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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.

JEL Classification: F14; F15; F61; F63

Keywords: Services Trade Policy; Commercial Presence; Institutions; Productivity

ملخص

نقوم بدراسة تأثير قيود تجارة الخدمات على تصنيع الإنتاجية لقطاع عريض من البلدان التي تمر بمراحل مختلفة من التنمية الاقتصادية. خفض القيود التجارية الخدمات له تأثير إيجابي على قطاعات الصناعات التحويلية التي تستخدم الخدمات كمدخلات وسيطة في الإنتاج. نقوم بالتعرف على الدور الحاسم للمؤسسات في البلدان المستوردة في تشكيل هذا التأثير. تستفيد البلدان ذات الجودة العالية للمؤسسية أكثر من غيرها من القيود التجارية وخدمات أقل من حيث زيادة الإنتاجية في الصناعات التحويلية. وتبين لنا أن تأثير تكييف المؤسسات يعمل من خلال تجارة الخدمات التي تنطوي على إقامة الأجانب (الاستثمار)، في مقابل تجارة الخدمات عبر الحدود.

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 higher input variety. Therefore, the extent to which policies restrict foreign access to upstream services markets is relevant for downstream productivity.

This indirect effect of services trade policies has been the subject of recent research using plant-level data. Thus, 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).[2] 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 countries and sectors.[3] Countries also differ on 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 and Freund and Bolaky, 2008).

Institutions may influence the downstream effects of services trade policy in several ways in the short and medium run.[4] 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.[5] Similarly, removing restrictions on the ability of foreign firms to sell products locally through eatablishment of a commercial presence (foreign direct investment) may fail to have the expected pro-competitive effect if a weak institutional and business

[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'). These figures on input intensity reflect the share of total intermediate consumption.

[2] The link between upstream and downstream performance is not limited to upstream services sectors nor to trade-specific policy measures. Bas and Causa (2013), Bas and Strauss-Kahn (2015) ((using firm-level data) and Blonigen (forthcoming) (using sector-level data) are examples of studies that investigate the downstream impact of policies targeting non-services upstream sectors. Arnold et al. (2008), Fernandes and Paunov (2011), Forlani (2012), Hoekman and Shepherd (forthcoming) (using firm-level data) and Barone and Cingano (2011) and Bourles et al. (2013) (using sector-level data) investigate the downstream effect of either economic outcomes (productivity, inward FDI, mark-up) or non trade-specific policies in the upstream services sectors.

[3] The most restrictive policies are observed in the high-income 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.

[4] 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 for instance Fiorini et al., 2015).

[5] 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
ows toward that particular destination.

environment in the host country inhibits foreign firms to enter the market, or, if they enter, induces them to operate inefficiently.[6]

Figure 1 presents some descriptive evidence in support of the conjecture that institutional 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) and two modes of supply that can be used to trade services, cross border exchange and FDI.[7] 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.

In this paper we investigate the effects of upstream services trade policy on downstream 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 in our assessment of the effects of services trade policy. We use data for a sample of 57 countries at all stages of economic development and find that the impact of services trade policies depend 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 comprise firm-level country case studies, which by construction preclude an aggregate and comparative perspective. Studies such as Barone and Cingano (2011) and Bourles et al., (2013) do 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 do not focus on services trade policy, but rely on the OECD Product Market Regulation (PMR) indicator for non-manufacturing industries. This variable has a strong focus on domestic

[6] 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 rms 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. (forthcoming). Bernard et al. (2010) and 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 rm, 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.

[7] Each data point in Figure 1 is a country-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).

policies and does not capture the discriminatory policy measures which are particularly relevant for trade.[8]

Second, while the structure of our 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 presents the data. Section 3 presents the results of the empirical analysis. Section 4 reports a battery of robustness checks. Section 5 concludes.

2. Empirical Strategy and Data

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

We follow the approach pioneered by Rajan and Zingales (1998), assuming that the effect of upstream services trade policy on downstream productivity is a positive function of the intensity with which services are used as intermediate inputs by downstream sectors. Therefore, the regressor of interest is constructed by interacting a country-sector measure of 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.[9] The baseline productivity regression is then:

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

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 regressors control variables at the country-sector level.

[8] Our paper complements Van der Marel (forthcoming) and Hoekman and Shepherd (forthcoming). These two studies use sector-level data with a wide country coverage to assess relevant related questions. Van der Marel 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 embed services trade policy into a gravity framework and show that lower restrictions to services trade effectively lead to higher trade in manufactured goods. Our non-gravity methodology focuses on downstream productivity effects, takes into account input-output linkages and permits us to relax the assumption of homogeneous impacts across countries.

[9] For the derivation of the shares of intermediate consumption from the IO tables, see Appendix 1.

