

Firm Performance, Participation in Global Value Chains and Service Inputs

Evidence from India

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Abstract

This paper explores the relationship between the use of service inputs, participation in global value chains, and firm productivity. Services play the role of both an intermediate input in production and a coordinator. Using a detailed Indian firm-level data set from 1990–2017, the paper estimates the productivity premium associated with varying depths of global value chain integration and different intensities and types of services used in the production. The study finds that firms in global value chains have a productivity premium between 13 and 22 percent relative to domestic firms, with some variation based on the depth of global value chain integration and the sector to which the firm

belongs. Both the type of service inputs used (composition of services) and the origin of services (whether sourced domestically or from abroad) matter for firm performance. While higher aggregate service input use (as captured by the share of expenditure on service inputs) is not necessarily associated with an increase in productivity, increased use of complex services and information technology services is associated with higher productivity. The use of imported services is associated with higher productivity. Moreover, firms that are more deeply integrated in global value chains benefit more from importing services.

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Firm Performance, Participation in Global Value Chains and Service Inputs: Evidence from India*

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1. Introduction

Technological progress, decreasing trade barriers and declining overall trade costs have promoted the fragmentation of production across countries, regions and continents (Gereffi and Fernances-Stark 2016; World Bank 2020). Increasingly, firms are organizing their production on a global scale. Policy makers in various developing countries have undertaken economic reforms to promote external competitiveness with the aim of improving domestic economic productivity. Participation in global value chains (GVCs) can lead to positive spill-over effects, such as the acquisition of new know-how, innovative activities and the ability to source goods and services at competitive prices. These factors play an important role for sustained growth of developing countries. Integration into GVCs can help smaller developing countries specialize in specific production lines or tasks (rather than building up an industry from scratch). This has greatly helped countries reach larger markets and create economies of scale.

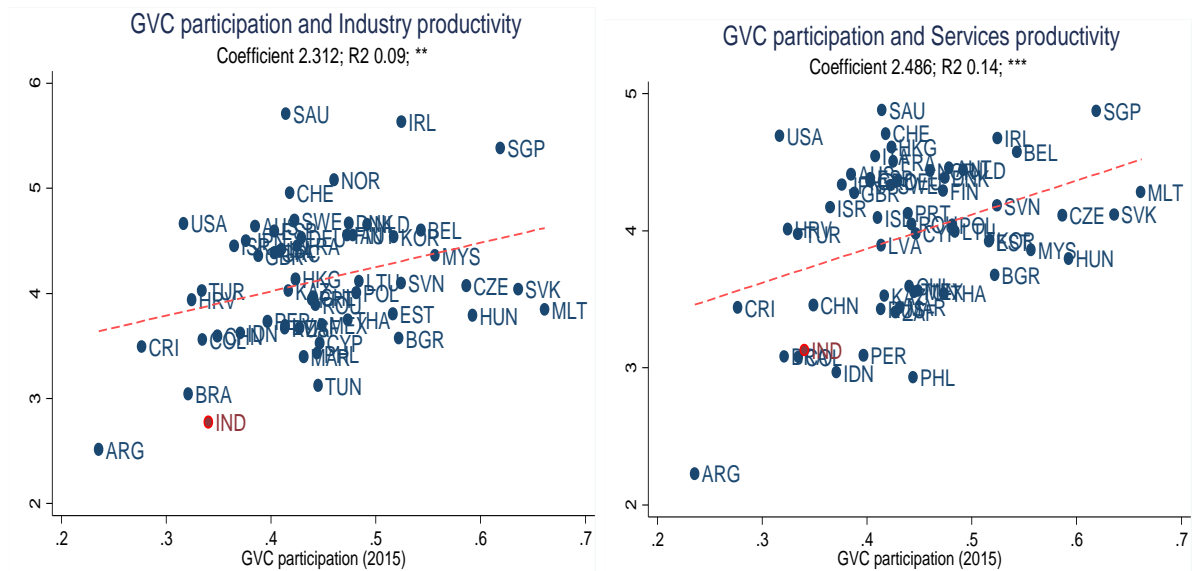
Empirical evidence has shown that GVC participation has substantial productivity benefits (Baldwin and Yan 2014). There is a strong positive correlation between the extent of participation in GVCs by countries and the productivity of the industrial and service sectors (Figure 1). The fragmentation of production across firms and countries allows for specialization and enables economies of scale. As services have increasingly become tradable due to lower trade costs and technological advances such as digital infrastructure, the sector has also benefited from the possibility of increased specialization of production as part of GVCs. Thus, for both goods and services, international integration facilitates access to technologies and knowledge.

Firms that engage in international trade are typically larger and have higher productivity levels (Melitz 2003; Helpman, Melitz and Yeaple 2014). Veugelers et al. (2015) found that European firms that are more involved in GVCs are also more productive. Participation in GVCs provides access to more efficient sourcing of inputs and larger markets abroad. Gaining access to GVCs and developing linkages with major suppliers and customers enables innovation and upgrading via knowledge and technological spillovers, learning by doing and the allocation of new tasks.

