Services Trade Policy and Manufacturing Productivity: The Role of Institutions

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Abstract

We study the effect of services trade restrictions on manufacturing productivity for a broad cross-section of countries at different stages of economic development. Decreasing services trade restrictiveness has a positive impact on the manufacturing sectors that use services as intermediate inputs in production. We identify a critical role of institutions in importing countries in shaping this effect. Countries with high institutional quality benefit the most from lower services trade restrictions in terms of increased productivity in downstream industries. We show that the conditioning effect of institutions operates through services trade that involves foreign establishment (investment), as opposed to cross-border arms-length trade in services.

Keywords: services trade policy, foreign direct investment, institutions, productivity
JEL: F14, F15, F61, F63

1. Introduction

Increasing productivity is an essential feature of economic growth and development. A large fraction of productivity growth originates in the manufacturing sector (Van Ark et al., 2008) and depends, among others, on the availability of high-quality upstream inputs (Jones, 2011). These include machinery and intermediate parts and components, as well as a range of services inputs (Johnson, 2014).[1] Trade is an important channel through which firms can improve their access to services inputs, resulting in lower prices and/or greater input variety. The extent to which policies restrict access to foreign services inputs is therefore likely to be relevant for downstream productivity performance.

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[1] As an illustration, the average dependence on (use of) transport, telecommunications, finance and business services by US manufacturing industries is around 10%, with significant variation across industries, rising to 25% in ISIC sector 26 ('Manufacture of other non-metallic mineral products').

Recent research has assessed the impact of reductions in import tariffs on intermediate products and/or the effect of product market regulation affecting tangible goods (non-services) that are used by downstream industries.[2] A related stream of research has focused on the downstream effects of services trade policies. Using plant-level data, Arnold et al. (2011) find that reducing barriers to services trade has a positive impact on the productivity of manufacturing firms in Czech Republic. Analogous results have been established for the case of Indonesia (Duggan et al., 2013) and India (Bas, 2014; Arnold et al., 2016).[3] Whether this effect is observed more generally across countries and how it is affected by differences in economic governance are questions that motivate this paper.

Barriers to services trade are high in many countries, but there is substantial variation across economies and sectors.[4] Countries also differ in other dimensions that may impact on the magnitude and distribution of the gains from services trade liberalization. Rodriguez and Rodrik (2001) have advanced the hypothesis that the effects of trade policy reforms are sensitive to conditioning factors that vary at the country level – in particular, the quality of local institutions. Empirical investigation of this conditionality hypothesis finds that trade openness is more likely to have a positive impact on income and economic growth if the institutional context is supportive (see for instance Borrmann et al., 2006; Freund and Bolaky, 2008).

Institutions may influence the downstream effects of services trade policy in several ways in the short and medium run.[5] Reducing barriers to cross border trade may be largely ineffective if low quality institutions in the importing country – such as pervasive corruption, weak rule of law or the absence of effective regulation – create economic uncertainty and insecurity for traders and investors.[6] Similarly, removing restrictions on the ability of foreign firms to sell products locally by establishing a commercial presence (foreign direct investment) may fail to have the expected pro-competitive effect if a weak institutional and business environment in the host country inhibits foreign firms to enter the market, or, if they enter, induces them to operate inefficiently.[7]

Figure 1 presents some descriptive evidence in support of the conjecture that insti-

[2] See e.g., Amiti and Konings (2007); Goldberg et al. (2010); Estevadeordal and Taylor (2013); Bas and Causa (2013); Bas and Strauss-Kahn (2015); Blonigen (2015).

[3] The link between upstream services policies and downstream performance is not limited to trade policy measures. Arnold et al. (2008), Fernandes and Paunov (2011); Forlani (2012); Hoekman and Shepherd (2016) (using firm-level data) and Barone and Cingano (2011) and Bourlès et al. (2013) (using sector-level data) investigate the impacts on economic outcomes (productivity, inward FDI, mark-up) of other forms of regulation and policy regimes affecting upstream services sectors.

[4] The most restrictive policies are observed in the high-income Gulf Cooperation Council (GCC) countries, South and East Asia, the Middle East and North Africa. Policies are relatively more liberal in Latin America, Eastern Europe and OECD countries. Sub-Saharan Africa is somewhere between the restrictive and the more liberal regions. Professional and transportation services tend to be the most protected sectors in all countries.

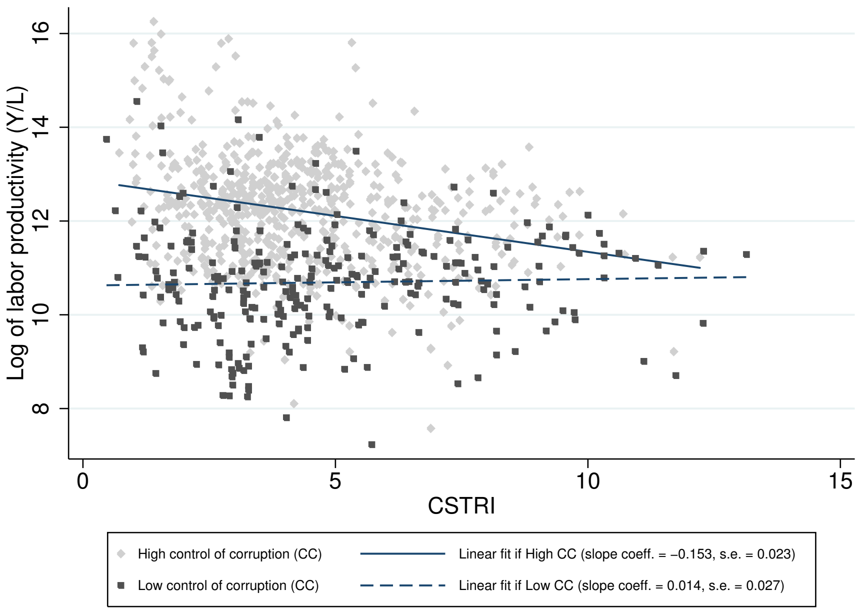
[5] In the longer run, the quality of institutions will affect the extent to which resources are (re-)allocated to sectors and activities in which a country has a comparative advantage (see Fiorini et al., 2015) and ultimately the patterns of comparative development (Acemoglu et al., 2001).

[6] Anderson and Marcouiller (2002) and Ranjan and Lee (2007) show empirically that when low quality institutions in the importing country generate insecurity in international transactions, this acts as a hidden tax on trade, reducing trade flows toward that particular destination.

[7] Macro evidence on the role of institutions as determinants of the effect of FDI on growth is presented by Busse and Groizard (2008) and Dort et al. (2014). At the micro level, a number of studies show that the productivity of firms is linked to the institutional environment in which they operate – see for example Gaviria (2002), Dollar et al. (2005), Lensink and Meesters (2014), and Borghi et al. (2015).

tutional quality matters for the impacts of services trade policy. It plots productivity in manufacturing (vertical axis) on a measure of services trade restrictiveness that takes into account the depth of input-output (IO) linkages for a range of upstream service sectors ($CSTRI$, on the horizontal axis).[8] Light dots represent manufacturing sectors in countries lying above the sample median of the variable 'control of corruption' (a measure of institutional quality); dark dots are manufacturing sectors in countries lying below this sample median. In the case of countries with high institutional quality, the (solid) regression line is negatively sloped, with a statistically significant coefficient of -0.153. Conversely, for countries with low institutional quality the slope of the (dashed) regression line is not statistically different from zero. This is suggestive that lower barriers to services trade are more likely to be associated with higher productivity in downstream manufacturing when there are strong local institutions.

Figure 1: $CSTRI$ and manufacturing productivity across institutional regimes: descriptive evidence



In this paper we use data for a sample of 57 countries at all stages of economic development to investigate the effects of upstream services trade policy on downstream

Bernard et al. (2010) find that better governance in destination countries is associated with multinational enterprises establishing more affiliates. Beverelli et al. (2015) provide some case-study evidence for the entry channel, using the example of a global telecommunications firm, Vodafone. After controlling for country size (level of GDP) and for the level of services trade restrictiveness in telecommunications, institutional quality is found to have a positive and statistically significant effect on the probability of Vodafone entering a market through establishment of a commercial presence.

[8] Each data point in Figure 1 is a country-manufacturing sector combination. The variable $CSTRI$ (Composite Services Trade Restrictiveness Index) is constructed using all modes of supply (this is discussed in greater detail in Section 2.2).

manufacturing productivity, and the role of institutions in determining the magnitude of such effects. Given that services can be exchanged through cross border trade and through establishment in a host country (FDI), both of these channels are considered. We find that the impact of services trade policies depends importantly on the quality of local institutions. Lower barriers to services trade have a statistically significant and economically meaningful effect on productivity of downstream industries in countries with good institutions. The positive effect of lower services trade barriers disappears if institutions are weak. Moreover, we find that the moderating role of institutions is likely to operate through the FDI channel, in which foreign suppliers produce and sell services locally as opposed to trade that occurs cross-border, with producers located in one country selling services to clients in another country without any factor movement occurring.

We contribute to the literature in three respects. First, we extend the empirical assessment of the effect of services trade policy on downstream manufacturing industries to a heterogeneous set of countries. Most extant research in this area comprises firm-level country-specific studies, which by construction preclude an aggregate and comparative perspective. Papers such as Barone and Cingano (2011) and Bourlès et al. (2013) adopt a cross-country empirical framework, but focus on a relatively homogeneous group of developed economies. In contrast, our sample of countries spans 27 nations classified as 'high income' by the World Bank, 16 upper middle income countries, 10 lower middle income countries and 4 low income economies. This allows consideration of heterogeneous effects across countries with very different institutional contexts and environments. Moreover, both papers mentioned above focus not on services trade policy, but on the OECD Product Market Regulation (PMR) indicator for non-manufacturing industries. This variable captures mostly domestic policies as opposed to the discriminatory feature of trade policy.[9]

Second, while the structure of the empirical model is not new to the literature, we propose an original instrument for services trade restrictions to account for the endogeneity problems common to specifications at the country-sector level. Third, to the best of our knowledge we are the first to provide a services policy-specific test of the conditionality hypothesis of Rodriguez and Rodrik (2001).

The paper is organized as follows. Section 2 discusses the empirical strategy and the data. Section 3 presents the results of the empirical analysis. Section 4 reports a battery of robustness checks. Section 5 concludes.

