on the STRIs take the expected sign in the regressions when they are statistically significant. Moreover, different services STRIs have different effects in a way that corresponds to anecdotal evidence and makes intuitive sense.

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Technical Annex

Table A.1. Sector coverage

STRI code	STRI description	EBOPS 2002
CS	Computer services	262
CO	Construction	249
PSleg	Legal services	275
PSacc	Accounting	276
PSarc	Architecture	280[a]
PSeng	Engineering	280[a]
TC	Telecommunications	247
DS	Distribution	
ASmot	Motion pictures	288[a]
ASbrd	Broadcasting	288[a]
ASsou	Sound recording	288[a]
TRair	Air transport	210
TRmar	Maritime freight transport	208
TRrof	Road freight transport	225
TRrai	Rail freight transport	221
CR	Postal and courier services	246
FSbnk	Commercial banking	260[a]
FSins	Insurance	253[a]

a. Indicates wider coverage than the corresponding STRI sector.

Table A.2. Summary statistics

	Mean	Standard deviation	Minimum	Maximum
Services exports (million USD)	58.880	306.459	-326	13 700
STRI	0.227	0.143	0	1
Distance (km)	5 398.110	4 852.664	161	19 539
Contiguity	0.069	0.254	0	1
Common official language	0.064	0.246	0	1
Colonial history	0.036	0.186	0	1
Common legal origin	0.196	0.397	0	1
Time difference (hours)	3.584	3.535	0	12
GDP (million USD)	1 372 002	2 546 061	12 115	16 244 600
Services RTA	0.485	0.500	0	1
Intra-EEA	0.409	0.492	0	1

Table A.3. Missing and zero export values in the cross-border services trade data, by sector

Sector	Missing	Zeroes
Computer	22.9%	5.6%
Construction	26.5%	19.6%
Legal	29.6%	12.0%
Accounting	35.8%	15.0%
Telecoms	31.1%	7.1%
Air	27.2%	3.8%
Maritime	23.2%	7.6%
Rail	31.1%	33.8%
Road	30.0%	13.5%
Courier	38.9%	20.1%
Banking	23.1%	10.3%
Insurance	23.3%	10.2%

Note: Shares of missing data for exports and zero recorded flows among all possible combinations of the 40 STRI countries as reporters and partners (excluding trade with self) and the 12 sectors.