Services play a dual role in GVCs, as an intermediate input in production, as well as a coordinator. They help co-ordinate the different stages of production spread across geographical locations with the help of transport networks, digital connectivity services and distribution links. The use of service inputs in manufacturing has increased substantially over time. Miroudot and Cadestin (2017) show that service inputs make up about 37 percent of the value of manufacturing exports. As companies grow, their need to coordinate the core business activities increases. With the tremendous expansion of supply chain networks in recent years, services such as transport, logistics and ICT services, as well as marketing, consultancy and professional services are vital in coordinating the production process that is spread across countries. If these services are not optimally supplied to firms, they can hold back productivity and growth (see Arnold et al., 2011). The associated services activities that come along with this expansion can, in part, be outsourced to external services providers at competitive prices and, in part, be produced and supplied within the firm itself. If the former dominates, then this will show up as intermediate input expenditures of the firm. Previous work on India has shown that the effective provision of these input services can have a significant effect on downstream firm performance (Arnold et al., 2015). Facilitating

the use of high-quality services, liberalizing the service sector, removing various types of policy barriers related to services and strengthening the institutional framework might allow India and other developing countries to strengthen their GVC participation and profit from the associated economic benefits.

Figure 1: GVC Participation and Economy-wide Productivity (2015-2016)



Source: OECD TiVA; WDI; Author calculations¹

Despite the recognition of the importance of services, studies on the relationship of the use of service inputs, the depth of GVC integration and firm productivity are few in number. Our study adds to the empirical evidence on GVC integration, service input use and firm performance using detailed firm-level data from India for the period 1990-2017. The study classifies the depth of GVC participation following Veugelers et al (2013) and Gereffi and Fernances-Stark (2016) and looks at different type of service inputs, i.e., the composition of services as well as the origin of services. Indian firms integrated in GVCs play an important role in India’s economy, contributing a disproportionate share of output and exports. Due to its rapid economic progress, its successful market liberalization and integration into the global economy and its recent reforms in the service sector, India offers an excellent case study to evaluate the relation between service inputs, GVC participation and firm productivity. The paper complements existing work on GVCs in India such as Goldar et. al (2018) and Banga (2016).

We estimate the productivity premium associated with varying depths of GVC integration and different intensities and types of services used as inputs. First, GVC integration is associated with higher productivity levels. Firms in GVCs have a productivity premium between 13 and 22 percent relative to domestic firms. The productivity premium increases with the depth of integration into GVCs - firms integrated at an intermediate and high level have a much higher productivity premium relative to firms participating in GVCs in a limited or low level. Second, there is variation across industries, with the productivity premium

¹ Note: GVC participation is the ratio of a country’s GVC exports to total exports where GVC exports include the foreign value-added content of exports and the domestic value-added content of exports that are re-exported by the importing country to a third country. Productivity here refers to labor productivity in PPP terms.

from GVC participation being higher in auto, electronics and IT/ITeS industries compared to textiles and chemicals. Third, a higher intensity of overall service input use is not necessarily associated with an increase in productivity. The composition of service inputs and the origin of services matter more for productivity. Fourth, an increase in the share of service expenditures on complex services by 1 percent is associated with a 10 percent higher productivity. Complex services are typically high-skill intense. Service inputs like research and development activities, technical, managerial and other sophisticated professional services, and in particular IT/ITeS services have substantially contributed to enhance within-firm productivity. Fifth, the origin of services (domestic vs. foreign) matters for firm performance, with firms importing services having a 10 percent higher productivity compared to firms not importing services. Around three percentage points of this productivity premium can be attributed to imports of complex services. Sixth, firms more deeply integrated in GVCs benefit more from importing services. Firms that are integrated at an intermediate level into GVCs have, on average, a 12 percent higher TFP than purely domestic firms. If these firms also import services, the total productivity premium reaches around 28 percent. Firms importing services and highly integrated into GVCs have on average a 54 percent higher productivity than purely domestic firms.

This paper is organized as follows. Section 2 describes the data and approach to analyze the relationship between firm performance, GVC participation and service input use at the firm level. Section 3 presents the descriptive analysis. The results of our estimation of the productivity premium associated with GVC participation and service input usage are presented in Section 4. Section 5 concludes.

2. Data and Empirical Strategy

We use detailed firm-level information from the Prowess database collected by the Centre for the Monitoring of the Indian Economy (CMIE). Prowess contains information primarily from income statements and annual reports of publicly listed companies in India. The data spans the years from 1990 to 2017. The data is a panel of medium and large firms accounting for around 70 percent of economic activity in India's formal industrial sector (see Goldberg et al., 2010a, 2010b).² The panel structure of Prowess enables within and across firm comparisons of performance changes and input usage over time. We use data from approximately 13,937 firms covering 89,804 observations.

Identifying the Mode of GVC Participation

We follow Veugelers et al. (2013) and identify a firm's integration in GVCs from the intensity of a firm's internationalization strategy, i.e., how many international activities the firm uses in combination. The three criteria used in the identification include (1) whether a firm is an intensive importer – it imports at least one-third of its total intermediate inputs;³ (2) whether a firm is an intensive exporter – it exports at least two-thirds of total output; and (3) whether the firm has access to international networks – it is majority foreign owned or has a majority stake in companies abroad, or belongs to an international oriented business group (total exports of the group is greater than two-thirds of total output or total imported

² The data set does not include small firms. However, the exclusion of small firms does not affect our analysis since mainly medium and large firms are integrated in GVCs, use a larger fraction of service inputs and undertake the majority of innovation activities.

³ Intermediate inputs include material inputs and as well service inputs.

inputs of the group is greater than one-third of total inputs).⁴ The categories and threshold values for exporting and importing are based on Veugelers et al (2013) and are similar to those used by Gereffi and Fernances-Stark (2016). Firms are categorized into one of five categories:

- (1) Highly Integrated/ Triple Mode of participation in GVCs- The firm fulfils all three criteria i.e., it exports intensively, import intensively and has well established global linkages.
- (2) Intermediate Depth/Dual Mode of participation in GVCs – The firm fulfills two of the three criteria (intensively exporting, intensively importing or being well linked internationally).
- (3) Low Depth/Single Mode of participation in GVCs- The firm fulfills one of the three criteria (intensively exporting, intensively importing or being well linked internationally).
- (4) Very Low/Limited participation in GVCs - The firm exports only a small share of its output (exports < 2/3 of output), its intermediated imports account only for a limited fraction of total inputs (intermediate imports <1/3 inputs) or the firm has only limited linkages to international networks.
- (5) No participation in GVCs– The firm is purely domestically owned and does not engage in exporting or importing activities.