[9] Our paper complements Van der Marel (2016) and Hoekman and Shepherd (2016). These two studies use sector-level data with a wide country coverage to assess relevant related questions. Van der Marel (2016) finds that countries with a high level of regulatory capacity are better able to export goods produced in industries that make relatively intensive use of services. He uses a world-average trade restrictiveness measure for each service sector, with the sector-level component of the country-sector interaction term representing regulatory capacity, in line with the methodology proposed by Chor (2010), whereas we use country-level policy measures to identify and quantify the impact of services trade reforms on downstream productivity. Hoekman and Shepherd (2016) embed services trade policy into a gravity framework and show that lower restrictions to services trade lead to higher trade in manufactured goods. Our non-gravity methodology focuses on downstream productivity effects, takes into account input-output linkages and allows for heterogeneous impacts across countries.

2. Empirical strategy and data

The objective of the empirical analysis is to estimate the impact of restrictive service trade policies on productivity in downstream manufacturing industries, and assess how institutional quality affects such impacts. We focus on labor productivity as the main measure of performance, but repeat the analysis using total factor productivity (TFP) as the performance indicator as part of the robustness checks.

We follow the approach pioneered by Rajan and Zingales (1998) and assume that the effect of upstream services trade policy is a positive function of the intensity with which services are used as intermediate inputs by downstream sectors. The regressor of interest is constructed by interacting country-sector services trade restrictiveness with a measure of services input use by downstream industries derived from input-output data. For any country i and downstream manufacturing sector j, we define a composite services trade restrictiveness indicator ($CSTRI$) as follows:

$$CSTRI_{ij} \equiv \sum_{s} STRI_{is} \times w_{ijs} \tag{1}$$

where $STRI_{is}$ is the level of services trade restrictiveness for country i and services sector s and w_{ijs} is a measure of input use of service s by manufacturing sector j in country i. We define w_{ijs} as the share of total intermediate consumption, i.e. the share associated to sector s in the total consumption of intermediate inputs (both domestically produced and imported) of sector j in country i.[10] The baseline regression is then:

$$y_{ij} = \alpha + \beta CSTRI_{ij} + \boldsymbol{\gamma}' \mathbf{x}_{ij} + \delta_i + \delta_j + \epsilon_{ij} \tag{2}$$

where the dependent variable is a measure of productivity of downstream manufacturing sector j in country i; δ_i and δ_j are respectively country and downstream sector individual effects; and $\mathbf{x}_{ij}$ is the column vector of relevant control variables at the country-sector level.

The coefficient β in model (2) is expected to be negative. Consider a decrease in the variable $CSTRI$ as an inflow of a factor of production – high quality services – from abroad. In the short run, this factor will be absorbed by all sectors. With a neoclassical production function, the marginal productivity of other production factors will increase, with a consequent increase in total factor productivity (TFP). In the longer run, the Rybczynski theorem suggests that service-intensive industries will expand, absorbing productive resources (including domestic services) from less service-intensive industries, which will contract. Labor productivity and TFP will increase in service-intensive (expanding) industries, while it should not be affected in contracting industries, as they keep the same input mix as before the services liberalization. Since β is the average effect across expanding industries – where y should be negatively associated with $CSTRI$ – and contracting industries – where the association should be null – β is expected to be negative.

To assess the potential role of institutional variables in moderating the effect of services trade restrictiveness on downstream productivity, we allow for heterogeneous effects

[10] A formal definition of the shares of intermediate consumption from the IO tables is provided in the online appendix.

of the regressor of interest across country-level measures of institutional quality. Accordingly, we propose the following interaction model:

$$y_{ij} = \alpha + \beta CSTRI_{ij} + \mu(CSTRI_{ij} \times IC_i) + \boldsymbol{\gamma}'\mathbf{x}_{ij} + \delta_i + \delta_j + \epsilon_{ij} \tag{3}$$

where IC_i is a continuous proxy for the prevailing institutional context in country i.[11] In this second specification, the impact of service trade restrictiveness is given by $\beta + \mu IC_i$ and therefore varies at the country level depending on the quality of local economic governance. Consistent with both the cross-border trade and the FDI channels outlined in Section 1, the coefficient μ should be negative (the negative effect of $CSTRI$ on y should be larger in countries with a better institutional environment).

2.1. Identification

Identification of the causal link from the composite measure of services trade restrictiveness ($CSTRI$) to manufacturing productivity is conducted in several steps. First, all regressions are estimated including country fixed effects and sector dummies. This neutralizes the risk of unobserved confounding factors varying at the sector-level, such as factor-intensity, or at the country-level, such as the country-level component of the productivity of the domestic services sectors.[12]

Second, we include in the empirical specification a measure of trade policy towards non-services inputs. Better access to high quality intermediate goods that embody international technology is likely to have a positive effect on productivity in those sectors where such inputs are relevant (i.e., that use such inputs relatively intensively). Insofar as downstream sectors lobby for policies that affect their input markets, this should encompass both services and goods. We control for trade restrictiveness pertaining to relevant non-services inputs by adding as a covariate a measure of average tariff protection across upstream manufacturing sectors, weighted by input intensity coefficients. Specifically, we include the variable

$$CTau_{ij} \equiv \sum_k \log(1 + \tau_{ik}) \times w_{jk} \tag{4}$$

where τ_{ik} is the (simple average) MFN tariff in country i and manufacturing sector k and the weights w_{jk} are the input penetration coefficients of k in j derived from the US IO table.[13] We discuss the robustness of the estimates to the inclusion of other relevant controls varying at the country-sector level in Section 3.1 below.

Third, there are lobbying mechanisms that potentially could lead to endogeneity of services trade policy. One is the possibility that the impact channel from the productivity

[11] We do not include the main effect of IC_i in equation (3) as it is accounted for by the country specific effects.

[12] More productive domestic services sectors are likely to offer higher quality services inputs at a lower price, increasing the productivity of downstream industries. Domestic services providers might have incentives to coalesce into a lobby to obtain protection from foreign competitors in the form of higher barriers to services trade (Fiorini and Lebrand, 2016), but this mechanism does not trigger any variability across the manufacturing sector dimension. Thus, the potential effect of domestic services productivity is controlled for by the country fixed effects.

[13] The definition of the input intensity weights is identical to the one introduced above for the variable $CSTRI$ (equation (1)). The choice of the US as a source country for IO data is discussed below.

of domestic services sectors to services trade policy (the policy component of $CSTRI$) goes through lobbying activity by the manufacturing industries, and therefore varies with services input intensity. In countries where the domestic services sector is characterized by low productivity, services intensive manufacturing industries may lobby for fewer restrictions on services trade. This would imply a positive correlation between the productivity of domestic services sectors and $CSTRI$ and – as a consequence – a positive sign for the omitted variable bias.

Another potential lobbying mechanism is that downstream productivity – or lack thereof – could affect the degree of trade liberalization for upstream industries, generating a problem of reverse causation. If low productivity downstream industries lobby for deeper upstream liberalization, an estimated negative coefficient would be biased toward zero.[14] If instead high productivity manufacturing industries are the ones with the incentives and capabilities to exert effective lobbying pressure for greater services trade openness, the sign of the simultaneity bias would be undetermined a priori for an estimated negative coefficient and negative in the case of an estimated positive coefficient.

To account for both the potential omitted variable and the reverse causation problems, we propose an instrument for $CSTRI$ to correct for the endogeneity of its policy component. Section 3.2 discusses the construction of the instrument and the results of two stage least squares (2SLS) regressions using the instrument.

Finally, the intensity of services consumption by a downstream manufacturing sector may be affected by the degree of services trade restrictiveness. Less restrictive services trade policies may enhance downstream intermediate consumption. In this case, the number of manufacturing industries for which the 'treatment' (lower trade restrictiveness in the services sector) is likely to have more bite would be increasing with the treatment itself. Moreover, the intensity of services consumption by a downstream manufacturing sector may also be affected by productivity in the manufacturing sector. This is because more productive manufacturing sectors are likely to consume higher quality and more differentiated services. In this second case, we would have an issue of reverse causality. Killing two birds with one stone, we measure w_{ijs} of any country i with the input penetration of service s into industry j for country $c \neq i$.

We adopt the assumption widely used in the literature following Rajan and Zingales (1998) and take the United States' IO linkages as representative of the technological relationships between industries.[15] In the baseline estimations, we therefore set $c =$ US and remove the US from the sample. The use of the US IO linkages as representative of technological relationships between services inputs and downstream manufacturing use is motivated by three observations: i) the US is a relatively liberal economy with regard to the restrictiveness of services regulation (ranking 29$^{\text{th}}$ out of 103 countries included in the World Bank STRI database); ii) it represents a generally business friendly environment,[16] which minimizes the possibility that other national regulations significantly influence these linkages; and iii) the US is a very diversified economy in terms of production of

[14] In this case the coefficient estimate would have to be interpreted – at worst – as a lower bound for the impact of services trade restrictiveness on manufacturing productivity, conditional on downstream lobbying (this argument is discussed in Bourlès et al., 2013). The same argument applies for the omitted variable bias discussed above.

[15] The adoption of the US as a reference country for IO data is common to the main studies featuring a cross country framework in this literature (Barone and Cingano, 2011; Bourlès et al., 2013).

[16] The US was ranked third in 2009 in terms of ease of doing business by the World Bank.

manufactured products, which assures representativeness across all covered downstream sectors.

Using US IO linkages has, however, a number of potential pitfalls, especially in an empirical framework that covers a substantial number of heterogeneous countries. The assumption that a unique set of technological linkages applies across the 57 countries in the sample may be questioned. The structure of the US economy differs substantially from a number of other countries in terms of availability of skilled labor, infrastructure endowments and quality, and other economic features that are important in framing inter-industry linkages. There is therefore clearly a trade-off between the benefits of addressing the endogeneity problem and the loss of measurement precision associated with the application of US IO data to all countries in the estimation sample. While this represents a limitation of the empirical approach, we believe the use of US data is a good compromise in dealing with this trade-off. Section 4.3 further addresses this important concern by assessing the robustness of our findings to alternative approaches, including the use of China's IO coefficients to represent the relationships between sectors.