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

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

where IC_i is a continuous proxy for the prevailing institutional context in country i.[10] 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 institutional framework. 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.[11]

Second, we include in the empirical specification a measure of trade restrictiveness applying to non-services inputs. Access to high quality intermediate goods embodying efficient international technology is likely to have a positive effect on productivity in those sectors where such inputs are relevant (i.e., that have high input use intensity). 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

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

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

[11] More productive domestic services sectors are likely to offer higher quality services at a lower price as inputs into domestic production, increasing the productivity of downstream industries. Moreover, domestic services providers might have the incentives to coalesce into a lobby to obtain protection from foreign competitors in the form of higher barriers to services trade (Fiorini and Lebrand, 2015). As this mechanism does not trigger any variability across the manufacturing sector dimension, the potential effect of domestic services productivity is controlled for by the country fixed effects.

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.[12]

Next, there are two lobbying mechanisms that could lead to endogeneity if not appropriately taken into account. The first is the possibility that the impact channel from the productivity 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.

A second 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 from our regression would be biased toward zero.13 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* that corrects for the endogeneity of its policy component. Section 3.1 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 restricted services trade policy may enhance downstream intermediate consumption and thus productivity in the manufacturing sector itself (more productive manufacturing sectors being able to consume higher quality and more differentiated services). In the first 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. In the 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 follow here the assumption widely adopted in the literature originating from [19], taking the United States' IO linkages as representative of the technological relationships between industries. In the baseline estimations, we therefore set c = US and remove the US from the sample.

2.2 Data

Given the focus on the role of institutions in shaping the downstream performance effects of services trade policy, data on the restrictiveness of services policies and country level institutional context and 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., 2012b). This includes measures affecting market access as well as policies that breach the national treatment principle (for example,

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[12] 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 reflects the discussion in the last paragraph of the present section.

[13] 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 Bourles et al., 2013). The same argument applies for the omitted variable bias discussed above.

domestic regulations that target foreign providers or services provision). The Services Trade Restrictiveness Indices (STRI) cover 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 – 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., 2012a for adetailed description of the database). Our interest in the effects of importing countries' institutions implies that the absence of information on the fourth mode of supply defined by the WTO (mode 2, consumption abroad) in the STRI database is not a constraint. We derive our 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.[14] STRI data do not vary over time. The indicators capture the prevailing policy regimes in the mid-2000s.

Data on services input intensity comes 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.[15] In our 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. 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 are used in our robustness checks. Tariff data are from UNCTAD TRAINS.

The estimation sample includes 57 countries and up to 18 manufacturing sectors (listed in Appendix Table 13). A description of all the variables used in the estimations, including the data sources, is provided in Appendix Table 11. 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 a commercial presence (Mode 3). The estimated coefficient for the composite 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

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

[15] 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.

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 based on the estimation of the Mode 3 case is further illustrated in Figure 2.[16] 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 performance. The effect is not statistically different from zero for countries with weak institutional environments (35% of our sample).

3.1 Instrumenting for the services trade restrictiveness measure

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.[17]

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 well 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 our instrument for *CSTRI*.

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 our 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

[16] 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.

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

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 the c countries, 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.[18]

To provide an initial sense of the instrument's relevance, Figure 3 plots *CSTRI* (all modes and mode 3) against its predicted values from the first stage regression of the baseline model. For both categories of measures the estimated coefficient is equal to 1.05.[19]

The results of the 2SLS estimation of the baseline and interaction model are presented in Table 3, together with the standard tools for weak identification diagnostics.[20] The Sanderson-Windmeijer (SW) tests[21] confirm the relevance of our instrument across specifications. Analogous conclusions obtain from the values of the Cragg-Donald (CD) 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).[22]

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 our analysis implies a conservative assessment of both the impact of *CSTRI* on productivity and of the moderating role of institutions. The 2SLS analysis provides support 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.[23]

3.2 Random services trade restrictiveness

To further ensure that our results can be given a clear economic interpretation, we perform a Placebo experiment in which the 'treatment' (services trade restrictiveness) is randomly assigned. We construct the $\widetilde{CSTRI}_{ij} \equiv \sum_s \widetilde{STRI}_{is} \times w_{ijs}$, variable, where $\widetilde{STRI}_{is}$ is a random

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

[19] One might argue that the *SI* weights also 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 our regressor of interest. This would result in a violation of the exclusion restriction. While the application of the *SI* weights remains our preferred approach given our strategy to address the exclusion restriction, the 2SLS results presented below (Table 3) remain robust when the *SI* -weighted average is replaced by an unweighted average.

[20] In the interaction model there are technically two endogenous regressors, *CSTRI* and *CSTRI x IC*. The excluded instruments are given in this case by $CSTRI^{IV}$ and $CSTRI^{IV}$ *x IC*. Given that the second endogenous regressor – *CSTRI x 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.

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

[22] 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.