Table A.4. STRI and cross-border exports of services: OLS estimations

	(1) All	(2) Computer	(3) Construction	(4) Accounting	(5) Legal	(6) Telecoms	(7) Air	(8) Maritime	(9) Rail	(10) Road	(11) Courier	(12) Banking	(13) Insurance
Ln(Distance)	-1.081***	-1.155***	-1.082***	-1.283***	-1.022***	-1.202***	-0.921***	-0.556**	-0.871***	-1.391***	-0.917***	-1.070***	-0.847***
	(0.123)	(0.222)	(0.230)	(0.189)	(0.133)	(0.218)	(0.162)	(0.232)	(0.183)	(0.184)	(0.217)	(0.145)	(0.133)
Contiguity	-0.147	-0.467**	0.664***	-0.620**	-0.384**	-0.252	-0.861***	-0.254	1.638***	-0.151	0.280	-0.334	0.170
	(0.135)	(0.235)	(0.200)	(0.254)	(0.190)	(0.189)	(0.127)	(0.217)	(0.205)	(0.246)	(0.267)	(0.229)	(0.267)
Common language	1.288***	1.860***	-0.056	0.982***	1.731***	0.920***	0.874***	0.027	0.738***	0.282	1.596***	2.235***	1.721***
	(0.184)	(0.394)	(0.200)	(0.281)	(0.260)	(0.198)	(0.321)	(0.314)	(0.246)	(0.189)	(0.291)	(0.312)	(0.369)
Time difference	0.026	0.021	0.064	0.086	0.048	0.002	-0.034	-0.025	-0.044	-0.036	0.086	0.062	-0.009
	(0.036)	(0.057)	(0.065)	(0.053)	(0.037)	(0.054)	(0.035)	(0.059)	(0.054)	(0.063)	(0.069)	(0.041)	(0.029)
Colonial history	0.710***	0.578***	0.684***	1.019***	1.019***	0.741***	1.235***	0.946***	0.240	0.766**	0.576**	0.392	0.333
	(0.156)	(0.215)	(0.235)	(0.224)	(0.230)	(0.247)	(0.259)	(0.334)	(0.394)	(0.303)	(0.280)	(0.268)	(0.290)
Common legal	0.175	-0.185	0.372*	0.132	-0.149	0.330**	0.341**	0.088	-0.150	0.378*	0.145	0.436**	0.167
	(0.122)	(0.204)	(0.201)	(0.170)	(0.162)	(0.155)	(0.165)	(0.207)	(0.280)	(0.228)	(0.185)	(0.199)	(0.165)
Services RTA	0.163	-0.441*	0.294	0.109	-0.076	-0.203	-0.207**	0.312	0.862***	0.233	-0.010	0.351	0.472**
	(0.206)	(0.255)	(0.353)	(0.220)	(0.238)	(0.198)	(0.092)	(0.473)	(0.295)	(0.282)	(0.530)	(0.219)	(0.191)
Intra-EEA	0.200	0.918**	-0.091	0.728*	0.270	0.518*	-0.067	-0.308	-1.249***	0.577	0.828	-0.427	-0.161
	(0.271)	(0.451)	(0.454)	(0.411)	(0.335)	(0.276)	(0.331)	(0.699)	(0.366)	(0.367)	(0.733)	(0.393)	(0.319)
Ln(Importer GDP)	0.861***	0.802***	0.808***	0.883***	0.837***	0.978***	1.018***	0.789***	0.453***	0.682***	0.881***	0.940***	1.049***
	(0.084)	(0.119)	(0.129)	(0.095)	(0.134)	(0.088)	(0.112)	(0.171)	(0.108)	(0.097)	(0.129)	(0.277)	(0.111)
Ln(Exporter GDP)	0.876***	0.934***	0.908***	0.979***	0.818***	0.911***	1.005***	0.849***	0.486***	0.851***	0.888***	0.807***	0.904***
	(0.077)	(0.078)	(0.107)	(0.101)	(0.111)	(0.090)	(0.082)	(0.141)	(0.095)	(0.089)	(0.122)	(0.191)	(0.074)
STRI exporter	-1.766**	-6.438***	-1.869	0.248	-1.864**	-1.780*	-3.046***	-5.122*	-0.957	-2.683	-2.110	-5.224***	-2.853**
	(0.766)	(2.237)	(2.418)	(0.935)	(0.764)	(0.908)	(1.156)	(2.632)	(0.991)	(3.351)	(1.342)	(1.649)	(1.173)
STRI importer	-1.529***	-2.529*	0.415	-0.497	-2.343***	-1.256	-1.725**	-2.317	-1.284	-6.838**	-2.157	-3.828***	-2.462***
	(0.559)	(1.496)	(2.054)	(0.427)	(0.788)	(0.880)	(0.876)	(1.894)	(0.927)	(2.752)	(1.551)	(1.250)	(0.555)
STRI bil. agr. exp.							-0.489						
							(1.155)						
STRI bil. agr. imp.							-0.644						
							(0.988)						
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector fixed effects	Y												
Observations	52 587	5 575	4 200	3 835	4 558	4 821	5 380	3 681	2 721	4 403	3 198	5 195	5 020

Notes: Standard errors in parentheses. * p < 0.1; ** p < 0.05; *** p < 0.01. The dependent variable is Ln(Exports). Standard errors are clustered by importer and exporter.