2.2. Data

Given the interest in the role of institutions in shaping the effects of services trade policy, data on the restrictiveness of services policies and country level institutional performance are needed. The World Bank's Services Trade Restrictiveness Database provides information for a broad set of countries (103 economies) on policies affecting services imports (Borchert et al., 2014). It includes measures affecting market access as well as policies that breach the national treatment principle (for example, domestic regulations that discriminate against foreign providers of services). The Services Trade Restrictiveness Index (STRI) covers five services sectors – financial services (banking and insurance), telecommunications, retail distribution, transportation and professional services (accounting and legal) – and the most relevant modes of supplying these services. These are commercial presence or FDI (mode 3) for all of these sub-sectors; cross-border supply (mode 1) for financial, transportation and professional services; and temporary cross-border movement of service-supplying individuals (mode 4), for professional services only (see Borchert et al., 2012, for a detailed description of the database).[17]

We derive the preferred versions of the $CSTRI$ variables using alternatively the STRI aggregated across all covered modes, and the STRI for mode 3. The latter has the greatest sectoral coverage, but is also of economic interest given that the characteristics of services often will require FDI for firms to be able to sell services in a foreign market. We follow Barone and Cingano (2011) and exclude retail distribution for the construction of the $CSTRI$ variables.[18] All STRI variables take values from 0 (maximum openness) to 100 (maximum restrictiveness) and they do not vary over time. The indicators capture the prevailing policy regimes in the mid-2000s.

[17] The focus on the effects of importing countries' institutions implies that the absence of information on supply of services via the cross-border movement of consumers (in WTO-speak, mode 2, i.e. consumption abroad) in the STRI database is not a constraint.

[18] The retail distribution sector is likely to matter mainly for consumption rather than for downstream production. The STRI database does not include information on policies affecting trade in wholesale services.

Data on services input intensity come from the mid-2000s OECD STAN IO Tables, where sectors are mapped to the ISIC Rev. 3 classification and aggregated to the 2 digit level. Productivity measures are constructed using data from the UNIDO Industrial Statistics Database. The data vary across countries, years and manufacturing sectors (ISIC Rev. 3). A key feature of the UNIDO database is that it provides the widest country coverage compared to alternative sources, such as EU KLEMS or OECD STAN.[19] In the baseline estimations, we use the natural logarithm of labor productivity in 2007 as a measure of industry productivity. A battery of robustness checks employing average productivity measures spanning several years, as well as estimations using TFP as the measure of productivity performance, are provided in Section 4.

As our proxies for productivity are revenue based (the UNIDO Database provides only information on sales, not physical output), the well-known problem arises of turnover being an imperfect measure of productivity when there is a wedge between prices and marginal costs over the business cycle (Hall, 1988), or in responses to trade policy reforms (De Loecker, 2011; De Loecker et al., 2016). Thus, we recognize there will be a degree of imprecision in the productivity measures.[20]

Data on institutional variables are from the World Bank's Worldwide Governance Indicators. In the baseline empirical analysis we use control of corruption as a measure of the institutional environment; other governance indicators (rule of law and quality of regulation) are used in the robustness checks. Tariff data are from UNCTAD TRAINS.

Section 3.1 presents robustness checks that include measures of comparative advantage related to physical capital, human capital and R&D. Sector level physical and human capital intensity are sourced from the NBER-CES Manufacturing Industry Database. In this database, sectors are classified using the 1987 4-digit SIC classification. We use a concordance table to map 4-digit SIC to 4-digit ISIC Rev. 3,[21] and average the resulting physical and human capital intensity data across 4-digit sectors within each 2-digit sector (or aggregation of sectors) used in the analysis. R&D intensity data are sourced from the OECD's BERD ('Business enterprise R&D expenditure by industry') dataset, which does not require any concordance.

The estimation sample includes 57 countries and up to 18 manufacturing sectors (listed in table A-1 in the Appendix). A description of all the variables used in the estimations, including the data sources, is provided in table A-2 of the Appendix. Summary statistics for key variables used in the analysis are reported in Table 1.

3. Results

The main estimation results for the baseline specification (2) and the interaction model (3) are given in Table 2. The first two columns use the STRI measure aggregated across all modes of supply, while the last two columns focus on measures applying to trade occurring through Mode 3 (FDI). The estimated coefficient for the composite

[19] The EU KLEMS database covers Australia, Japan, the US and 25 EU countries (O'Mahony and Timmer, 2009). The OECD STAN database covers 33 OECD countries.

[20] Revenue-based productivity measures combine quantity-based productivity and prices, and thus tend to understate the variation in producers' physical efficiencies (see Syverson, 2011).

[21] Available at Jon Haveman's Industry Concordances webpage, `http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeConcordances.html`.

Table 1: Summary statistics (key variables)

Variable	obs	mean	median	sd	min	max
y	912	11.486	11.483	1.364	7.170	16.195
$CSTRI$ (All modes)	912	4.554	4.012	2.461	0.467	20.047
$CSTRI$ (Mode 3)	912	4.348	3.609	2.918	0.000	22.620
IC	912	2.922	2.734	1.008	1.259	5.025
$CTau$	912	0.064	0.048	0.049	0.004	0.307

From estimation sample of Table 2

y = log of labor productivity (output per worker)

$CSTRI$ is defined in equation (1)

IC = Institutional Context proxied by control of corruption

$CTau$ is defined in equation (4)

measure of services trade restrictiveness has the expected negative sign in the baseline specification for both 'All modes' in column (1) and 'Mode 3' in column (3) of Table 2: less restrictive policy environments are associated with higher productivity in downstream manufacturing sectors. In both cases, however, the estimate is not statistically different from zero.

Moving to the interaction model, we find a statistically significant, negative coefficient for the interaction term. Thus, lower services trade restrictiveness is associated with higher downstream manufacturing productivity, with the estimated effect increasing with country-level institutional capacity. The results of the interaction model suggest that the lack of statistical significance in the baseline specification is driven by a composition effect. The coefficient on $CTau$ is negative, although not statistically significant. Higher tariff protection on manufacturing inputs seems to be only weakly associated with lower productivity of downstream manufacturing industries.

The role of institutions in the Mode 3 case is further illustrated in Figure 2.[22] For 95% of the sample the effect of $CSTRI$ has the expected negative sign and, for 65% of the observations (associated with 33 countries with a level of control of corruption above 2.4), the effect is statistically significant at the 0.05 level. The positive productivity effect of lower trade restrictiveness in upstream services sectors increases with institutional quality. The effect is not statistically different from zero for countries with weak institutional environments (35% of the sample).

Finally, a placebo test is conducted by replacing the values of the variable $STRI$ with random draws from a uniform distribution defined on the same support. The results of such an exercise is presented in the online appendix and indicate that the moderating role of institutions is not observed when replacing the policy 'treatment' (services trade restrictiveness) with a measure reflecting nothing but random variation.

[22] The figure reports marginal effects evaluated at 39 values of the control of corruption variable and 95% confidence intervals. The latter are calculated using the Delta method.

Table 2: Baseline and Interaction Model Estimation

	All modes		Mode 3	
	(1)	(2)	(3)	(4)
$CSTRI$	-0.018	0.057	-0.032	0.054*
	(0.023)	(0.037)	(0.020)	(0.031)
$CSTRI \times IC$		-0.035***		-0.037***
		(0.013)		(0.012)
$CTau$	-0.516	-0.465	-0.477	-0.441
	(1.068)	(1.047)	(1.068)	(1.056)
Observations	912	912	912	912
R-squared	0.581	0.583	0.582	0.585

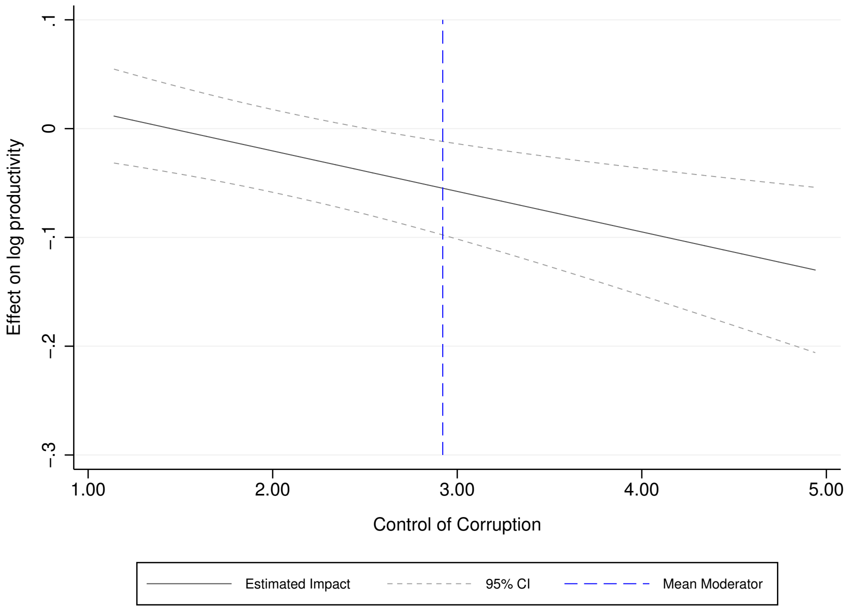
Robust (country-clustered) standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Country fixed effects and sector dummies always included

IC = Institutional Context proxied by control of corruption

Figure 2: Impact of a one unit increase in $CSTRI$ (Mode 3) on the downstream log productivity y



3.1. Adding country-sector controls

An obvious concern that arises is whether the results in Table 2 are in part due to country-industry characteristics that contribute to determining manufacturing productivity performance. Such factors may include the trade policy that applies to manufacturing industries and differences in comparative advantage across countries as reflected in endowments of physical, human and knowledge capital.[23] To consider the robustness of the results we control for merchandise trade policy by constructing the 'output' tariff $OTau_{ij}$ as the weighted average of tariffs faced in each export market $c \neq i$ for manufacturing sector j, with weights given by import shares.[24] An implication of the Melitz (2003) model is that trade protection in own and export markets negatively correlates with average industry productivity. The results reported in columns (1)-(2) of Table 3 confirm the negative effect of tariffs in export markets on productivity, both in the regressions with all modes (panel (a)) and in the regressions with mode 3 only (panel (b)).[25]

We incorporate measures of comparative advantage of country i in sector j following Romalis (2004), where comparative advantage is defined as the product between country-level endowment of a productive factor and sector-level intensity in the use of that factor. We consider three factors that are likely to be related to manufacturing productivity: physical capital, human capital and R&D. The comparative advantage variables are computed relative to the US – which continues to be excluded from the sample. Accordingly, the variable K_{ij} is equal to the capital stock (per million people) of country i relative to the capital stock (per million people) of the US, times the capital intensity of sector j in the US. Similarly, the variable H_{ij} is equal to the human capital index of country i relative to the human capital index of the US, times the human capital intensity of sector j in the US, and the variable $R\&D_{ij}$ is equal to the stock of researchers engaged in R&D (per million people) of country i relative to the stock of researchers in R&D (per million people) of the US, times the R&D intensity of sector j in the US.[26]

The results are reported in columns (3)-(8) of Table 3. All the comparative advantage measures have the expected positive sign, although they fail to reach statistical significance. The magnitude of the coefficient of interest on $CSTRI \times IC$ remains similar to the baseline estimations of Table 2. The only exception is column (8), where the use of $R\&D$ reduces the sample size by 35%. In this case, the coefficient on $CSTRI \times IC$ loses statistical significance in panel (a) (all modes). In panel (b), despite shrinking by 40% relative to the baseline case of column (4) of Table 2, the coefficient remains negative

[23] We are grateful to the referees for suggesting the different controls we apply in what follows.