[23] 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 el 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.

draw from a uniform distribution with support $[0,100]$. We then perform 100,000 regressions of model (3), each with a different, randomly constructed $\widetilde{CSTRI}_{ij}$, and we estimate the marginal effects. As in the baseline case, we evaluate the marginal effects at 39 values of the IC (control of corruption) variable. The resulting dataset, therefore, contains 3,900,000 estimated marginal effects. Figure 4 graphically represents the marginal effects with the confidence intervals – averaged across all the 100,000 regressions. It is apparent that the marginal effects are never statistically different from zero. Our results, therefore, cannot be obtained with random services trade restrictiveness measures.[24]

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 as moderated by institutions, 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.[25] 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. Figure 5 plots the level of the mode 3 STRI for the 57 economies and four services sectors covered by the analysis. Countries are sorted by the average restrictiveness across sectors, from lowest (least restrictive) to highest (most restrictive). 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 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:

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

where Y_{ij} is productivity without the log transformation. Figure 6 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 sectorial dimension, low restrictions to services trade and low

24 The same results are obtained if the median is used instead of the mean. Confidence intervals for each regression are computed using the Delta method.

25 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.

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.

Table 4 presents the results of our 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,[26] 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. As indicated in Figure 5, the elimination of barriers to mode 3 services trade in this country implies far-reaching liberalization, especially for the telecommunication and transport sectors. Such a policy change, in conjunction with with the relatively strong institutional context that prevails in Botswana, generates a statistically significant potential 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), fixing the average level of services input use of the sector at its median level.

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.[27] 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

[26] 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.

[27] The values of column (4) are given by the following formula: $100 \times (\beta + \mu \times IC_b) \times [\sum_s (0 - STRI_{is}) \times w_{js}] - 100 \times (\beta + \mu \times IC_b) \times [\sum_s (0 - STRI_{bs}) \times w_{js}] \quad \forall i$ where j is ISIC sector 28 and b is Italy.

productivity effect. Finally, columns (6) and (7) rank countries according to their average level of mode 3 STRI and control of corruption, respectively.[28]

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 at 42nd is more open than Italy, which ranks 27th. In contrast, the quantitative impact of better institutions in Denmark translates into a productivity difference of 22 percentage points.

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 12th in terms of restrictions to mode 3 services trade, but 47*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.[29]

Similar patterns are observed for Arab countries. Morocco is the most open Arab economy in terms of level of trade restrictions against mode 3 supply of services. It is also less restrictive than Turkey. However, it has a relatively weaker institutional climate than that prevailing in the GCC member states, who in contrast are countries with high barriers to inward FDI in services. Barriers to mode 3 trade are also high in Jordan and Lebanon. The institutional context in Oman is comparable to Italy's, but the trade policy stance is substantially more restrictive. As a result, almost all of the difference in potential productivity effect is accounted for by the trade policy change. Morocco, in contrast, has a mode 3 policy stance comparable to Italy's but has weaker institutions. If it were only for the differences in the levels of STRI, the productivity effect would be just 3.5 percentage points less than in Italy. But the weaker institutional context in Morocco reduces the potential productivity change by another 6.7 percentage points relative to Italy. To conclude the discussion of Table 4, compare Jordan to a country with a similar trade policy stance but weaker institutional performance, such as Lebanon. While the STRI component of the difference in the productivity effect compared to Italy is very similar (17 percentage points), the institutional components are very different, reflecting the higher quality of institutions in Jordan. Although Jordan and many GCC countries have relatively good institutional contexts, they are much weaker than what prevails in the best governed nations. If we run a counterfactual exercise where we rplace the prevailing institutional performance indicators with those of the best country in the sample (Denmark), the potential downstream productivity effects of mode 3 liberalization would increase by a factor of three or more for most countries, depending on the country and the sector of focus.[30]

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[28] 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.

[29] 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).

[30] Country-sector estimates for all 2-digit ISIC categories are available from the authors on request.

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 clearly 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 5 reports the results for the baseline and interaction models for the three categories.[31]

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, where intangibility and non-storability make FDI relatively more important as a mode of international supply.[32]

4. Robustness Checks

4.1 Alternative measures of productivity

We start assessing the robustness of the results by replicating 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.[33] 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 6, remain stable.[34]

The second alternative measure is a proxy for total factor productivity (TFP).[35] 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., Levchenko:2009aa). 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 datapoint in the real investment series

[31] Due to the exclusion of the telecommunication sector from the construction of *CSTRI*, results of columns (1)-(4) of Table 5 are not strictly comparable with results in Table 2.

[32] Beverelli et al. Beverelli_etal_CEPR 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.

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

[34] For the construction of the average labor productivity as well as for the TFP estimates below, UNIDO output data expressed in US dollars is 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., forthcoming). This adjustment is irrelevant in the baseline regressions of Section 3, which use data for only one year.

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

starting from the 1960s.[36] 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 6). However, this smaller sample continues to include many non OECD countries and thus heterogeneity in institutional contexts.[37] 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 7 report the results for two alternative measures of institutional performance, rule of law and regulatory quality.[38] All findings are stable, with the magnitude of the moderating effect slightly amplified.