Table A.5. STRI and cross-border exports of services: SILS estimations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
STRI exporter	-7.454***	-7.348***	-7.438***	-7.211***	-7.648***	-7.094***	-6.869***
	(2.114)	(2.381)	(2.118)	(2.113)	(2.235)	(1.902)	(1.797)
STRI importer	-7.086***	-6.926***	-7.065***	-6.834***	-7.238***	-6.709***	-6.467***
	(2.008)	(2.292)	(1.976)	(1.968)	(2.126)	(1.790)	(1.656)
Ln(Distance)	-1.961***	-1.855***	-1.929***	-1.828***	-1.446***	-2.198***	-2.130***
	(0.229)	(0.283)	(0.255)	(0.350)	(0.263)	(0.200)	(0.212)
Common language	4.689***	6.010***	4.843***	4.979***	5.715***	4.719***	3.866***
	(0.402)	(0.414)	(0.458)	(0.493)	(0.379)	(0.358)	(0.334)
Colonial history		-0.507					
		(0.555)					
Services RTA			0.049				
			(0.632)				
Intra-EEA				0.368			
				(0.834)			
Time difference					-0.111		
					(0.101)		
Common legal						-1.155***	
						(0.220)	
Contiguity							-1.843***
							(0.445)
CR	-1.181***	-1.237***	-1.188***	-1.219***	-1.172***	-1.192***	-1.168***
	(0.355)	(0.376)	(0.369)	(0.365)	(0.358)	(0.337)	(0.338)
CS	1.236***	1.293***	1.242***	1.238***	1.286***	1.195***	1.211***
	(0.279)	(0.289)	(0.284)	(0.283)	(0.287)	(0.276)	(0.274)
FSbnk	0.529	0.585	0.534	0.524	0.580	0.543	0.442
	(0.527)	(0.565)	(0.530)	(0.531)	(0.550)	(0.526)	(0.476)
FSins	0.524	0.553	0.527	0.508	0.571	0.493	0.446
	(0.337)	(0.360)	(0.337)	(0.336)	(0.354)	(0.324)	(0.321)
PSacc	1.264***	1.249**	1.261***	1.198***	1.318***	1.141***	1.065***
	(0.434)	(0.505)	(0.420)	(0.416)	(0.471)	(0.383)	(0.362)
PSleg	1.069**	1.071**	1.069**	1.010**	1.128**	0.938**	0.870**
	(0.465)	(0.507)	(0.475)	(0.473)	(0.490)	(0.433)	(0.412)
TC	0.846***	0.834***	0.843***	0.824***	0.845***	0.823***	0.827***
	(0.281)	(0.293)	(0.284)	(0.282)	(0.291)	(0.273)	(0.258)
TRair	5.687***	5.669***	5.681***	5.559***	5.809***	5.500***	5.302***
	(0.924)	(1.027)	(0.903)	(0.893)	(0.982)	(0.862)	(0.780)
TRmar	2.390***	2.296***	2.381***	2.337***	2.399***	2.352***	2.425***
	(0.495)	(0.548)	(0.500)	(0.493)	(0.536)	(0.463)	(0.444)
TRrai	-0.961***	-1.008***	-0.965***	-0.976***	-0.973***	-0.941***	-1.017***
	(0.361)	(0.365)	(0.363)	(0.364)	(0.357)	(0.358)	(0.354)
TRrof	0.840**	0.845**	0.841**	0.839**	0.835**	0.826**	0.808**
	(0.387)	(0.392)	(0.390)	(0.388)	(0.391)	(0.385)	(0.376)
Observations	52 587	52 587	52 587	52 587	52 587	52 587	52 587

Notes: Standard errors in parentheses. * p < 0.1; ** p < 0.05; *** p < 0.01. The dependent variable is Ln(Exports)-Ln(Exporter GDP)-Ln(Importer GDP)+Ln(OMR)+Ln(IMR). All regressions include year fixed effects. Standard errors are clustered by importer and exporter.

Table A.6. STRI and probability of positive cross-border exports: Logit estimations