Table 1 reports the share of firms by mode of GVC Participation. In 2015, only 1.6 percent of firms were triple mode firms (High GVC involvement), around 6 percent were Dual (Intermediate) mode firms, 23.18 percent were Single (Low) mode firms, 32.45 percent had limited participation in GVCs, and 36.69 percent of firms had no GVC involvement. See Manghnani et. al (2021) for a more detailed documentation of the integration of Indian firms in GVCs.

Table 1: Share of Firms by mode of GVC Participation

Mode of Participation in GVCs	Share (%)
High /Triple Mode of GVC Participation	1.64
Intermediate/ Dual Mode of GVC Participation	6.04
Low/Single Mode of GVC Participation	23.18
Very Low/ Limited GVC Participation	32.45
No GVC Participation	36.69

Note: Shares pertain to year 2015

GVC Participation and Firm Performance

A premium in productivity is in general associated with GVC participation (see among others Amiti and Konings, 2007, and Goldberg et al., 2010b). Moreover, a higher intensity of use of complex service inputs can be associated with a higher productivity. The productivity premium associated with different depths of GVC integration and service input use is estimated in the baseline by:

$$\ln Tfp_{ist} = \beta_1 GVC\ mode_{ist} + \gamma_1 service\ intensity_{ist} + X_{ist}\Gamma + \alpha_t + \alpha_i + \epsilon_{ist} \quad (1)$$

where $GVC\ mode_{ist}$ is the depth of GVC integration of firm i operating in industry s at time t . The mode of GVCs is classified as zero, low, single, dual, and triple modes of internationalization.

⁴ As Gereffi et al. (2005) emphasize, being in the same business group can be interpreted as vertical integration of firms in GVCs. Even if a firm in a business group exports or imports a small share directly, it may do so much more intensively indirectly at arm's length.

TFP or the total factor productivity is constructed following the methodology of Akerberg, Caves and Fazer (2015) building on Levinsohn and Petrin (2003) using intermediate inputs as proxy.⁵ Since Prowess does not have reliable employment information, the total wage bill is used to measure labor inputs. Gross fixed assets are constructed by the perpetual inventory method Value added, defined as gross output minus the value of material inputs, energy and service inputs, is used as dependent variable in the production function. All relevant values are deflated using sector specific Indian wholesale price indices provided by the Office of the Economic Adviser of the Indian Ministry of Commerce and Industry. The service sector deflator is constructed from the National Accounts Statistics series on the service sector contribution towards the gross domestic output.

To measure service inputs, all expenditures incurred for royalties, technical know-how, license fees, research and development, rent & lease rent, selling & distribution, finance and insurance, outsourced manufacturing and outsourced professional jobs, travel and communication expenses, and repair and maintenance are considered. The variable service intensity measures the intensity of services used in the production and is measured by the share of expenditures spend on service inputs relative to total expenditures.⁶

We further disaggregate services and look separately at complex services and IT related services. Complex services are considered as having a greater level of production complexity because of its higher fixed training costs (Costinot, 2009). Complex services are broadly defined as high value-added and high-skill intense services, which usually require strong domestic institutions and the rule of law, because contracting for them is often more complicated than contracting for traditional services. Such services include finance, insurance, securities and pension management, technical, trade and other business services.⁷ We also examine the role of service imports in an extension to the baseline.

We control for firm size and the (log) expenditures on services in the vector X_{ist} , following Arnold, Javorcik and Mattoo (2011). Further, we include time and firm fixed effects to account for unobserved firm and industry specific heterogeneity related to a firms' location, management characteristics, comparative advantages of specific industries, and time specific economic shocks and trends.

3. Descriptive Analysis

Table 2 reports average values for some key variables- output, productivity and different service intensities. These vary considerably across the depth of integration into GVCs. Table 3 presents the average output and productivity by GVC mode. The patterns in India are consistent with the empirical evidence from other countries where firms that engage in international trade are usually the ones that are more productive (Melitz, 2003; Helpman, Melitz and Yeaple, 2014). Also, firms with foreign ownership are typically more productive. As can be seen from the table, firms that are more deeply integrated in GVCs

⁵ The correlation between TFP estimates following Levinsohn and Petrin (2003) and Akerberg et al. (2015) is 0.94.

⁶ Total expenditures include expenditures on imported intermediate goods and services.

⁷ A discussion about complexity can be found in Costinot (2009). Here, complex services include financial and insurance services, outsourced professional jobs, royalties, technical know-how, license fees, and research and development.

(intermediate and high GVC participation) are typically larger and are, on average, more productive, as measured by total factor productivity.

Table 2: Summary Statistics

Variable	Average	Unit
Output	2.157	in million Indian Rupees (logged and deflated)
Wage	0.544	in million Indian Rupees (logged and deflated)
Productivity	0.002	total factor productivity
Service Intensity	15.230	relative to total expenditures
IT related service intensity	1.360	relative to total expenditures
Complex service inputs	6.590	relative to total expenditures

Table 3: Average Output and productivity by GVC mode

GVC Mode	Output	Productivity
No	1.187	-0.149
Very Low	2.277	0.040
Low	2.585	0.059
Intermediate	3.087	0.094
High	3.019	0.189

Note: Calculation based on all years. Output is in million Indian Rupees (logged and deflated). Productivity is measured by TFP constructed following the methodology of Akerberg, Caves and Frazer (2015).