The various measures of institutional governance quality proposed so far are highly correlated with levels of economic development. This raises a potential concern: the cross-country variability in economic development that is not accounted for by institutions may exert an analogous moderating effect on the impacts of services trade policy on downstream manufacturing productivity. To check whether this is the case, we regress 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 which are orthogonal to institutions. We then use this variable – $\widetilde{\mathrm{pcGDP}}$ – as moderator in the interaction model. Estimates are reported in the last two columns of Table 7.

The coefficient of the interaction term when M= $\widetilde{\mathrm{pcGDP}}$ is not statistically different from zero. This finding strengthens the interpretation of our results as institutions-specific. In other words, the institutional environment prevailing in the importing countries is likely to matter more than other dimensions of local economic development.

4.3 Alternative input penetration measures

The services input penetration 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, which represent the ratio between services inputs and total output of a downstream sector.[39] 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 penetration, 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.[40] Estimation results are given in Table 8.

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[36] 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.

[37] The countries included in the estimation sample for columns (3)-(4) of Table 6 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.

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

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

[40] For a derivation of these alternative input penetration measures from the IO Table, see Appendix 1.

The sign and statistical significance of the estimated coefficients is robust across all measures of input penetration. 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 8 generate economic effects that are similar in magnitude.

In the light of the substantial heterogeneity of the countries in our sample, one can question the representativeness of the US as the baseline country for the IO linkages. In Table 9 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.[41] China may be a more representative baseline for our 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.[42]

4.4 Variations in country and industry coverage

The baseline and interaction models were re-estimated in a series of robustness regressions excluding, one at a time, each of the 57 countries in the estimation sample. Table 10 reports the main benchmark estimates of Table 2 and compares them with key summary statistics of the coefficients estimated in the 57 robustness regressions. Beyond the very high average stability, the maximum and the minimum robustness estimates are always within a one standard deviation interval around the benchmark coefficient values. The last column of Table 10 shows the number of robustness regressions where the p-values for the estimates are below 0.05. The pattern of statistical significance is fully robust to variations in the country coverage.

The same robustness exercise is replicated excluding each of the 18 manufacturing sectors at a time. Summary statistics are reported in Table 11. While the signs and the average values of the robustness estimates fully confirm the benchmark patterns, the maximum values for the interaction coefficients exceed the benchmark estimates by more than one standard deviation. There are also few cases (two for the 'All modes' specification and one for 'Mode 3') where the statistical significance of the estimated interaction coefficient is below the threshold level of 0.05. The regression that generates lower magnitudes (in negative terms) and reduced significance of the moderating impact of institutions across modes of provisions is the one that excludes the sector of 'Coke, refined petroleum and nuclear fuel' (ISIC 23). However, when the same regression is estimated using alternative input intensity measures (technical or Leontief coefficients) or alternative moderator variables (rule of law or regulatory quality), both the magnitude and the statistical significance of the interaction coefficient are restored to values very close to the full sample benchmarks. The role of energy production (ISIC sector 23) therefore appears to be a relatively minor source of perturbation of the otherwise very stable pattern of robustness. At the same time, it suggests that industry-specific characteristics can give rise to a more or less pronounced role of institutions. An investigation of this additional source of variability is beyond the scope of the present analysis and is left for future research.

5. Conclusions

Services trade policy reform is an important ingredient for economic development, 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

[41] In 2006 China had a per capita GNI (Atlas method) of 2,050 US dollars. For that year the GNI per capita interval for lower middle income countries was fixed by the World Bank at 906-3,595 US dollars.

[42] 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.

restrictiveness of services trade policy may not be a sufficient condition for positive effects on the productivity of downstream industries.

Two main results emerge from the analysis. First, the quality of institutions significantly moderates the impact of services trade policy on manufacturing productivity. Second, the moderating role of institutions occurs through the FDI channel (mode 3), rather than through the cross-border trade channel (mode 1).

Our estimates are robust to instrumentation of the main variable of interest (composite services trade restrictiveness), 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 is remarkably similar across various specifications, lending confidence to our quantification. 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, and this will confront 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 IC measures we have used are proxies for the quality of economic institutions. They are not services-specific, in contrast to the services trade policy data. Better understanding of sector-specific institutions and their impacts is an important open question.

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Figure 1: *CSTRI* and Manufacturing Productivity Across Institutional Regimes: Descriptive Evidence