	(1) Pooled	(2) Computer	(3) Construction	(4) Accounting	(5) Legal	(6) Telecoms	(7) Air	(8) Maritime	(9) Rail	(10) Road	(11) Courier	(12) Banking	(13) Insurance
Ln(Distance)	-1.298***	-1.426***	-1.289***	-1.529***	-1.730***	-1.149***	-1.361***	-1.075***	-1.598***	-1.302***	-1.466***	-1.165***	-1.063***
	(0.158)	(0.358)	(0.178)	(0.254)	(0.392)	(0.249)	(0.227)	(0.330)	(0.205)	(0.248)	(0.218)	(0.203)	(0.170)
Contiguity	0.672***		0.239	0.230	-0.974**		1.069	1.470	0.773**	2.351***	1.452***		-0.908*
	(0.116)		(0.333)	(0.914)	(0.464)		(1.135)	(1.293)	(0.350)	(0.581)	(0.387)		(0.471)
Common language	-0.969**	1.069	-1.213**	-0.621	-0.608	-1.317**	-3.127***	-2.857***	-0.647	-2.659***	-1.483***	-0.736	0.883**
	(0.381)	(1.044)	(0.542)	(0.702)	(0.718)	(0.572)	(0.501)	(0.691)	(0.599)	(0.570)	(0.390)	(0.519)	(0.415)
Time difference	0.056**	0.028	0.045	0.014	0.008	-0.027	-0.002	0.126***	0.128***	0.088*	0.201***	0.027	0.046*
	(0.028)	(0.051)	(0.036)	(0.058)	(0.042)	(0.038)	(0.041)	(0.033)	(0.039)	(0.050)	(0.054)	(0.032)	(0.026)
Colonial history	0.459		0.586	1.745***	0.657**			3.582***	0.382	-0.196	1.378	0.908**	1.069
	(0.342)		(0.578)	(0.563)	(0.332)			(0.852)	(0.757)	(0.630)	(0.934)	(0.407)	(0.794)
Common legal	0.220*	-0.392	0.309	0.166	0.219	0.516*	0.028	0.455	-0.027	0.035	0.058	0.708***	0.529*
	(0.125)	(0.370)	(0.252)	(0.275)	(0.274)	(0.297)	(0.276)	(0.484)	(0.255)	(0.245)	(0.219)	(0.270)	(0.285)
Services RTA	-0.810***	-1.277***	-0.500***	-0.690***	-1.284***	-0.699***	-0.929***	-0.368*	-1.141***	-1.068***	-1.375***	-1.203***	-0.352***
	(0.125)	(0.265)	(0.187)	(0.210)	(0.281)	(0.199)	(0.019)	(0.221)	(0.170)	(0.210)	(0.247)	(0.213)	(0.132)
Intra-EEA	0.381	0.988**	0.830***	0.275	-0.630	-0.221	-0.636	0.643	0.699*	0.255	1.254***	0.930*	0.319
	(0.252)	(0.408)	(0.261)	(0.407)	(0.511)	(0.337)	(0.432)	(0.821)	(0.381)	(0.624)	(0.415)	(0.548)	(0.331)
Ln(Importer GDP)	0.401***	0.474***	0.649***	0.641***	0.365***	0.607***	0.423***	0.498***	0.182*	-0.041	0.408***	0.601***	0.500***
	(0.057)	(0.087)	(0.087)	(0.092)	(0.099)	(0.127)	(0.148)	(0.136)	(0.098)	(0.187)	(0.151)	(0.122)	(0.118)
Ln(Exporter GDP)	0.373***	0.542***	0.615***	0.590***	0.363***	0.441***	0.372***	0.390***	0.177*	-0.099	0.478***	0.475***	0.471***
	(0.049)	(0.073)	(0.080)	(0.110)	(0.102)	(0.113)	(0.109)	(0.146)	(0.106)	(0.152)	(0.143)	(0.090)	(0.104)
STRI exporter	-1.213**	-4.281	-1.674	-1.368	-1.940***	-2.002	-2.566*	5.156*	-0.874	-2.365	-0.276	-4.180***	-0.828
	(0.552)	(3.378)	(1.830)	(0.975)	(0.752)	(1.316)	(1.330)	(3.063)	(0.569)	(2.581)	(1.182)	(0.971)	(1.033)
STRI importer	-1.456***	1.376	1.384	-2.098***	-3.544***	-2.566*	-3.392**	1.082	-0.710	-2.051	-1.403	-1.674*	-1.229*
	(0.498)	(3.511)	(1.671)	(0.681)	(0.951)	(1.558)	(1.699)	(2.891)	(0.432)	(2.284)	(1.178)	(0.924)	(0.710)
STRI bil. agr. exp.							-0.542						
							(2.662)						
STRI bil. agr. imp.							-0.005						
							(2.628)						
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector fixed effects	Y												
Observations	64 709	5 456	5 730	5 006	5 491	4 895	5 439	4 008	5 206	5 459	4 766	5 586	5 984

Notes: Standard errors in parentheses. * p < 0.1; ** p < 0.05; *** p < 0.01. The dependent variable is a dummy variable for strictly positive bilateral exports. Standard errors are clustered by importer and exporter.