Firms that are more deeply integrated into GVCs contribute a disproportionate share of the output and exports. Double and triple mode firms (intermediate and high levels of GVC integration) constitute less than 10 percent of the total manufacturing firms in numbers but produce over 22 percent of the total manufacturing output and 50 percent of exports (Figure 2). Triple mode firms by themselves account for about 6 percent of total output and for nearly 15 percent of total exports. The majority of the output share, nearly half of the total output, is produced by firms who are classified as low or single mode of GVC integration. Similar patterns are observed when we look at the shares within specific industries. We show the distribution of firms, output and exports for two major manufacturing industries - Apparel and Textiles and Electronics in Figure 3 and Figure 4, respectively.⁸

The kernel-density functions of productivity with respect to different international trading activities and different modes of GVC participation are presented in Figure 5 and Figure 6, respectively. Since the TFP distribution is skewed, it is preferable to look at the full distribution of TFP levels rather than only average values. The kernel density shows the shares of firms (density) that reach each productivity level. Thus, it shows the probability of choosing a firm with a certain productivity level when firms are randomly drawn from each category of GVC activities.

Firms that both export and import are more productive than firms that are only exporters, only importers and firms serving the domestic market only. Further, the distribution of the estimated productivity confirms that firms that are more deeply integrated in GVCs are, on average, more productive. The superior performance of deeply integrated firms (dual and triple mode) in GVCs is particularly visible in

⁸ Apparel and Textiles comprise the sector categories 13, 14 and 15 (according to 2-digit NIC classification); Electronics comprise the sector categories 26 and 27 (according to 2-digit NIC classification).

the upper tail of the distribution. Firms with a high or intermediate mode of GVC integration are not only more productive on average, they are also likely to be among the best performers. This pattern is observed across manufacturing industries. See Annex Figures A.1-A.3 for the kernel densities for the Automobile industry, Apparel and Textiles, Electronics, and Chemicals and Pharmaceuticals industries respectively.

While it is difficult to draw direct comparisons between Indian firms active in GVCs and those in Europe due to the data differences, the study of Veugelers et al. (2013) does allow for some observations due to similar GVC definition. In Europe, like in India, increasing values of productivity is associated with increasing levels of GVC participation across single, dual and triple mode firms which are classified as having a low, intermediate and high level of GVC participation respectively.

Figure 2: Distribution of Manufacturing firms, output and exports by different modes of integration in GVCs

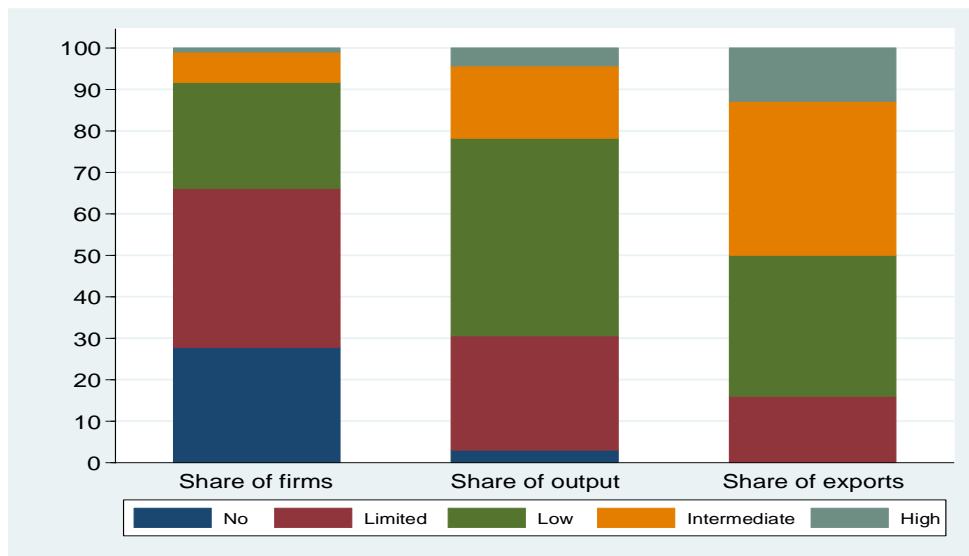


Figure 3: Apparel and Textile firms, output and exports by different modes of integration into GVCs

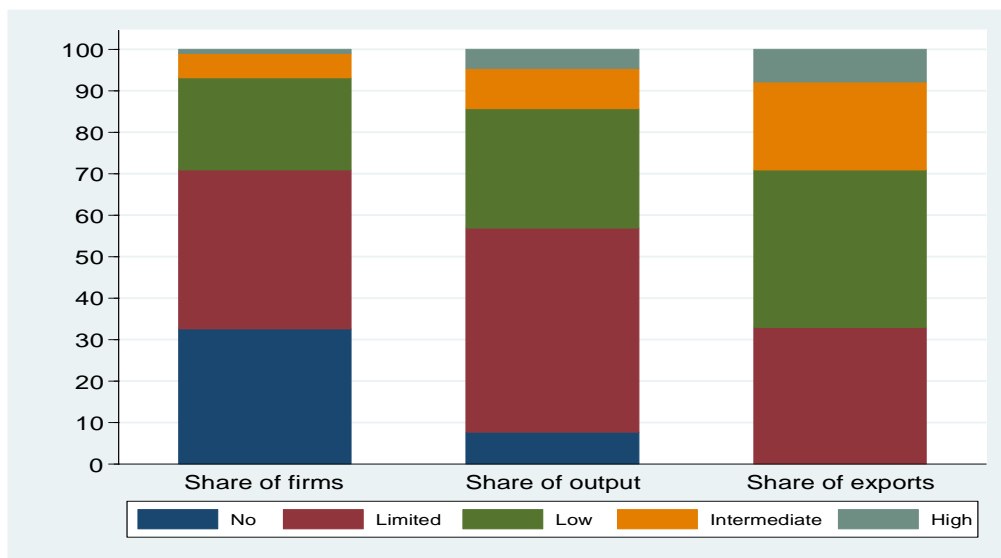


Figure 4: Electronics firms, output and exports by different modes of integration into GVCs