[24] That is, $OTau_{ij} \equiv \sum_{c \neq i} \log(1+\tau_{icj}) \times s_{ijk}$, where τ_{icj} is the tariff imposed by country c vis-à-vis country i's exports in sector j, and s_{ijc} is the share of imports from country c in sector j in total manufacturing imports of country i.

[25] The import tariff imposed by country i in sector j should also negatively correlate with productivity. This variable is included in the construction of $CTau$. We have also performed regressions with own tariff ($\log(1+\tau_{ij})$) and a version of $CTau$ that only includes sectors $k \neq i$, $\widetilde{CTau}$. The results, available upon request, are very similar to those of Table 3, with a negative and statistically significant coefficient on $OTau$, and a negative (although not statistically significant) coefficient on own tariff and on $\widetilde{CTau}$. The magnitude and statistical significance of the coefficient of interest (the interaction between $CSTRI$ and IC) remains unchanged.

[26] See section 2.2 and Appendix table A-2 for a description of the data sources used.

and statistically significant.[27]

Finally, an additional specification is estimated (column (9)) to perform two further robustness checks. First, to test that the role of institutions in shaping the downstream effect of services trade policy is not driven by correlated moderating mechanisms, we assess the robustness of the estimated coefficient for the $CSTRI \times IC$ term to the inclusion of other interactions between the trade policy measure ($CSTRI$) and country characteristics that are correlated with institutional quality. We use three such variables: the level of financial development ('fin dev'), defined as the ratio of central bank assets to GDP, and the human capital and the physical capital stock, both obtained from the Penn World Tables. Second, we check that the impact of institutions on the effect of services trade policy is robust to controlling for the analogous role that institutions may play in moderating the productivity effect of other relevant trade policies (import tariffs on inputs and manufactured products) as well as standard country-industry productivity determinants such as K_{ij} and H_{ij}.

As shown in column (9) of Table 3, the sign and magnitude of the estimated coefficient for $CSTRI \times IC$ is robust to this augmented specification. Statistical significance remains within the standard threshold (p value equal to 0.053) for the case of mode 3 services trade (panel (b)), while the p-value for the estimated coefficient of the term $CSTRI \times IC$ in the mode 1 specification (panel (a)) is very close to the standard threshold for statistical significance (p value of 0.105).

The estimated coefficients for the three additional interaction terms are much closer to zero than the estimated coefficient for $CSTRI \times IC$ and never attain statistical significance. This suggests the effect of institutions dominates the potential moderating role of other dimensions of economic development, such as financial development or human capital. The lack of statistical significance of the estimated coefficients for the other interaction terms involving IC indicates that the (potential) moderating role of institutions for the effects of goods-related trade policies and standard productivity determinants is not a factor underlying our results.

3.2. Instrumenting for services trade restrictiveness

As noted in Section 2, there are reasons one might be concerned with potential endogeneity of the $CSTRI$ measures as a result of the policy component of $CSTRI$. In the spirit of Arnold et al. (2011, 2016), we propose an instrumental variable approach that exploits information on services trade policy adopted by other countries. Our instrument – $CSTRI^{IV}$ – is constructed by replacing the policy component $STRI_{is}$ with a weighted average of $STRI_{cs}$ in other countries $c \neq i$. We define this weighted average as:

$$STRI_{is}^{IV} \equiv \sum_{c} STRI_{cs} \times SI_{ci} \tag{5}$$

where $SI_{ic} \equiv 1 - \left\{\frac{pcGDP_i}{pcGDP_i + pcGDP_c}\right\}^2 - \left\{\frac{pcGDP_c}{pcGDP_i + pcGDP_c}\right\}^2$ is an index of similarity in GDP per capita between two countries i and c.[28]

[27] The results of regressions including all the comparative advantage variables in the same estimation are very similar those presented in Table 3, and are available upon request.

[28] We take the definition of the similarity index from Helpman (1987).

Table 3: Additional controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel (a): all modes									
$CSTRI$	-0.019	0.055	-0.017	0.072*	-0.013	0.062	-0.034	-0.000	0.228
	(0.023)	(0.037)	(0.024)	(0.041)	(0.025)	(0.042)	(0.023)	(0.037)	(0.445)
$CSTRI \times IC$		-0.034**		-0.042***		-0.034**		-0.015	-0.030
		(0.013)		(0.015)		(0.014)		(0.013)	(0.018)
$CTau$	-0.522	-0.472	-0.955	-1.035	-0.959	-0.901	-0.881	-0.903	0.252
	(1.043)	(1.022)	(1.125)	(1.106)	(1.122)	(1.100)	(1.180)	(1.175)	(3.325)
$OTau$	-1.665**	-1.640**							-0.922
	(0.687)	(0.682)							(2.695)
K			1.167	1.541					4.985
			(0.956)	(0.987)					(3.515)
H					7.201	7.397			3.610
					(4.913)	(4.837)			(9.568)
$R\&D$							0.947	1.070	
							(0.615)	(0.640)	
$CSTRI \times$ fin dev									0.001
									(0.002)
$CSTRI \times$ human capital									-0.001
									(0.040)
$CSTRI \times$ capital stock									-0.007
									(0.021)
$CTau \times IC$									-0.808
									(1.192)
$OTau \times IC$									-0.051
									(0.771)
$K \times IC$									-0.657
									(0.826)
$H \times IC$									0.969
									(1.566)
Observations	912	912	912	912	866	866	595	595	848
R-squared	0.584	0.586	0.582	0.585	0.588	0.590	0.748	0.749	0.591
Panel (b): mode 3									
$CSTRI$	-0.032	0.053*	-0.032	0.067*	-0.029	0.058	-0.042*	0.012	0.097
	(0.020)	(0.030)	(0.020)	(0.033)	(0.021)	(0.036)	(0.022)	(0.032)	(0.424)
$CSTRI \times IC$		-0.037***		-0.042***		-0.036***		-0.022**	-0.031*
		(0.012)		(0.013)		(0.013)		(0.011)	(0.016)
$CTau$	-0.484	-0.449	-0.914	-1.004	-0.920	-0.875	-0.854	-0.883	0.564
	(1.042)	(1.029)	(1.122)	(1.111)	(1.123)	(1.107)	(1.200)	(1.200)	(3.314)
$OTau$	-1.662**	-1.648**							-0.749
	(0.686)	(0.683)							(2.701)
K			1.165	1.513					5.168
			(0.951)	(0.966)					(3.439)
H					6.797	6.210			3.923
					(4.964)	(4.990)			(9.510)
$R\&D$							0.886	0.951	
							(0.625)	(0.636)	
$CSTRI \times$ fin dev									0.002
									(0.002)
$CSTRI \times$ human capital									-0.005
									(0.040)
$CSTRI \times$ capital stock									-0.002
									(0.021)
$CTau \times IC$									-0.906
									(1.189)
$OTau \times IC$									-0.124
									(0.776)
$K \times IC$									-0.748
									(0.796)
$H \times IC$									0.545
									(1.552)
Observations	912	912	912	912	866	866	595	595	848
R-squared	0.585	0.588	0.583	0.587	0.589	0.591	0.750	0.750	0.592

Robust (country-clustered) standard errors in parentheses
* $p<0.10$, ** $p<0.05$, *** $p<0.01$
Country fixed effects and sector dummies always included
IC = Institutional Context proxied by control of corruption

The similarity index gives more weight to the policies adopted in countries with levels of economic development that are closer to that of the reference country i. The choice of this weighting system is based on the following rationale. Countries with similar levels of per capita GDP will likely have similar sectoral shares and similar forces shaping the political economy of trade policy. As a result, we expect the similarity weight in GDP per capita to increase the predictive power of the instrument for $CSTRI$. Evidence of the instrument's relevance is reported in the online appendix.

In order to satisfy the exclusion restriction the instrument must be at least as good as one that is randomly assigned in the reduced form model, that is, exogenous to productivity of manufacturing sectors in country i. A first potential violation of this condition can arise again through a lobbying channel. If services trade policy in country c responds to that of country i because of reciprocity or other negotiation linkages in the context of a trade agreement, lobbying motives coming from manufacturing sectors in i could affect the policy outcomes in c. As a result, the same endogeneity problems discussed for $CSTRI$ would apply to the instrument. Moreover, the productivity of manufacturing sectors in country i may respond to services trade policy in country c through channels that are not captured by $CSTRI$, such as international competition between countries. Consider a services trade policy reform in c that affects the productivity of manufacturing sectors in that country. If competition between c and i is strong enough (at least for some manufacturing sectors), country i's manufacturing productivity may react to the productivity change in c.

To minimize the impact of such trade policy linkages and effects of international competition between country i and other countries c, we select only c countries that: (i) are not member of any PTA (existing or notified to the WTO at some point between 2000 and 2007) that includes country i; and (ii) do not belong to the same geographical region as that of country i.[29]

One limitation of our instrument is that the SI weights might reflect unobserved determinants of productivity and therefore their application might create a link between the instrument and the dependent variable which does not go through the regressor of interest. This would violate the exclusion restriction. While the application of the SI weights remains our preferred approach, the 2SLS results presented below (Table 4) remain robust when the SI-weighted average is replaced by an unweighted average.