Table A.7. STRI and exports of goods by BEC category

	BEC 2	BEC 41	BEC 42	BEC 51	BEC 53	BEC 61	BEC 62	BEC 63
Log GDP	0.731***	0.912***	0.920***	1.117***	1.048***	0.814***	0.901***	0.794***
	(0.032)	(0.086)	(0.087)	(0.122)	(0.135)	(0.093)	(0.133)	(0.072)
Log exch. rate	-0.555	0.108	0.071	-10.539***	-4.654**	0.753	-0.554	-0.178
	(0.801)	(2.230)	(2.436)	(2.774)	(2.332)	(2.843)	(3.368)	(2.087)
Computer	-0.937	-3.782**	-5.096***	-6.161***	-6.322***	-3.202	-3.63	-4.487***
	(0.681)	(1.698)	(1.731)	(2.148)	(1.956)	(2.014)	(2.664)	(1.483)
Distribution	-0.795	-3.354**	-3.807**	-7.346***	-5.889***	-2.195	-1.796	-3.361***
	(0.510)	(1.480)	(1.480)	(2.002)	(1.870)	(1.664)	(2.329)	(1.162)
Banking	-0.513	-2.208**	-3.085***	-4.963***	-3.520***	-0.945	-1.51	-3.228***
	(0.381)	(1.054)	(1.115)	(1.198)	(1.137)	(1.215)	(1.649)	(0.957)
Insurance	-1.128***	-2.811***	-3.476***	-4.904***	-3.940***	-1.736	-1.804	-3.319***
	(0.405)	(0.990)	(1.087)	(0.988)	(1.102)	(1.254)	(1.786)	(1.161)
Engineering	-0.01	1.236	0.759	3.827*	3.323***	2.791**	3.143**	-0.309
	(0.501)	(1.097)	(1.149)	(2.178)	(1.217)	(1.386)	(1.324)	(1.090)
Telecoms	-0.660*	-2.891***	-3.279***	-6.035***	-3.783***	-2.893**	-3.144**	-3.746***
	(0.338)	(0.858)	(0.918)	(1.328)	(0.856)	(1.104)	(1.453)	(0.819)
Air	-0.999**	-1.748	-2.095	-3.737*	-2.539*	-2.287	-3.525*	-4.493***
	(0.495)	(1.357)	(1.471)	(1.927)	(1.411)	(1.469)	(1.922)	(1.169)
Maritime	-0.785	-3.253**	-4.265***	-3.369*	-3.605***	-2.782**	-1.873	-5.345***
	(0.684)	(1.312)	(1.303)	(1.943)	(1.161)	(1.378)	(1.682)	(1.003)
Rail	-0.215	-1.375**	-1.296*	-5.462***	-1.832***	-1.177*	-1.317*	-1.098
	(0.208)	(0.610)	(0.752)	(0.874)	(0.589)	(0.597)	(0.717)	(0.737)
Road	-1.015	-1.415	-2.213	-5.874**	-4.552*	-0.263	0.049	-2.950*
	(0.765)	(2.157)	(2.163)	(2.465)	(2.438)	(2.237)	(2.950)	(1.615)
Courier	-0.301	-2.196**	-2.581**	-4.561***	-3.366***	-1.625	-2.286	-3.000***
	(0.360)	(0.989)	(1.007)	(1.000)	(0.975)	(1.103)	(1.375)	(0.822)
R^2	0.832	0.655	0.635	0.483	0.632	0.49	0.537	0.613
N	79	79	79	79	79	79	79	79

Note: STRIs are included one by one in the regressions for each sector. The coefficients for the control variables, R^2 and N reported are from the regressions using the telecoms STRI, but take similar values in the other regressions.