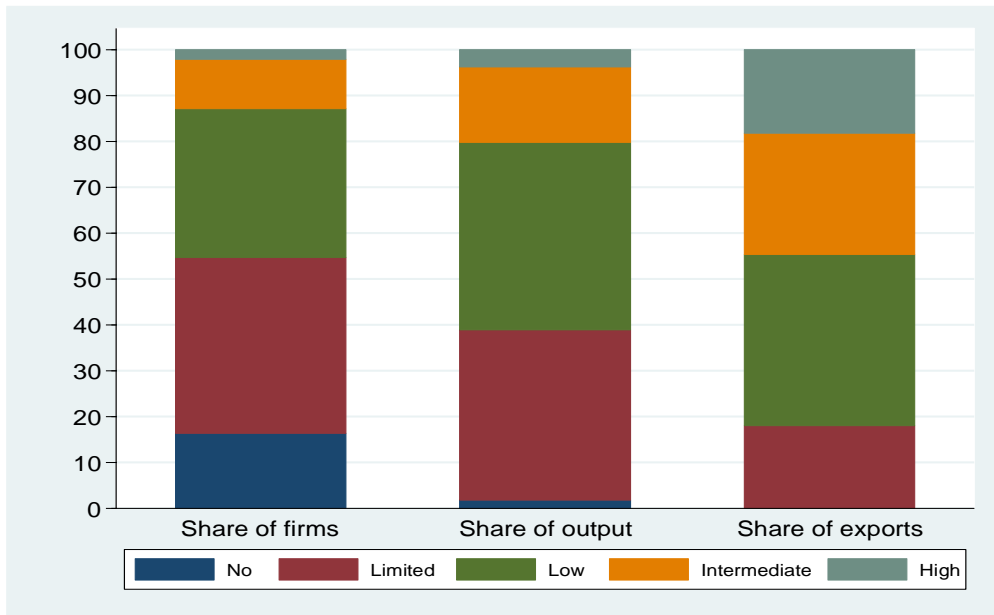


Figure 5: Total Factor Productivity density and international market integration

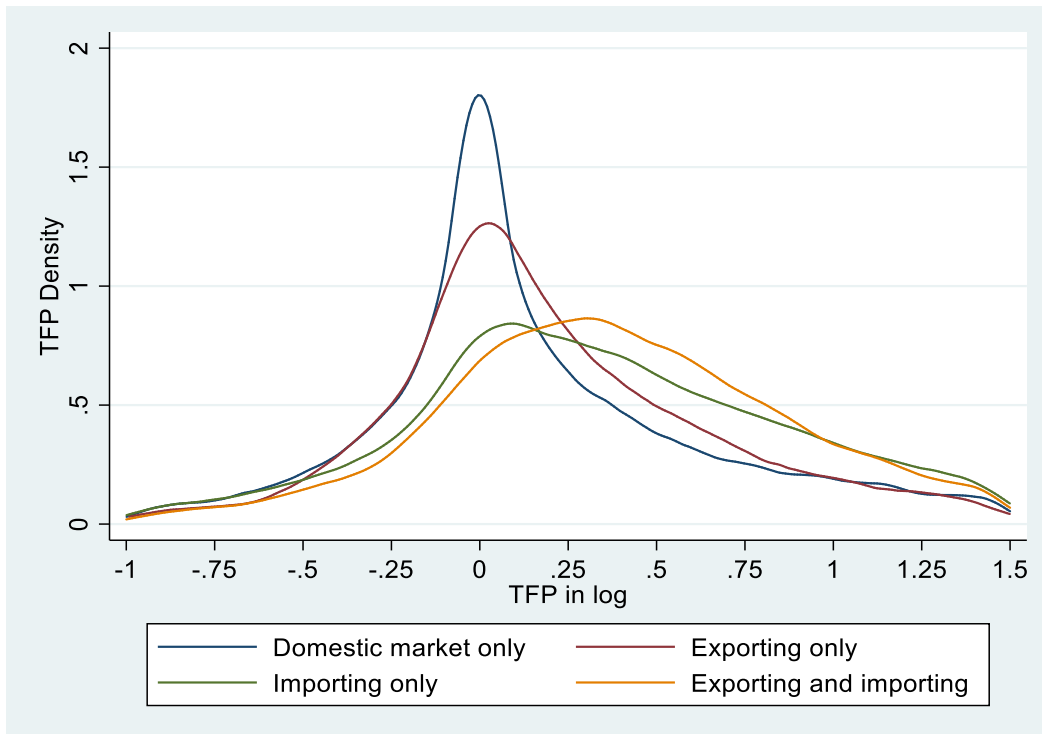
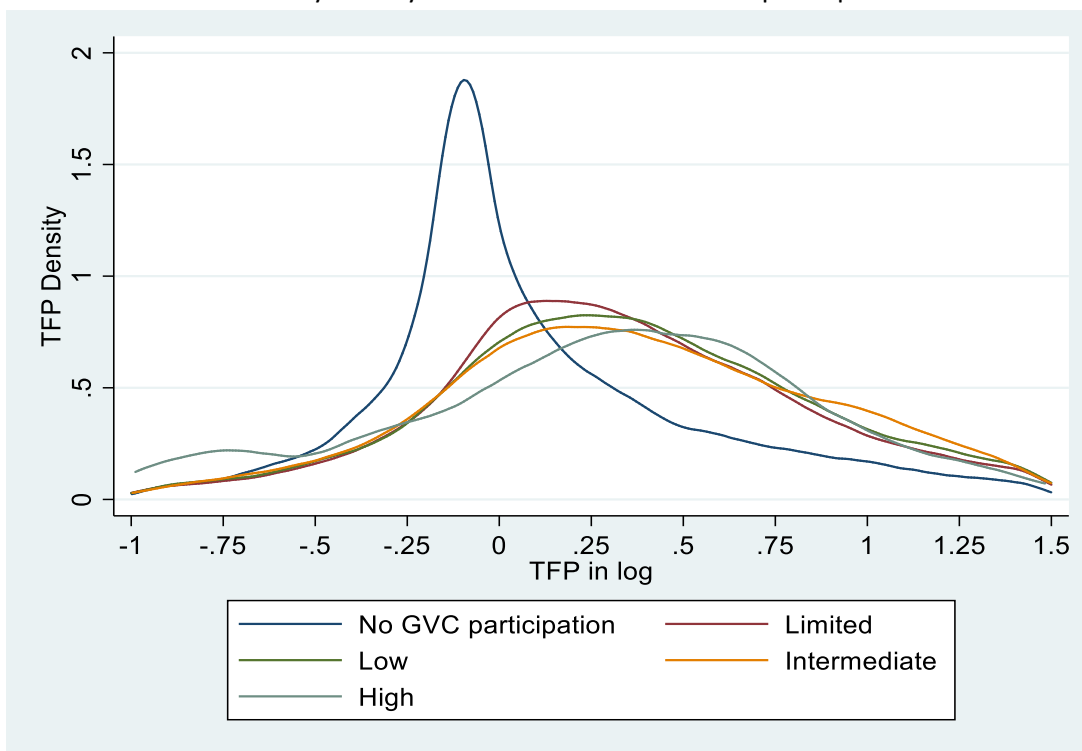