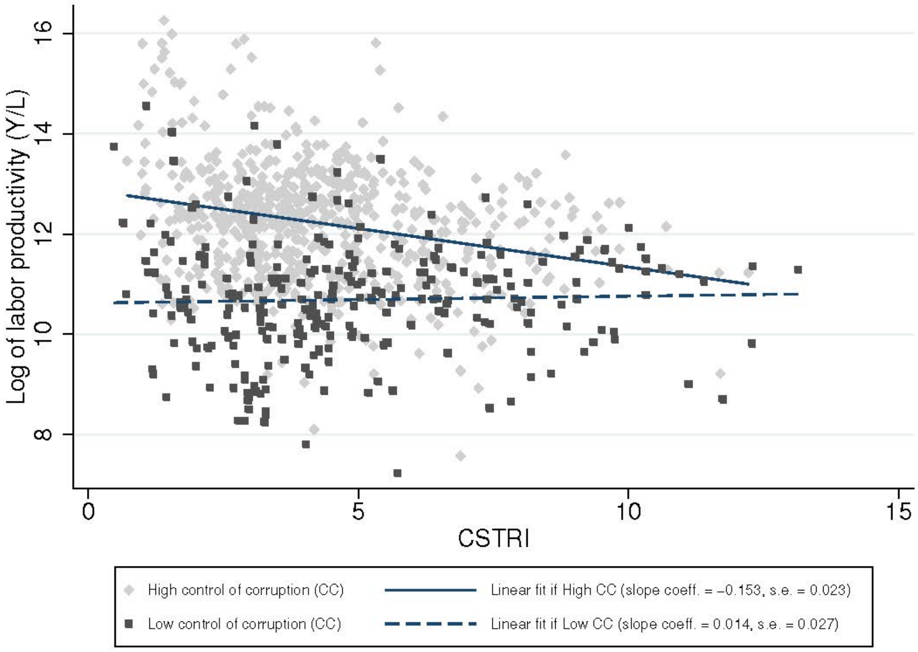

Figure 2: Impact of a One Unit Increase in *CSTRI* (Mode 3) on the Downstream Log Productivity y