The results of the 2SLS estimation of the baseline and interaction model are presented in Table 4, together with the standard tools for weak identification diagnostics.[30] The Sanderson-Windmeijer (SW) tests[31] confirm the relevance of the instrument across specifications. Analogous conclusions obtain from the values of the Cragg-Donald (CD)

[29] We use geographic regions as defined by the World Bank.

[30] In the interaction model there are technically two endogenous regressors, $CSTRI$ and $CSTRI \times IC$. The excluded instruments are given in this case by $CSTRI^{IV}$ and $CSTRI^{IV} \times IC$. Given that the second endogenous regressor – $CSTRI \times IC$ – is just the interaction of the truly (potentially) endogenous regressor ($CSTRI$) and an exogenous variable (IC), there is still only one causality problem to be tackled. Exogeneity of IC is guaranteed by the country level fixed effects (present in both the first stage and in the reduced form regressions) which control for any possible factor confounding the relationship between IC and productivity. Moreover, reverse causality issues are fairly minimal to this statistical relationship given that IC represents institutional features of the economy which are likely to be unaffected by manufacturing productivity in the late 2000s.

[31] The test statistics are derived in Sanderson and Windmeijer (2016) and are consistent with the diagnostic approach presented in Angrist and Pischke (2008).

F statistic, which are always well above the corresponding critical values tabulated in Stock and Yogo (2005) (SY). The same is true, in the interaction models, for the heteroskedasticity robust F statistic introduced by Kleibergen and Paap (2006) (KP).[32]

The 2SLS results are quantitatively very similar to those of Table 2. The magnitude of the estimates are preserved when $CSTRI$ is instrumented. The coefficients of both the baseline and the interaction model become bigger (in negative terms) for the 'All modes' models. In this case, the estimates of Table 2 appear biased toward zero, which, in the context of this analysis, implies a conservative assessment of both the impact of $CSTRI$ on productivity and of the moderating role of institutions. The 2SLS analysis indicates that the Table 2 estimates are a reliable (and conservative) benchmark insofar as endogeneity bias is either absent or results in a slight reduction of the estimated impacts.[33]

3.3. Quantification

The above analysis provides support for using the benchmark estimates of Table 2 as the basis of a quantification exercise. Our methodology permits quantifying the effect of services trade policy on the productivity of individual downstream industries, but not on overall downstream productivity. However, the sign of the estimated coefficient on $CSTRI$ in the baseline model, as well as that of the estimated marginal effects in the interaction model, provide a qualitative assessment of the impact of increasing services trade policy restrictions which applies to all downstream industries (at any non zero level of services input intensity).

To quantitatively assess the downstream effect of services trade policy we use the estimates of the interaction model given in column (4) of Table 2 and calculate the productivity changes associated with complete removal of the restrictions to services trade through commercial presence.[34] The actual policy change implied by such a hypothesized liberalization varies significantly across countries, both in terms of magnitude and in terms of services sector coverage. Descriptive evidence on actual policies is provided in the online appendix. This demonstrates that for many countries elimination of all restrictions to mode 3 services trade would entail an important policy change for many if not most services sectors.

The estimated effect of eliminating mode 3 services trade restrictions varies across downstream manufacturing industries depending on their services input use. As measures of services input use adopted for the quantification exercise are derived from the input-output table for the US (the reference country), the variation due to different input intensities of downstream sectors is the same across countries. Therefore, the two factors

[32] The SY critical values are tabulated under the assumption of conditional homoskedasticity making the comparison of the KP values with the SY critical thresholds not fully consistent. We still report the values of KP for the interaction models for the sake of completeness. In the case of the baseline specifications with only one endogenous regressor, KP is equal to the SW F statistic.

[33] An additional validation of our conclusions regarding the reliability of Table 2 estimates comes from the heteroskedasticity-robust endogeneity test implemented by the STATA command xtivreg2 (see Baum et al., 2002). For the 'All modes' baseline specification we cannot reject the null hypothesis of non-endogeneity at a 5% percent level of statistical significance, for all the other models we cannot reject even at a 10% percent level.

[34] The focus on mode 3 instead of all modes is intended to restrict the set of policy instruments which are relevant for the counterfactual elimination of all restrictions.

Table 4: 2SLS regressions

	All modes		Mode 3	
	(1)	(2)	(3)	(4)
$CSTRI$	-0.221*	-0.033	-0.032	0.028
	(0.129)	(0.082)	(0.066)	(0.069)
$CSTRI \times IC$		-0.054**		-0.038**
		(0.022)		(0.017)
$CTau$	-0.145	-0.199	-0.476	-0.381
	(1.057)	(1.014)	(1.007)	(0.991)
Observations	912	912	912	912
R-squared	0.518	0.540	0.553	0.556
First-stage Weak Identification Test (SW F stat)				
$CSTRI$	12.73	43.82	36.26	61.73
(p-value)	0.00	0.00	0.00	0.00
$CSTRI \times IC$		47.67		204.01
(p-value)		0.00		0.00
CD F stat (and SY critical values at x% maximal IV size)				
CD F	53.56	36.70	115.98	54.85
SY (x=10)	16.38	7.03	16.38	7.03
SY (x=15)	8.96	4.58	8.96	4.58
KP F stat (heteroskedasticity robust)				
KP		10.16		15.98

Robust (country-clustered) standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Country fixed effects and sector dummies always included

that shape cross-country differences in productivity effects for a given manufacturing sector are (i) the actual policy change required to eliminate services trade restrictions; and (ii) the local institutional context.

The percentage change in productivity implied by setting services trade restrictiveness equal to zero is given by:

$$\%\Delta Y_{ij} = 100 \times \big(\beta + \mu \times IC_i\big) \times \big[\sum_s (0 - STRI_{is}) \times w_{js}\big] \quad (6)$$

where Y_{ij} is productivity without the log transformation. Figure 3 plots the distribution of $\%\Delta Y_{ij}$ computed on the 912 country-sector pairs used in the estimation. The few negative values are associated with positive marginal effects of $CSTRI$ when the institutional context is very weak. Positive but low productivity effects reflect low services input intensity from the sectoral dimension, low restrictions to services trade and low institutional quality from the country dimension. In contrast, very high values of $\%\Delta Y_{ij}$ (which can amount to more than a doubling of productivity) are likely to obtain in sectors with high services input intensity and countries where there are both significant services trade restrictions and a robust enough institutional context. Examples where this is the case include Uruguay, Botswana, Jordan, Qatar, Canada, Austria, Germany and France. The average productivity effect is a 22% increase.

Figure 3: Distribution of $\%\Delta Y_{ij}$

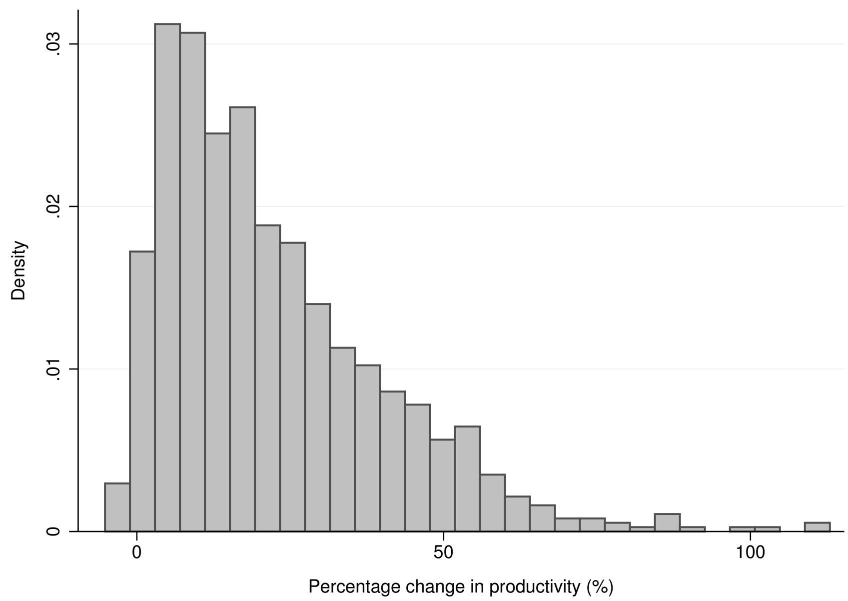


Table 5 presents the results of the quantification exercise. Column (1) reports the effects in each country of eliminating restrictions to mode 3 services trade for the manufacturing sector generating the highest average value added in the period 2000-2007,[35] as well as the statistical significance of the estimated marginal effect given the prevailing level of institutional quality. The manufacturing sectors' ISIC Rev. 3 codes are reported in column (2). The effects are larger the higher initial levels of (weighted) services trade restrictiveness and the better the institutional context. Consider Botswana as an illustration. The elimination of barriers to mode 3 services trade in this country implies far-reaching liberalization, especially for the telecommunication and transport sectors.[36] Such a policy change, in conjunction with with the relatively strong institutional context that prevails in Botswana, generates a statistically significant potential

[35] For Ukraine there are no value added data reported in the UNIDO database. In this case we take the sector with the highest average output.

[36] See Figure 3 of the online appendix.

productivity increase of 35% in the sector with the highest average national value added during the 2000-2007 period. This productivity effect is 20 percentage points greater than the median productivity change associated with the same policy reform in other countries for their respective highest value-added sectors. However, it is still some 26 percentage points lower than the maximum effect observed in the sample (for Canada).

To facilitate cross-country comparisons, columns (3)-(5) focus on the same manufacturing sector, and compare the productivity effect in each country for this sector with that of a benchmark economy (column (3)). The effect is decomposed into two parts. The first (column (4)) reflects heterogeneity in services trade restrictiveness, which implies that a different policy change is needed in each country to attain full liberalization. The second (column (5)) reflects heterogeneity in the institutional context that prevails across countries. We choose Italy as the benchmark economy for this exercise, and focus on the sector 'fabricated metal products except machinery and equipment' (ISIC Rev. 3 code 28). This is the sector for which the average level of services input use is equal to the median across all manufacturing sectors in the sample.