Figure 6: Total Factor Productivity density and different modes of GVC participation



4. Firm Performance, GVC participation and Service Input Usage

We present the results of our estimation of the productivity premia associated with GVC participation and service input usage as specified in equation (1). In additional estimations, we consider imports and exports of services. Further, we also look at sectoral differences.

Baseline Results

Table 4 confirms that there is a productivity premium associated with being integrated into GVCs. Column 1 shows that firms integrated in GVCs have a productivity premium between 13 and 22 percent relative to domestic firms. Moreover, as the coefficients indicate, the productivity premium is increasing in the extent of integration, with triple mode firms being associated with the highest productivity premium. A higher service input use (as captured by the share of expenditure on service inputs) is not necessarily associated with an increase in productivity. The composition of service use matters as well.

An increase in the share of service expenditures on complex services by 1 percent is associated with a 10 percent higher productivity (column 2). Thus, a firm’s purchase of technological know-how, licenses or sophisticated professional services is associated with a higher productivity as these services involve using more sophisticated production licenses, better management tools or digital value-added services. In particular, the intensive use of IT services and ITES, which are highly sophisticated, is associated with an increase in productivity (columns 3 and 4). Even though the size of the coefficient of the share of IT and ITES on total services in columns 3 and 4 is relatively small, the magnitude of the potential effect is relatively large since the share of IT services and ITES on total services is relatively small. Hence, a small

increase in expenditures for IT and ITES might (*ceteris paribus*) increase the share of IT and ITES on total services substantially which is correlated with a higher productivity.

The results are robust when controlling for the different types of service use (column 4). An interaction term of the different modes of GVC participation and service intensities, and respectively different service type, is not significant (results not shown, available on request). Thus, the premium for the use of services on productivity is not dependent on GVC integration.

Table 4: Estimated Productivity Premium for GVC participation and Service Intensity

VARIABLES	(1)	(2)	(3)	(4)
Limited GVC participation	0.1375*** (0.0173)	0.1334*** (0.0173)	0.1376*** (0.0173)	0.1334*** (0.0173)
Low GVC participation	0.1454*** (0.0122)	0.1435*** (0.0122)	0.1454*** (0.0122)	0.1436*** (0.0121)
Intermediate GVC participation	0.1614*** (0.0096)	0.1608*** (0.0095)	0.1614*** (0.0096)	0.1610*** (0.0095)
High GVC participation	0.2208*** (0.0403)	0.2203*** (0.0403)	0.2209*** (0.0403)	0.2205*** (0.0403)
Service Intensity	0.0009 (0.0097)	0.0032 (0.0096)	0.0013 (0.0096)	0.0050 (0.0096)
Complex Service Intensity		0.1039*** (0.0074)		0.1091*** (0.0076)
ITES Intensity			0.0068** (0.0034)	0.0149*** (0.0035)
(Log) Service Input Expenditures	-0.3952*** (0.0183)	-0.3936*** (0.0183)	-0.3948*** (0.0183)	-0.3929*** (0.0182)
Size	0.3828*** (0.0115)	0.3803*** (0.0115)	0.3833*** (0.0115)	0.3823*** (0.0115)
Constant	-0.1936** (0.0797)	0.2300*** (0.0845)	-0.1982** (0.0798)	0.2413*** (0.0845)
Observations	89,521	89,521	89,521	89,521
R-squared	0.344	0.355	0.343	0.352
Number firms in sample	13,919	13,919	13,919	13,919

Note: The size of a firm is measured by log annual sales. Complex services intensity and ITES intensity is measured as log share of expenditures of complex services and, respectively, ITES on total service expenditures. Firm, industry and year fixed effects are included in all regressions. The sample includes all manufacturing and service firms and spans the years from 1995 to 2016. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The R-squared corresponds to the overall adjusted R-squared.