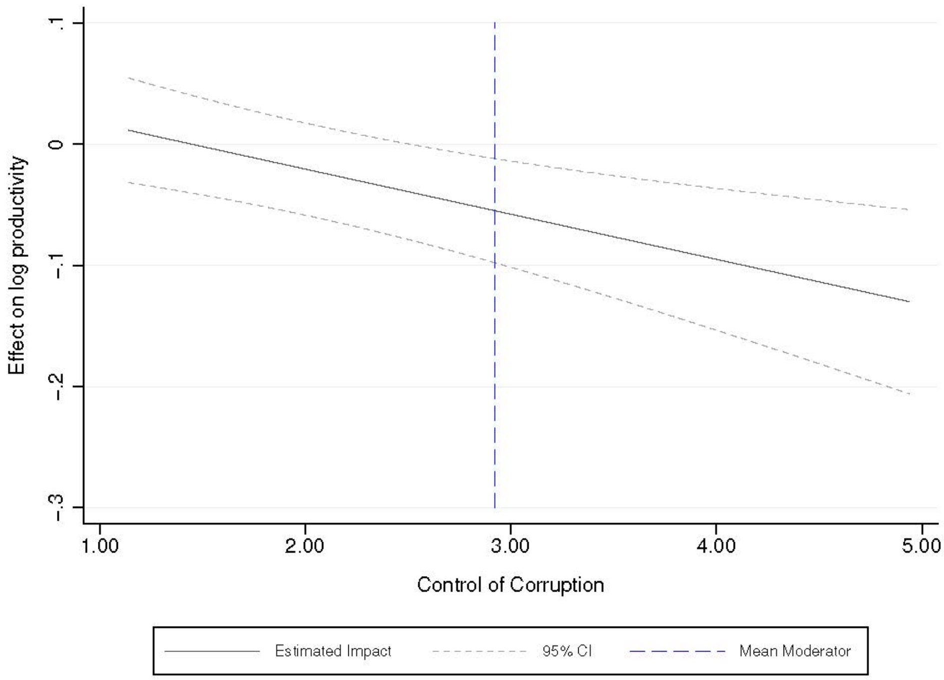

Figure 3: Instrument's Predictive Power for *CSTRI*

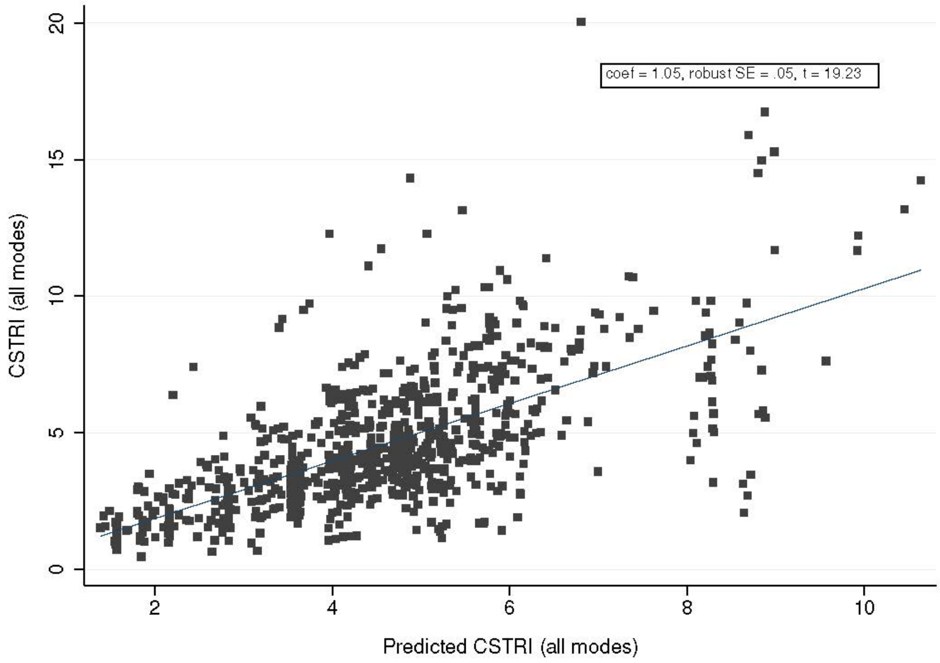

Figure 4: Impact of a One Unit Increase in *CSTRI* (Mode 3) on y : Random Assignement of *STRI*