Column (3) reports the difference in the productivity effect with respect to the one estimated for Italy, $\%\Delta Y_{ITA} = 18\%$, while column (4) reports the difference in productivity effects after aligning the institutional attainment of each country with that of the benchmark economy. Intuitively, the values in column (4) answer the question 'what would be the difference in the productivity effect of liberalization if the institutional context were the same as in Italy?' and therefore captures the impact of heterogeneity in levels of trade restrictiveness.[37] Column (5) is obtained by subtracting the policy contribution from the overall difference, that is, (3) minus (4), and provides a measure of the role of institutions in generating the difference in the productivity effect. Finally, columns (6) and (7) rank countries according to their average level of mode 3 STRI and control of corruption, respectively.[38]

Consider first the case of a country with low barriers to mode 3 services trade and a better institutional context than Italy, such as Denmark. Other things equal, lower trade restrictions would imply less in the way of policy change associated with full liberalization and therefore a smaller productivity effect. However, despite the lower STRI in Denmark, the potential productivity effect in the fabricated metal products industry is almost 18 percentage points higher than in Italy, reflecting the much better institutional context. If Denmark had the same institutional environment as Italy, the productivity effect of removing services trade barriers would be 4.4 percentage points less than in Italy. The negative difference reflects the lower restrictions to trade in services in Denmark, which is more open than Italy (the former ranks 42^{nd}, the latter 27^{th} in terms of STRI). In contrast, the quantitative impact of better institutions in Denmark translates into a productivity difference of 22 percentage points.

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[37] The values of column (4) are given by the following formula:

$$100 \times (\beta + \mu \times IC_b) \times \big[\sum_s (0 - STRI_{is}) \times w_{js}\big] - 100 \times (\beta + \mu \times IC_b) \times \big[\sum_s (0 - STRI_{bs}) \times w_{js}\big] \quad \forall i$$

where j is ISIC sector 28 and b is Italy.

[38] For both cases countries are ranked from the highest to the lowest value of the corresponding variable. Note that for the STRI, the most restrictive country is ranked 1, whereas for the institutional variable (control of corruption), the country with the best performance is ranked 1.

Table 5: Productivity effect of eliminating restrictions to mode 3 services trade

	Highest VA Sector		Fabricated Metal Products (ISIC: 28)			Country Rankings	
	$\%\Delta Y$	ISIC	$\%\Delta Y - \%\Delta Y_{ITA}$	Components of (3)		$STRI$	IC
			(4)+(5)	STRI	IC		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kyrgyz Republic	-3.65	27	-19.13	-9.91	-9.21	51	57
Burundi	-.95	15-16	-18.72	-3.05	-15.66	34	56
Ecuador	0	15-16	-18.00	-18.00	0.00	57	54
Mongolia	2.35	17-19	-16.49	-12.81	-3.68	54	50
Lithuania	3.5**	23	-11.20	-9.50	-1.70	53	33
Ukraine	4.17	27	-14.52	-2.79	-11.73	25	53
Georgia	4.22	15-16	-15.04	-13.00	-2.05	56	40
Albania	4.72	15-16	-15.08	-7.88	-7.19	50	51
Lebanese Republic	6.2	15-16	-13.91	16.99	-30.90	7	55
Viet Nam	6.74	15-16	-12.69	-0.66	-12.03	17	49
Malawi	7.14	15-16	-12.50	-3.44	-9.06	22	45
Sweden	7.74***	34	-3.27	-11.93	8.66	55	4
Peru	7.92	15-16	-12.24	-8.11	-4.13	48	41
China	8.07	27	-8.77	9.41	-18.18	12	47
Czech Republic	8.61**	34	-3.79	-2.99	-0.79	36	29
Colombia	8.76	15-16	-10.73	-6.56	-4.17	28	38
India	8.76	23	2.10	25.57	-23.47	3	44
Yemen	9.65	15-16	-11.19	7.88	-19.07	14	52
Romania	11.25*	15-16	-10.52	-6.48	-4.05	46	36
Morocco	11.43	15-16	-10.23	-3.52	-6.71	30	42
Oman	11.75**	23	8.24	9.03	-0.78	9	27
Bulgaria	14.17	15-16	-8.76	-2.66	-6.10	32	39
Mauritius	14.96***	17-19	-2.07	-4.02	1.95	40	22
Japan	15.39***	34	10.04	-1.14	11.19	26	14
Tanzania	15.41	15-16	-7.32	2.47	-9.79	21	43
Poland	15.91**	15-16	-8.17	-7.28	-0.89	44	31
Hungary	17.03***	32	-1.98	-4.50	2.52	35	20
Greece	17.69**	15-16	-7.11	-6.67	-0.44	41	28
Kuwait	17.84**	23	23.65	18.67	4.98	4	23
Chile	18.15***	15-16	-3.03	-9.45	6.42	37	12
Sri Lanka	18.26*	17-19	0.20	7.91	-7.70	11	34
Brazil	18.57*	15-16	-5.12	0.71	-5.83	29	35
New Zealand	18.79***	15-16	-3.69	-12.28	8.59	47	3
Italy	19.71**	29	0.00	0.00	0.00	27	25
Indonesia	20.9	15-16	-4.31	21.68	-25.99	5	46
Turkey	21.72**	17-19	5.64	10.11	-4.47	20	32
Spain	22.69***	15-16	-3.99	-8.69	4.70	52	16
Ethiopia	22.82	15-16	-1.04	33.75	-34.80	1	48
Portugal	23.77***	15-16	-3.33	-8.09	4.75	49	17
Qatar	24.23***	23	33.31	19.44	13.87	2	19
Germany	24.55***	34	27.06	4.25	22.81	24	10
Saudi Arabia	27.15*	24	2.49	13.87	-11.38	10	37
South Korea	29.17***	29	5.62	2.36	3.26	19	21
Uruguay	30.99***	15-16	7.69	-1.99	9.68	15	15
Ireland	35.01***	24	4.97	-6.87	11.84	45	8
Botswana	35.81***	36-37	10.84	1.64	9.20	16	18
Belgium	35.92***	24	5.45	-4.45	9.90	39	13
South Africa	36.72**	15-16	6.76	8.44	-1.68	13	30
United Kingdom	40.77***	15-16	7.20	-5.66	12.86	43	9
Malaysia	40.77**	32	14.07	14.68	-0.61	8	26
Austria	49.61***	29	25.33	0.64	24.68	31	6
Finland	50.76***	21-22	19.99	-3.36	23.35	33	2
Jordan	53.63**	15-16	17.68	17.62	0.06	6	24
Netherlands	55.08***	15-16	16.09	-3.84	19.93	38	5
Denmark	57.67***	15-16	17.71	-4.45	22.16	42	1
France	61.12***	15-16	20.44	2.92	17.52	23	11
Canada	61.94***	15-16	26.80	2.04	24.76	18	7

* p<0.10, ** p<0.05, *** p<0.01

Moving to the opposite end of the spectrum, in a country with higher barriers to mode 3 services trade and weaker institutional governance than Italy, the trade policy difference alone would make the potential productivity effect bigger, but weaker institutions might reverse the pattern. This case is illustrated by China, ranked 12$^{\text{th}}$ in terms of restrictions to mode 3 services trade, but 47$^{\text{th}}$ for control of corruption. If China removed its mode 3 barriers to trade and its institutional performance was at the higher level of Italy, the productivity effect would be 9.4 percentage points higher than in Italy. Weak institutions account for a negative difference of 18.2 percentage points and make the estimated potential productivity effect in China 8.7 percentage points lower than in Italy.[39]

Another example is provided by a comparison between Malaysia and Austria. The institutional context in Malaysia is similar to Italy's, but the trade policy stance is substantially more restrictive. As a result, all of the difference in potential productivity effect (14 percent) is accounted for by the trade policy change. Austria, in contrast, has a policy stance comparable to Italy's and has better institutions. If it were only for the differences in the levels of STRI, the productivity effect would be almost the same as for Italy. But the better institutional context in Austria makes the potential productivity change in the country 25 percentage points higher than in Italy.[40]

To conclude the discussion of Table 5, compare Botswana to a country with a similar trade policy stance but weaker institutional performance, such as Tanzania. While the STRI component of the difference in the productivity effect compared to Italy is very similar, the institutional components are very different, reflecting the higher quality of institutions in Botswana.

3.4. Cross-border trade versus FDI

The estimates of the interaction model fitted with data on mode 3 policy measures suggest that the moderating role of the institutional environment operates through the FDI channel. In this section we investigate whether the effect on downstream productivity is shaped by institutions in an analogous way when it comes to policies that reduce restrictions to cross-border (mode 1) services trade. Since mode 1 policy data are available only for financial, transport and professional services, we construct a mode 1 version of $CSTRI$ using only these three sectors. For the sake of consistency, this version of $CSTRI$ is computed for the all modes and the mode 3 cases as well. Table 6 reports the results for the baseline and interaction models for the three categories.[41]

While the $CSTRI$ coefficient in the mode 1 baseline model continues to be statistically not different from zero, the moderating role of institutions is absent from the mode 1 interaction model. Thus, the critical channel through which institutions matter appears to be mode 3. This is consistent with the characteristics of services production,

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[39] Considering that the marginal effect of $CSTRI$ is not statistically different from zero when estimated at the Chinese level of institutional performance, the role of institutions is actually about 8 percentage points higher (in negative terms) than that reported in column (5).

[40] Table 5 shows that several OECD countries have high potential productivity effects when compared to Italy. In most cases the institutional context drives this result.

[41] Due to the exclusion of the telecommunication sector from the construction of $CSTRI$, results of columns (1)-(4) of Table 6 are not strictly comparable with results in Table 2.

Table 6: Modal comparison

	All modes		Mode 3		Mode 1	
	(1)	(2)	(3)	(4)	(5)	(6)
$CSTRI$	-0.006	0.062	-0.026	0.055*	0.037	0.085
	(0.025)	(0.038)	(0.021)	(0.032)	(0.025)	(0.054)
$CSTRI \times IC$		-0.032**		-0.035***		-0.022
		(0.014)		(0.012)		(0.019)
$CTau$	-0.540	-0.495	-0.501	-0.467	-0.577	-0.549
	(1.069)	(1.053)	(1.069)	(1.061)	(1.075)	(1.059)
Observations	912	912	912	912	912	912
R-squared	0.581	0.582	0.581	0.584	0.582	0.582

Robust (country-clustered) standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Country fixed effects and sector dummies always included

IC = Institutional Context proxied by control of corruption

where intangibility and non-storability make FDI relatively more important as a mode of international supply.[42]

4. Robustness checks

4.1. Alternative measures of productivity

To further explore the robustness of the results we replicate the estimation with other measures of manufacturing sector productivity. We use two alternative productivity measures, both evaluated over the three year period from 2006 to 2008.[43] The first variable is simply the 3 year average version of the labor productivity measure used to generate the results reported in Table 2. While the more limited country and sector coverage of the UNIDO data for the year 2008 causes a reduction in sample size by approximately 10%, the results, given in columns (1) and (2) of Table 7, remain stable.[44]

[42] Beverelli et al. (2015) develop a theoretical model that embodies the key characteristics of services and services trade and use this to analyze in greater detail the moderating role played by institutions through the FDI channel.