Table A.8. STRI and imports of goods by BEC category

	BEC 2	BEC 41	BEC 42	BEC 51	BEC 53	BEC 61	BEC 62	BEC 63
log GDP	0.785***	0.834***	0.790***	0.828***	0.884***	0.835***	0.832***	0.747***
	(0.035)	(0.036)	(0.046)	(0.039)	(0.047)	(0.029)	(0.024)	(0.027)
log exch. rate	-0.512	-0.258	-0.14	3.542*	-0.994	1.593	0.263	0.404
	(1.035)	(0.705)	(1.308)	(1.943)	(1.066)	(0.957)	(1.025)	(0.878)
Computer	-1.443*	-1.390*	-0.873	-3.569**	-2.970***	-4.240***	-4.760***	-4.080***
	(0.726)	(0.711)	(0.936)	(1.479)	(0.964)	(0.943)	(1.103)	(1.074)
Distribution	-0.988	-1.393***	-0.701	-4.383***	-3.411***	-4.073***	-5.344***	-4.703***
	(0.670)	(0.525)	(0.863)	(1.354)	(0.808)	(0.550)	(0.535)	(0.602)
Banking	-0.598	-0.426	0.178	-2.885***	-1.615***	-3.471***	-4.104***	-3.945***
	(0.465)	(0.387)	(0.594)	(0.881)	(0.505)	(0.390)	(0.375)	(0.341)
Insurance	-0.88	-0.888**	-0.454	-3.544***	-1.590***	-3.342***	-4.051***	-3.713***
	(0.531)	(0.345)	(0.564)	(1.047)	(0.422)	(0.579)	(0.452)	(0.508)
Engineering	0.557	0.471	1.283**	-0.39	1.487*	-1.011	-1.1	-0.882
	(0.521)	(0.529)	(0.634)	(0.570)	(0.822)	(0.756)	(0.754)	(0.726)
Telecoms	-1.060**	-0.783**	-0.549	-2.488***	-2.231***	-3.063***	-3.650***	-3.358***
	(0.404)	(0.322)	(0.501)	(0.651)	(0.448)	(0.337)	(0.361)	(0.330)
Air	-0.793	-0.355	0.327	-2.306**	-1.536**	-3.408***	-3.760***	-3.940***
	(0.598)	(0.440)	(0.710)	(0.901)	(0.719)	(0.637)	(0.773)	(0.748)
Maritime	-1.199**	-0.14	-0.331	-2.024**	-1.969***	-2.860***	-3.060***	-3.622***
	(0.542)	(0.570)	(0.747)	(0.869)	(0.627)	(0.675)	(0.802)	(0.683)
Rail	-0.406	-0.512***	-0.623**	-1.700*	-1.655***	-1.313***	-1.974***	-1.958***
	(0.255)	(0.155)	(0.241)	(0.893)	(0.261)	(0.449)	(0.565)	(0.545)
Road	-0.67	-1.108*	0.299	-2.757**	-2.864***	-4.739***	-5.299***	-4.789***
	(0.870)	(0.623)	(1.134)	(1.100)	(0.792)	(0.732)	(0.876)	(0.866)
Courier	-0.687*	-0.397	-0.133	-1.406**	-1.841***	-2.311***	-2.736***	-2.963***
	(0.396)	(0.300)	(0.495)	(0.598)	(0.350)	(0.312)	(0.342)	(0.284)
R^2	0.861	0.884	0.787	0.793	0.788	0.892	0.917	0.862
N	79	79	79	79	79	79	79	79

Note: STRIs are included one by one in the regressions for each sector. The coefficients for the control variables, R^2 and N reported are from the regressions using the telecoms STRI, but take similar values in the other regressions.

The determinants of intra-industry trade

If trade was driven by product differentiation only, consumers had the same preferences and the same level of income across countries, and all countries produced all types of goods, trade would be balanced for all products. This is obviously not the case. First, a competitive fringe of homogenous or plain vanilla products exists in many markets alongside premium products. Second, a large body of research finds that consumers to some extent prefer local brands (home bias) and that lower income consumers demand relatively less premium products. Third, many countries do not produce all product categories. When assessing the possible relationship between product differentiation and services trade restrictiveness we therefore need to control for market size (GDP), income levels (GDP per capita) and the extent to which the country exports the good in question at all. The regression equation is therefore the following: $GL_i = \alpha_0 + \alpha_1 lnGDP_i + \alpha_2 lnGDPcap_i + \alpha_3 lnX_i + \alpha_4 STRI_i + \varepsilon_{is}$. Subscript *i* represents country.