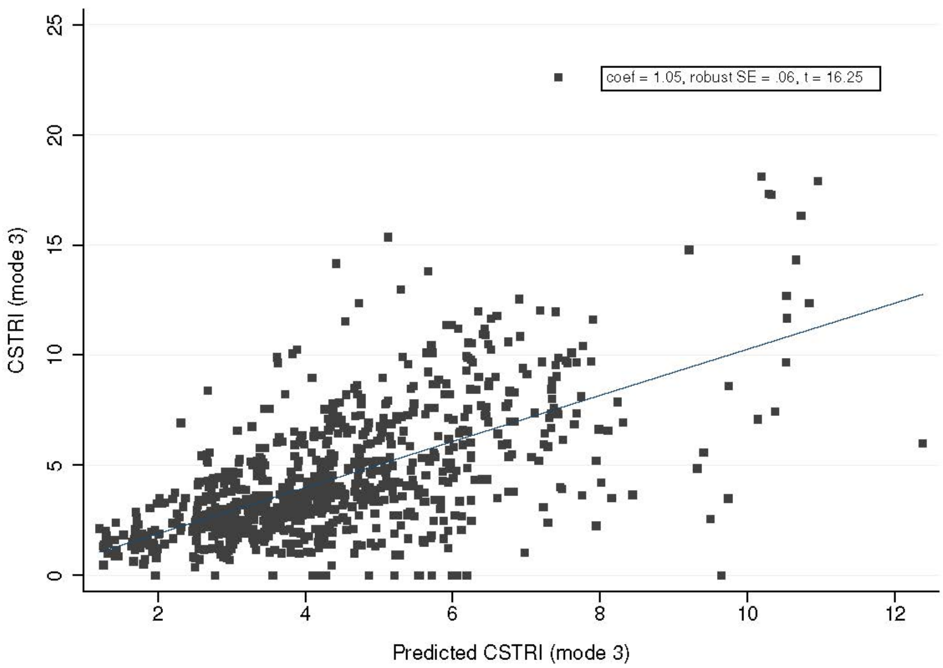

Figure 5: Mode 3 STRI

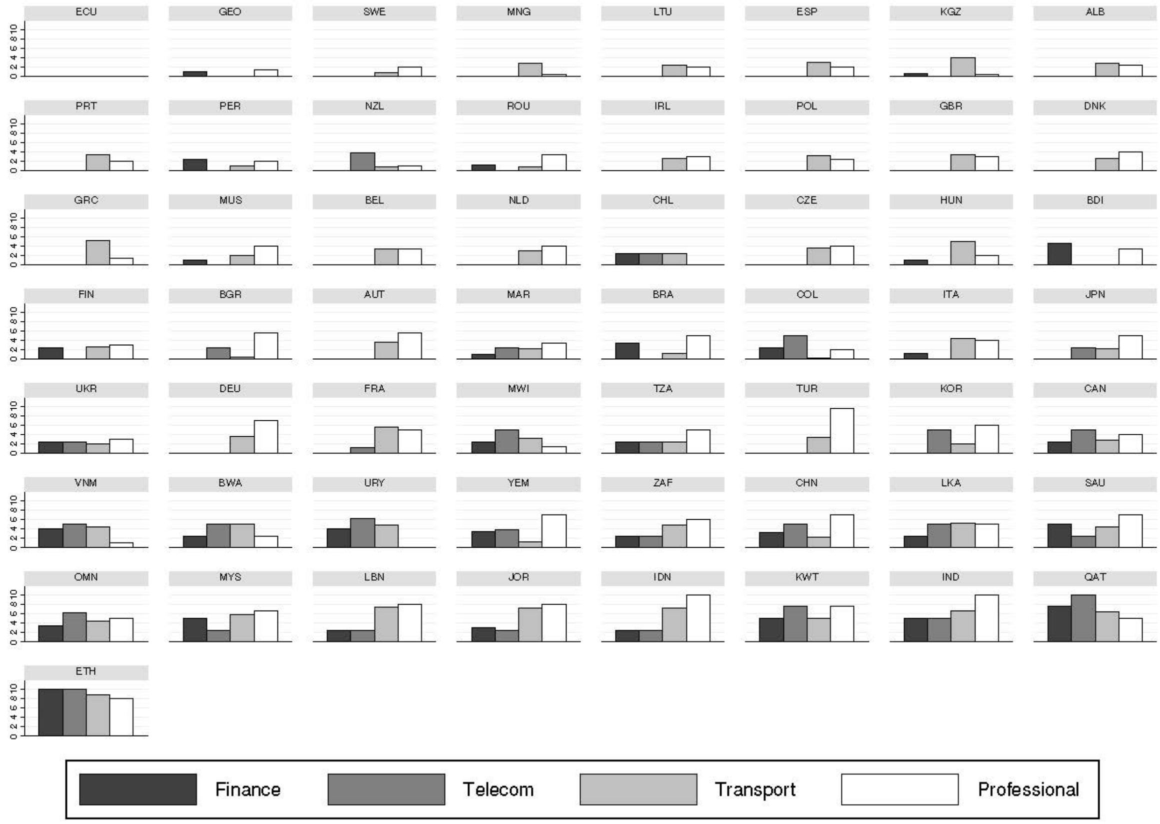

Figure 6: Distribution of $\%\Delta Y_{ij}$

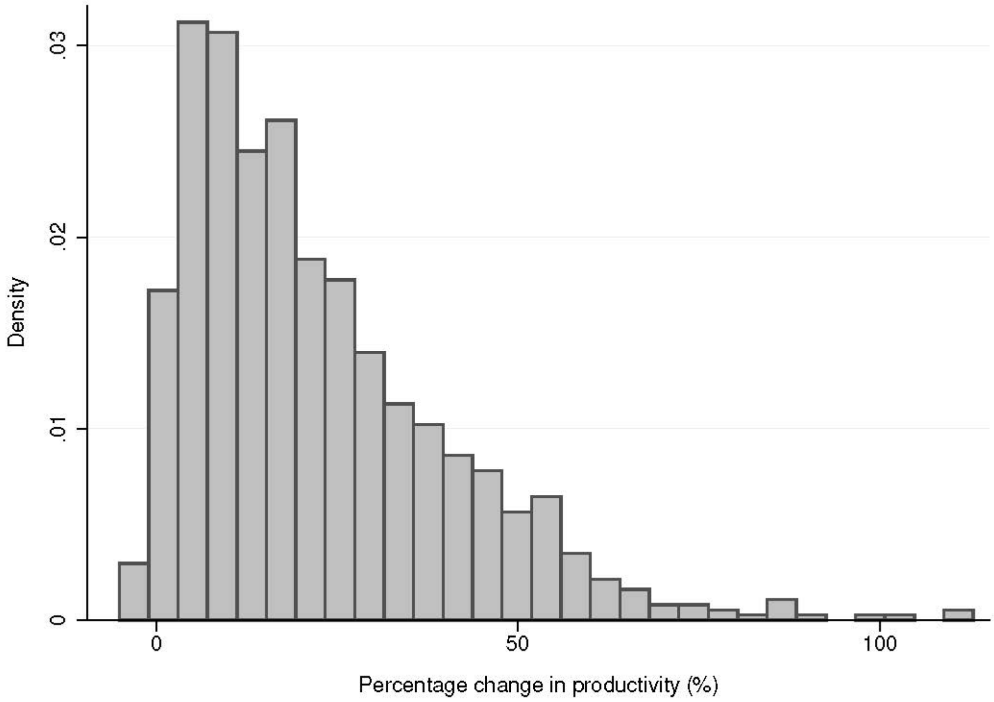

Table 1: Summary Statistics (Key Variables)

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

Notes: From estimation sample of Table 2. *y* = log of labor productivity (output per worker). *CSTRI* is defined in equation (1); *IC* = control of corruption; *CTau* is defined in equation (4)

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		-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

Notes: 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 = control of corruption

Table 3: 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 x 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 x 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

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

Table 4: 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

Notes: * p<0.10, ** p<0.05, *** p<0.01

Table 5: 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 x 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

Notes: 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 = control of corruption

Table 6: 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 x 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 x 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

Notes: 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 = control of corruption

Table 7: Interaction Model Estimation With Alternative Moderator Variables

Moderator (*M*)	**Rule of Law**		**Reg. Quality**		$\widetilde{pc}GDP$	
	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 x 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

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

Table 8: 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 x 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

Notes: 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 = control of corruption

Table 9: Estimation with Chinese Input Penetration 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 x 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

Notes: 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 = control of corruption

Table 10: Variation in Country Coverage

	Table 2 benchmark		Summary stats from 57 regressions			
	coeff.	**robust se**	**mean**	**max**	**min**	**# pval $<$ .05**
All modes						
β baseline	-0.018	0.023	-0.018	-0.009	-0.029	0
μ interaction	-0.035***	0.013	-0.035	-0.027	-0.040	57
Mode 3						
β baseline	-0.032	0.020	-0.032	-0.025	-0.038	0
μ interaction	-0.037***	0.012	-0.037	-0.029	-0.042	57