[43] Conservatively, only those data points with non-missing information for all the three years are retained.

[44] For the construction of the average labor productivity as well as for the TFP estimates below, UNIDO output data expressed in US dollars are deflated by the price level of GDP (output-side) of the US, taking 2005 as a reference year. Data on prices is from the Penn Word Table, version 8.1 (see Feenstra et al., 2016). This adjustment is irrelevant in the baseline regressions of Section 3, which use data for only one year.

Table 7: Alternative measures of productivity

	y average		$\log TFP$	
	(1)	(2)	(3)	(4)
Panel (a): all modes				
$CSTRI$	-0.017	0.059	-0.012	0.066**
	(0.025)	(0.044)	(0.028)	(0.030)
$CSTRI \times IC$		-0.035**		-0.048***
		(0.016)		(0.013)
$CTau$	-0.668	-0.640	-1.697	-1.508
	(0.992)	(0.972)	(1.108)	(1.177)
Observations	815	815	203	203
R-squared	0.626	0.628	0.925	0.926
Panel (b): mode 3				
$CSTRI$	-0.036	0.048	-0.012	0.067***
	(0.021)	(0.039)	(0.027)	(0.022)
$CSTRI \times IC$		-0.035**		-0.042***
		(0.014)		(0.013)
$CTau$	-0.612	-0.590	-1.709	-1.735
	(0.983)	(0.978)	(1.120)	(1.232)
Observations	815	815	203	203
R-squared	0.627	0.630	0.925	0.927

Robust (country-clustered) standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
Country fixed effects and sector dummies always included
IC = Institutional Context proxied by control of corruption

The second alternative measure is a proxy for total factor productivity (TFP).[45] We assume a Cobb-Douglas model and use an accounting exercise to derive $\log TFP_{ijt}$ as $\log O_{ijt} - a_j \log L_{ijt} - (1 - a_j) \log K_{ijt}$. In this expression, O_{ijt} denotes real output in country i and sector j at time t; a_j is the sectoral share parameter; L and K are respectively employment (directly available from the UNIDO database) and the real capital stock. The latter is derived using the standard inventory method, where the capital stock in year t is given by $K_{ijt} = (1 - d)K_{ij(t-1)} + I_{ijt}$, I is real investment and d is the depreciation rate, set equal to 0.08 (as in Levchenko et al., 2009). We assume that the initial level of capital stock is given by $K_{ij0} = I_{ij0}/(d + g_{ij})$, where g_{ij} is the growth rate of real investment (this has no time subscript because we use average values across the first ten years that are reported). For each country-sector pair we take I_{ij0} as the first non-missing data point in the real investment series starting from the 1960s.[46] Finally, we construct the labor shares as the average values across countries and time of the ratio between the wage bill and value added.

Use of the TFP proxy reduces the sample size to slightly more than 200 observations and 23 countries (see columns (3) and (4) of Table 7). However, this smaller sample continues to include many non OECD countries and thus heterogeneity in institutional

[45] Other papers deriving sector-level productivity measures using the UNIDO database include Levchenko et al. (2009) and Cipollina et al. (2012).

[46] The series of real investment is constructed deflating the UNIDO data on investment with the price level of capital formation from the Penn World Table, version 8.1.

contexts.[47] The key results continue to hold: the effect of $CSTRI$ is never statistically different from zero in the baseline model, and continues to be mediated by the institutional context in the interaction model. The estimates of the interaction coefficients are slightly larger (in negative terms) than the corresponding values in the benchmark regressions.

4.2. Alternative moderator variables

As a second robustness exercise we replicate the interaction model estimation with different IC moderator variables (M). Columns (1)-(4) of Table 8 report the results for two alternative measures of institutional performance, rule of law and regulatory quality.[48] All findings are stable, with the magnitude of the moderating effect slightly amplified.

Finally we test for the existence of alternative moderating mechanisms pertaining to economic development but uncorrelated with the quality of governance institutions. We do this by regressing the log of per capita GDP on the control of corruption indicator. The vector of residuals of this linear model is a proxy for those components of economic development that are orthogonal to institutions. We then use this variable – $\widetilde{\text{pcGDP}}$ – as moderator in the interaction model. Estimates are reported in the last two columns of Table 8. The coefficient of the interaction term when $M = \widetilde{\text{pcGDP}}$ is not statistically different from zero. This finding strengthens the interpretation of the results as institutions-specific in that the institutional environment prevailing in the importing countries is likely to matter more than other dimensions of local economic development.

Table 8: Interaction model estimation with alternative moderator variables

Moderator (M)	Rule of Law		Reg. Quality		$\widetilde{\text{pcGDP}}$	
	All Modes	Mode 3	All Modes	Mode 3	All Modes	Mode 3
	(1)	(2)	(3)	(4)	(5)	(6)
$CSTRI$	0.075*	0.078**	0.071*	0.074**	-0.020	-0.033*
	(0.039)	(0.032)	(0.038)	(0.032)	(0.024)	(0.019)
$CSTRI \times M$	-0.040***	-0.045***	-0.039***	-0.044***	-0.013	-0.011
	(0.014)	(0.012)	(0.013)	(0.011)	(0.010)	(0.010)
$CTau$	-0.450	-0.429	-0.486	-0.465	-0.460	-0.435
	(1.050)	(1.060)	(1.049)	(1.055)	(1.074)	(1.070)
Observations	912	912	912	912	912	912
R-squared	0.584	0.586	0.583	0.585	0.581	0.582

Robust (country-clustered) standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
Country fixed effects and sector dummies always included

4.3. Alternative input use measures

The services input use measure adopted in this paper is the ratio between the cost of services inputs and the value of total intermediate consumption of downstream manufacturing industries. This measure differs from the definition of IO technical coefficients,

[47] The countries included in the estimation sample for columns (3)-(4) of Table 7 are Albania, Denmark, Ecuador, Ethiopia, Finland, Georgia, Germany, Hungary, India, Ireland, Italy, Japan, Jordan, South Korea, Kuwait, Lithuania, Malaysia, Morocco, Spain, Sri Lanka, Tanzania, and Turkey.

[48] Both variables come from the Worldwide Governance Indicators.

which represent the ratio between services inputs and total output of a downstream sector.[49] Our definition does not embed differences in value added across manufacturing sectors, representing therefore a better proxy for technological differences in intermediate input consumption. To test the robustness of our preferred measure of input use intensity, we replicate the estimation using both US technical coefficients and the coefficients derived from the US Leontief inverse matrix, which capture also the indirect linkages between upstream and downstream industries.[50] Estimation results are given in Table 9.

Table 9: Estimation with Technical and Leontief IO coefficients

IO weights	Technical				Leontief			
	All modes		Mode 3		All modes		Mode 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$CSTRI$	-0.050	0.082	-0.069*	0.089	-0.049	0.069	-0.070	0.110
	(0.045)	(0.069)	(0.035)	(0.060)	(0.070)	(0.103)	(0.052)	(0.105)
$CSTRI \times IC$		-0.062***		-0.068***		-0.056*		-0.078**
		(0.022)		(0.021)		(0.029)		(0.032)
$CTau$	-0.465	-0.253	-0.373	-0.153	-0.477	-0.240	-0.387	-0.078
	(1.087)	(1.063)	(1.094)	(1.085)	(1.119)	(1.117)	(1.141)	(1.148)
Observations	912	912	912	912	912	912	912	912
R-squared	0.581	0.584	0.582	0.586	0.581	0.582	0.582	0.583

Robust (country-clustered) standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
Country fixed effects and sector dummies always included
IC = Institutional Context proxied by control of corruption

The sign and statistical significance of the estimated coefficients are robust across all measures of input use. Given the smaller size of technical and Leontief IO weights with respect to the shares of total intermediate consumption, the higher coefficient estimates in Table 9 generate economic effects that are similar in magnitude.

In the light of the substantial heterogeneity of the countries in the sample, one can question the representativeness of the US as the baseline country for the IO linkages. In Table 10 we present results using the services shares of manufacturing intermediate consumption derived from China's 2005 IO accounting matrix. China was classified as lower middle income country by the World Bank in 2006.[51] China may be a more representative baseline for the estimation sample, which includes both middle and low income countries. The sign and statistical significance of the coefficient estimates are not affected by the use of China's data. The higher values of the coefficients using Chinese IO data suggests that the use of US data is a conservative choice for the economic quantification of the results.[52]

[49] The ratio between the cost of services inputs and the value of the downstream industry output is the proxy for direct input intensity usually adopted in the empirical literature on the indirect effect of services policies on manufacturing (see for example Barone and Cingano, 2011).

[50] The derivation of these alternative input use measures from IO matrices is reported in the online appendix.

[51] In 2006 China had a per capita GNI (Atlas method) of 2,050 US dollars. For that year the GNI per

Table 10: Estimation with Chinese input use measures

	All modes		Mode 3	
	(1)	(2)	(3)	(4)
$CSTRI$	-0.068	0.141	-0.087*	0.118
	(0.054)	(0.092)	(0.044)	(0.079)
$CSTRI \times IC$		-0.091***		-0.087***
		(0.033)		(0.030)
$CTau$	-0.351	-0.374	-0.376	-0.401
	(0.691)	(0.693)	(0.693)	(0.698)
Observations	912	912	912	912
R-squared	0.586	0.588	0.587	0.590

Robust (country-clustered) standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
Country fixed effects and sector dummies always included
China excluded from the estimation sample
IC = Institutional Context proxied by control of corruption

4.4. Variations in country and industry coverage

The wide country coverage featured in the present analysis might raise concerns regarding the influence of observable and unobservable characteristics that are idiosyncratic across different subsets of countries. We start addressing this issue by replicating the estimation of the baseline and interaction models for two groups of countries, 'emerging' and 'advanced'. The former excludes the set of most developed economies, while the latter excludes the set of least advanced economies.[53] As shown in Table 11, results are qualitatively robust across subsamples. We find a stronger role of institutions for emerging economies. If we limit the sample to advanced economies only, we continue to find a statistically significant role for institutions, but the magnitude of the coefficient is well below that for emerging economies. This is intuitive given that institutional quality in advanced economies is both better and less heterogeneous than in emerging economies.