Table A.9. Intra-industry trade and the STRI

The GL-index calculated at 4-digit HS level

	Pooled	HS 30	HS 60	HS 61	HS 85	HS 87
Log GDP	0.147**	0.268***	0.162**	-0.077	0.174**	0.150***
	(0.063)	(0.048)	(0.064)	(0.114)	(0.076)	(0.046)
Log GDP per capita	-0.231*	0.127	-0.275	-0.608***	-0.149	-0.388***
	(0.128)	(0.142)	(0.177)	(0.233)	(0.141)	(0.111)
Export dummy						12.114***
						(0.798)
Computer	-4.474**	-1.739	-1.744	-10.600***	-4.026*	-3.979**
	(1.913)	(1.612)	(2.636)	(2.892)	(2.199)	(1.786)
Distribution	-4.007***	-1.129	-3.048*	-10.460***	-3.544**	-3.622***
	(1.285)	(1.293)	(1.679)	(2.089)	(1.578)	(1.211)
Banking	-4.999***	-2.000*	-4.613***	-8.968***	-4.568***	-5.081***
	(1.079)	(1.064)	(1.519)	(2.164)	(1.333)	(1.006)
Insurance	-3.494***	-0.565	-1.482	-7.636***	-3.206**	-3.048***
	(1.215)	(1.179)	(1.783)	(1.804)	(1.371)	(1.121)
Engineering	1.233	0.115	0.439	2.277	0.997	1.752*
	(1.015)	(0.996)	(1.353)	(1.905)	(1.125)	(0.923)
Telecoms	-4.209***	-2.216**	-5.427***	-7.874***	-3.795***	-4.459***
	(0.881)	(0.956)	(0.931)	(1.586)	(1.025)	(0.790)
Air	-3.105**	-1.602	-4.991***	-6.281***	-2.598	-2.621*
	(1.493)	(1.150)	(1.603)	(2.320)	(1.665)	(1.492)
Maritime	-3.745***	-4.173***	-2.38	-6.734***	-3.772***	-2.788*
	(1.409)	(1.177)	(2.027)	(2.469)	(1.420)	(1.655)
Rail	-1.541**	-0.504	-1.7	-4.018	-1.279*	-2.123**
	(0.768)	(0.536)	(1.166)	(2.957)	(0.682)	(0.837)
Road	-3.202	-1.798	-2.715	-7.835**	-2.44	-2.683
	(2.015)	(1.808)	(2.358)	(3.511)	(2.342)	(1.860)
Courier	-3.671***	-2.426***	-2.537***	-6.889***	-3.609***	-3.343***
	(0.670)	(0.479)	(0.864)	(0.937)	(0.900)	(0.546)
N	10 292	535	518	1 432	4130	1 370

Note: STRIs are included one by one in the regressions for each sector. The coefficients for the control variables and N reported are from the regressions using the telecoms STRI, but take similar values in the other regressions.

Table A.10. STRI and import prices

Electronics and clothing

	HS 85		HS 61			
	robust	cluster	robust	cluster	robust	cluster
log GDP	-0.042***	-0.029	-0.081***	-0.069**	-0.070***	-0.039
	(0.011)	(0.030)	(0.008)	(0.030)	(0.008)	(0.041)
log GDP per capita	0.330***	0.352***	0.237***	0.285***	0.285***	0.304***
	(0.020)	(0.047)	(0.015)	(0.068)	(0.018)	(0.064)
Distribution	0.862***	1.605**	1.612***	2.078**		
	(0.241)	(0.714)	(0.175)	(0.893)		
Courier	0.949***	0.803**				
	(0.120)	(0.394)				
Legal					0.883***	0.922**
					(0.107)	(0.450)
R^2	0.155	0.089	0.257	0.239	0.297	0.198
N	1 599	1 599	972	972	972	972

Note: First, third and fifth column present results using robust regressions (rreg), the second, fourth and sixth column present results using standard errors clustered around 40 countries.