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Variation in Sector Coverage

	Table 2 benchmark		Summary stats from 18 regressions			
	coeff.	**robust se**	**mean**	**max**	**min**	**# pval $<$ .05**
All modes						
β baseline	-0.018	0.024	-0.018	-0.002	-0.027	0
μ interaction	-0.035***	0.014	-0.035	-0.007	-0.048	16
Mode 3						
β baseline	-0.032	0.020	-0.032	-0.013	-0.042	1
μ interaction	-0.037***	0.012	-0.037	-0.015	-0.048	17

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendices

1. Input Penetration Measures

Shares of intermediate consumption

Shares of intermediate consumption are derived from the first quadrant of the Input-Output (IO) matrix, i.e. the intermediate demand matrix M. M is a square matrix of dimension n where rows – indexed by r – are the supplying industries (domestic and international) and the columns – c – the using (domestic) industries. The number of industries in the IO table is equal to n. A generic element m_{rc} of the matrix M is the cost borne by sector c for the output produced by sector j (domestic production plus imported foreign production) and used as intermediate input into c. For each services-manufacturing sector pair (s, j), s' share of j's total intermediate consumption is equal to:

$$w_{js} \equiv \frac{m_{sj}}{\sum_{r=1}^{n} m_{rj}} \qquad (1)$$

IO technical coefficients

IO technical coefficients are the elements of the square matrix A, defined as:

$$A \equiv YM \qquad (2)$$

where Y is a dimension n square matrix of zeros, except along the main diagonal, that includes the inverse output of each industry. For each services-manufacturing sector pair (s, j), the IO technical coefficient is the element a_{sj} of matrix A and it gives the cost of the intermediate inputs from services sector s for one dollar of total production of manufacturing sector j.

Leontief coefficients

The third input penetration measure used in the paper consists of the coefficients derived from the Leontief inverse matrix. The input penetration of services sector s into manufacturing sector j that takes into account the indirect linkages between the supplying and the using sectors is given by the element l_{sj} of matrix L, defined as:

$$L \equiv VB \qquad (3)$$

where V is a dimension n square matrix of zeros, except along the main diagonal, that includes the value added-output ratios of each industry. B is the Leontief inverse $(I - A)^{-1}$, with A defined in equation (2) above.

2. Appendix Tables

Table 12: List of all Variables Used in the Empirical Analysis

Variable	Description and source
Country - manufacturing sector level	
$CSTRI_{ij}$	Index of composite services trade restrictiveness capturing the exposure of manufacturing sector *j* in country *i* to restrictions to trade in services. Variable defined in equation (1). The modal category of *CSTRI* depends on the the modal category of the *STRI* component. Source: policy data from STRI Database, World Bank. Input intensity data from US IO Table (mid 2000) from OECD STAN IO Database
$CSTRI_{ij}^{IV}$	Instrumental variable for *CSTRI*, defined and discussed in Section 3.1. Source: policy data from STRI Database, World Bank. Input intensity data from US IO Table (mid 2000) from OECD STAN IO Database. GDP per capita data (2007, in current US dollars) from World Development Indicators Database, World Bank
$\overline{C}STRI_{ij}$	Placebo version of *CSTRI*, defined and discussed in Section 3.2. Source: policy data randomly assigned. Input intensity data from US IO Table (mid 2000) from OECD STAN IO Database
$Ctau_{ij}$	Index of composite trade restrictiveness capturing the exposure of manufacturing sector *j* in country *i* to restrictions to trade in goods. $Ctau_{ij}$ is defined in equation (4). Source: 2006 simple average MFN tariffs from UNCTAD TRAINS. Input intensity measures from US IO accounts (mid 2000), OECD STAN IO Database
$\log TFP_{ij}$	Log of total factor productivity in manufacturing sector *j* in country *i*. $\log TFP_{ij}$ is defined in Section 4.1. Source: output, total employment, investment, value added from UNIDO INDSTAT4, Rev. 3. Prices from Penn World Table 8.1
y_{ij}	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. Source: output and total employment from UNIDO INDSTAT4, Rev. 3. Prices from Penn World Table 8.1
y_{ij} average	Average of y_{ij} over the three year period from 2006 to 2008. Source: output and total employment from UNIDO INDSTAT4, Rev. 3. Prices from Penn World Table 8.1
Country - services sector level	
$STRI_{is}$	Trade restrictiveness index for services sector *S* in country *i*. The 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	
w_{js}	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 Appendix 1. Source: OECD STAN IO Database. US IO table, mid 2000
Country level	
IC_i	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 Indicator, World Bank
$\widetilde{pc}GDP_i$	Proxy for the components of economic development which are not orthogonal to institutional capacity. $\widetilde{pc}GDP$ is defined in Section 4.2. Source: per capita GDP from World Development Indicators Database, World Bank. Institutional capacity data (control of corruption) from Worldwide Governance Indicator, World Bank

Table 13: 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		

Notes: Sectors are ISIC Rev. 3 manufacturing industries