In addition, the baseline and interaction models were re-estimated in a series of robustness regressions excluding, one at a time, each of the 57 countries or each of the each of the 18 manufacturing sectors in the estimation sample. The results, presented and discussed in the online appendix, show that the pattern of statistical significance is robust to variations in country and sectoral coverage.

capita interval for lower middle income countries was fixed by the World Bank at 906-3,595 US dollars.

[52] The benchmark results remain qualitatively robust when instrumenting $CSTRI$ with a variable that minimizes the country-specific components in the input intensity weights. Estimates from regressions that replicate the 2SLS procedure proposed in Barone and Cingano (2011) are available upon request.

[53] We use the World Bank per capita income categories for 2007 and define as most developed economies the countries classified as high-income (in the sample, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, South Korea, Kuwait, Netherlands, New Zealand, Oman, Portugal, Qatar, Saudi Arabia, Spain, Sweden and the UK). The group of least developed economies comprises countries classified as low income (in the sample, Burundi, Ethiopia, Kyrgyz Republic, Malawi, Tanzania, Viet Nam and Yemen).

Table 11: Emerging versus advanced economies

	Emerging economies				Advanced economies			
	All modes		Mode 3		All modes		Mode 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$CSTRI$	-0.023	0.124*	-0.027	0.096	-0.036	0.007	-0.039*	0.013
	(0.030)	(0.063)	(0.024)	(0.060)	(0.024)	(0.031)	(0.021)	(0.026)
$CSTRI \times IC$		-0.070***		-0.057**		-0.019		-0.021**
		(0.025)		(0.026)		(0.012)		(0.009)
$CTau$	-1.424	-1.294	-1.417	-1.305	-0.530	-0.515	-0.503	-0.490
	(1.347)	(1.341)	(1.343)	(1.339)	(0.874)	(0.867)	(0.877)	(0.879)
Observations	511	511	511	511	815	815	815	815
R-squared	0.521	0.525	0.522	0.524	0.636	0.637	0.637	0.638

Robust (country-clustered) standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
Country fixed effects and sector dummies always included
IC = Institutional Context proxied by control of corruption

5. Conclusions

Services trade policy reform is a potentially important dimension of economic development strategies because services are essential inputs into manufacturing, and the productivity of firms and industries is in part a function of the quality and variety of available services inputs. Reducing the restrictiveness of services trade policy should increase competition on services markets and give firms in all sectors access to a greater variety and lower-priced services. However, taking action to liberalize trade in services may not be sufficient to have positive effects on the performance of downstream industries. Our analysis shows that the quality of economic governance significantly moderates the impact of services trade policy on manufacturing productivity, and that this effect operates through the FDI channel (mode 3) rather than through the cross-border trade channel (mode 1).

The results are robust to inclusion of country-sector variables that are likely to determine differences across countries in manufacturing productivity, to alternative moderating mechanisms and to instrumentation of the composite services trade restrictiveness measure, to alternative specifications of the dependent variable (manufacturing productivity), to alternative measures of institutional quality and to variations in country and industry coverage. The magnitude of coefficient estimates does not change substantially across various specifications. On average, across 57 countries and 18 manufacturing sectors, we estimate a potential downstream productivity effect of full services trade liberalization of 22%. The effect is larger the better a country's institutional environment.

The finding that institutions matter for the effect of services trade policy is consistent with the more general literature on the role of institutions in achieving and sustaining economic growth and development. The result that FDI policies matter most is intuitive and consistent with the characteristics of services: their intangibility and nonstorability often will require that some, and often much, of the value added produced by a firm be generated locally for transactions to be feasible. Thus FDI is frequently the preferred mode of supply in practice, confronting foreign affiliates with the investment climate that prevails in a host country. Our analysis suggests trade policy reform efforts aimed at enhancing the availability of services need to be multidimensional – reducing services trade barriers may not be sufficient for countries to realize positive economic effects if the institutional environment is poor.

The finding that country-level governance institutions matter for the impact of services trade policy calls for further research. Our results reveal that different measures of governance have the same qualitative effect, whether we use control of corruption, rule of law or the quality of regulation. Determining more specifically which dimensions of economic governance and institutional frameworks are most relevant in shaping the effects of services trade policies is an important subject for further work. Analysis to 'unpack institutions' is necessary to be able to identify specific policy implications and recommendations. Such an exercise cannot be done with variables that vary only at the country level. Instead, data on sector-specific governance institutions need to be collected and matched with services-specific trade policy measures to assess how the $CSTRI$ measures interact with different country characteristics and institutional variables, both horizontal, such as competition policy-related, and sector-specific, such as those related to regulatory regimes.

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Appendix

Table A-1: List of countries and sectors in the estimations

Country		Sector
Albania	Kyrgyz Rep.	15-16
Austria	Lebanese Rep.	17-19
Belgium	Lithuania	20
Botswana	Malawi	21-22
Brazil	Malaysia	23
Bulgaria	Mauritius	24
Burundi	Mongolia	25
Canada	Morocco	26
Chile	Netherlands	27
China	New Zealand	28
Colombia	Oman	29
Czech Republic	Peru	30
Denmark	Poland	31
Ecuador	Portugal	32
Ethiopia	Qatar	33
Finland	Romania	34
France	Saudi Arabia	35
Georgia	South Africa	36-37
Germany	Spain	
Greece	Sri Lanka	
Hungary	Sweden	
India	Tanzania	
Indonesia	Turkey	
Ireland	Ukraine	
Italy	United Kingdom	
Japan	Uruguay	
Jordan	Viet Nam	
Korea, Rep.	Yemen	
Kuwait		

Sectors are ISIC Rev. 3 manufacturing industries

Table A-2: List of all variables used in the empirical analysis

Variable	Description and source
Country-manufacturing sector level (ij)	
y	Log of labor productivity (output per worker) in manufacturing sector j in country i. Output expressed in current USD is deflated using the price level of GDP (output-side) of the US taking 2005 as a reference year. Sources: output and total employment from UNIDO INDSTAT4, Rev. 3; prices from the Penn World Table 8.1.
y average	Average of y over the three years period from 2006 to 2008. Sources: output and total employment from UNIDO INDSTAT4, Rev. 3; prices from the Penn World Table 8.1
$\log TFP$	Log of total factor productivity in manufacturing sector j in country i, defined in Section 4.1. Sources: output, total employment, investment, value added from UNIDO INDSTAT4, Rev. 3; prices from the Penn World Table 8.1
$CSTRI$	Index of composite services trade restrictiveness capturing the exposure of manufacturing sector j in country i to restrictions to trade in services, defined in equation (1). The modal category of $CSTRI$ depends on the the modal category of the $STRI$ component. Sources: policy data from the STRI Database, World Bank; input intensity data from the US IO Table (mid 2000), OECD STAN IO Database.
$CSTRI^{IV}$	Instrumental variable for $CSTRI$, defined and discussed in Section 3.2. Sources: policy data from the STRI Database, World Bank; input intensity data from the US IO Table (mid 2000), OECD STAN IO Database; GDP per capita data (in current US dollars) from the World Development Indicators Database, World Bank.
$Ctau$	Index of composite trade restrictiveness of manufacturing sector j in country i, defined in equation (4). Sources: simple average MFN tariffs from UNCTAD TRAINS; input intensity data from the US IO Table (mid 2000), OECD STAN IO Database.
$Otau$	Index of composite market access restrictiveness of manufacturing sector j in country i, defined in footnote (24). Sources: minimum of simple average MFN, simple average applied and preferential tariffs from UNCTAD TRAINS; trade shares from reported import data in UNCTAD TRAINS.
K	Physical capital comparative advantage measure of country i in manufacturing sector j relative to the US, defined in Section 3.1. Sources: physical capital is the capital stock at constant 2011 national prices (in mil. 2011 USD) of country i from the Penn World Table 8.1; physical capital intensity of sector j in the US calculated from the NBER-CES Manufacturing Industry Database.
H	Human capital comparative advantage measure of country i in manufacturing sector j relative to the US, defined in Section 3.1. Sources: human capital index of country i from the Penn World Table 8.1. Human capital intensity of sector j in the US calculated from the NBER-CES Manufacturing Industry Database.
R&D	R&D comparative advantage measure of country i in manufacturing sector j relative to the US, defined in Section 3.1. Sources: Number of researchers in R&D (per million people) of country i relative to the US from from the World Development Indicators Database, World Bank; R&D intensity of sector j in the US calculated from the BERD ('Business enterprise R&D expenditure by industry') data from OECD Research and Development Statistics.
Country-services sector level (is)	
$STRI$	Trade restrictiveness index for services sector s in country i. This paper uses alternatively the 'All modes', 'Mode 3' and 'Mode 1' version of the indexes. Source: STRI Database, World Bank.
Manufacturing sector-services sector level (js)	
w	Input intensity of services s into manufacturing sector j. In the benchmark estimation it is equal to the s share of total intermediate consumption (of domestic and imported inputs) for j. Alternative measures are described in the online appendix. Source: US IO Table (mid 2000), OECD STAN IO Database.
Country level (i)	
IC	Proxy for institutional capacity of country i. In the benchmark estimation it is equal to the level of control of corruption in 2007. Alternative measures used in the paper are rule of law and regulatory quality. Source: Worldwide Governance Indicators, World Bank.
fin dev	Central bank assets to GDP (percentage) in 2007 as a proxy for the degree of financial development (see Section 3.1). Sources: International Financial Statistics, International Monetary Fund.
human capital	Human capital in 2007 (introduced in Section 3.1). Sources: human capital index of country i from the Penn World Table 8.1.
capital stock	Natural logarithm of physical capital stock per million of people in 2007 (see Section 3.1). Sources: physical capital is the capital stock at constant 2011 national prices (in 2011 USD) of country i from the Penn World Table 8.1.
$\mathrm{pc}\widetilde{\mathrm{GDP}}_i$	Proxy for the components of economic development which are not orthogonal to institutional capacity, defined in Section 4.2. Sources: per capita GDP from World Development Indicators Database, World Bank; institutional capacity data (control of corruption) from the Worldwide Governance Indicators, World Bank.