Table 5: Estimated Productivity Premium for GVC participation and Service Imports

VARIABLES	(1)	(2)	(3)	(4)
Limited GVC participation	0.0845*** (0.0178)	0.0994** (0.0402)	0.0841*** (0.0178)	0.0809*** (0.0177)
Low GVC participation	0.0953*** (0.0128)	0.1007*** (0.0150)	0.0953*** (0.0128)	0.0945*** (0.0127)
Intermediate GVC participation	0.1120*** (0.0102)	0.1098*** (0.0104)	0.1122*** (0.0102)	0.1126*** (0.0101)
High GVC participation	0.1676*** (0.0404)	0.2632*** (0.0991)	0.1664*** (0.0404)	0.1669*** (0.0404)
(Log) Service Input Expenditures	-0.3954*** (0.0183)	-0.3958*** (0.0183)	-0.3964*** (0.0183)	-0.3953*** (0.0182)
Service Intensity	0.0007 (0.0096)	0.0003 (0.0096)	0.0005 (0.0096)	0.0020 (0.0095)
Service Import Dummy	0.0955*** (0.0079)	0.2153*** (0.0560)	0.0801*** (0.0091)	0.0782*** (0.0091)
Limited GVC participation x Service Import Dummy		0.1165** (0.0568)		
Low GVC participation x Service Import Dummy		0.1266** (0.0576)		
Intermediate GVC participation x Service Import Dummy		0.1365** (0.0675)		
High GVC participation x Service Import Dummy		0.2206** (0.1117)		
Complex service Intensity				0.1026*** (0.0074)
Complex Service Import Dummy			0.0258*** (0.0088)	0.0261*** (0.0087)
Export Service Dummy	0.0395 (0.0561)	0.0396 (0.0561)	0.0397 (0.0561)	0.0345 (0.0555)
Size	0.3767*** (0.0114)	0.3771*** (0.0114)	0.3762*** (0.0114)	0.3744*** (0.0114)
Constant	-0.2251** (0.0977)	-0.2272** (0.0978)	-0.2236** (0.0975)	0.2039** (0.1009)
Observations	89,521	89,521	89,521	89,521
R-squared	0.343	0.343	0.342	0.353
Number firms in sample	13,919	13,919	13,919	13,919

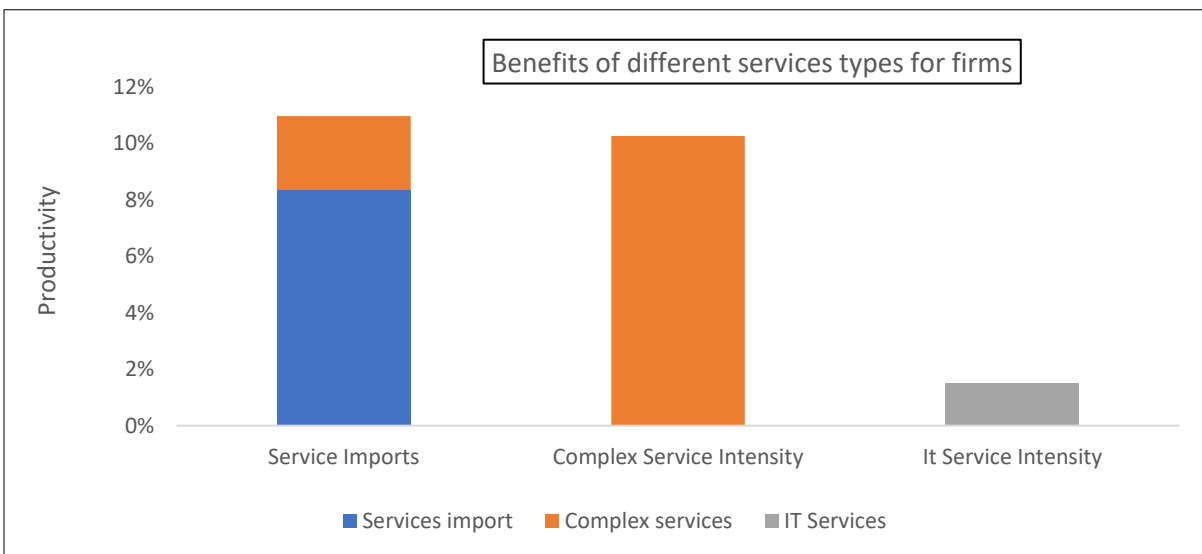
Note: The size of a firm is measured by log annual sales. Firm, industry and year fixed effects are included in all regressions. The sample includes all manufacturing and service firms and spans the years from 1995 to 2016. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The R-squared corresponds to the overall adjusted R-squared

Service Imports and Exports

The imported service related premium on the productivity is estimated by adding indicator variables for service imports and service exports to the baseline estimation equation (Table 4). The indicator variable for service imports is equal to 1 if the firm imports services and the indicator variable for service exports is equal to 1 if the firm exports services. Like in the baseline before, we control for size, service expenditures, firm heterogeneity and time specific effects.

Table 5 analyzes trade in services and GVC participation in more detail. Column 1 shows that firms importing services have a 10 percent higher productivity compared to firms not importing services. Around three percentage points of this productivity premium can be attributed to imports of complex services (see column 3). Explicitly accounting for complex service intensities shows that this correlation is robust (see column 4). Thus, there is a productivity premium associated with imports of services, particularly complex services. Exporting services, in contrast to importing services, does not appear to be associated with higher productivity. Figure 7 presents the relationship between the different types of services used and the productivity of firms based on the coefficients in Tables 4 and 5.

Figure 7: Benefits of GVC participation and importing services

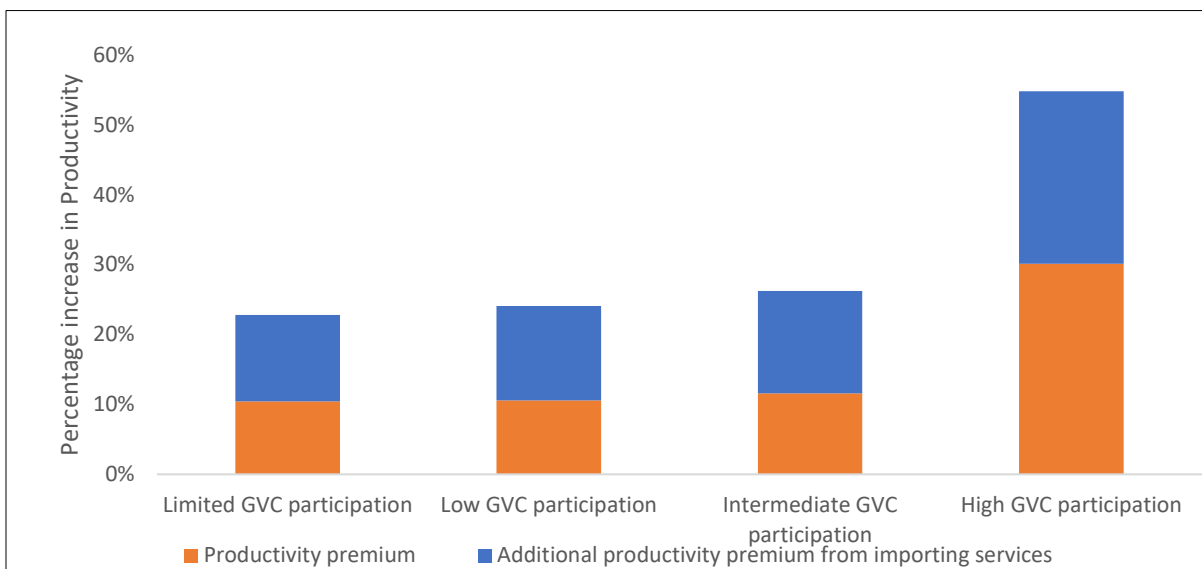


Note: The first bar of the figure shows the association between service imports and productivity accounting as well for imports of complex services based on column 4 of Table 5. The second bar shows the productivity premium associated with the use of complex services based on column 4 of Table 4. The third bar shows the impact of ITeS intensity on productivity based on column 4 of Table 4. The magnitude of the effect is robust across specification.

In column 2 of Table 5, service imports are interacted with the different GVC participation modes. Interacting service imports with the GVC participation mode reveals that firms more deeply integrated in GVCs benefit more from importing services. Figure 8 shows the benefit of being integrated in GVCs and starting to import services for firms in different GVC modes in detail. Firms that are integrated at an intermediate level into GVCs have, on average, a 12 percent higher TFP than purely domestic firms. If these firms also import services, the total productivity premium reaches around 28 percent. Firms importing services and highly integrated into GVCs have on average a 54 percent higher productivity than purely domestic firms. Hence, it appears that foreign sourced services are of a higher quality and their use is

associated with higher productivity. The results suggest that both the type of service used as well as the origin of services (whether sourced domestically or from abroad) matter. It appears that firms that use foreign service inputs in their production are more productive than firms producing only for the domestic market and relying only on domestic services.

Figure 8: Benefits of GVC participation and importing services



Note: The figure is based on the interaction coefficient of the service dummy with the different GVC modes shown in column 2 in Table 5.

Foreign owned firms that import services besides using domestic services are more productive than their domestic counterparts. Tables A.1 and A.2 in the annex provide further details. The specifications in the two tables are similar to those in Tables 4 and 5, respectively, except that the variable capturing the depth of GVC integration is replaced by separate indicator variables for export status, import status and foreign ownership status. The coefficients on both the export and import indicator variables are positive and significant, with the magnitude on the import status being almost three times the magnitude on the export status, suggesting that the productivity premium associated with imports is much higher than exports. Foreign owned firms are, on average, 15 percent more productive than purely domestic owned firms, while firms that export have, on average, a productivity premium of around 4 percent compared to firms only serving the Indian market. This alternative specification confirms the productivity enhancing characteristics of complex services and IT services. The use of more high skill related business services is associated with a higher productivity of around 11 percent, importing such complex services boosts the productivity by additional 2 percent (see Table A.2, column 4).

Differences across Sectors

There are some differences across industries in the productivity premium associated with GVC participation and the use of service inputs. Table 6 presents the results for some major industries. In the automobile industry, double mode firms, i.e., firms with an intermediate level of global integration, have a productivity premium of 47 percent compared to firms not integrated in GVCs. Firms highly integrated

in the Electronics industry and the IT service and ITES industry are much more productive than their purely domestic counterparts. Triple mode firms in the IT/ITeS and electronics industries are respectively 49 and 35 percent more productive than firms not integrated into GVCs. On the other hand, the productivity premiums associated with intermediate and high levels of GVC integration are relatively lower in the textiles and apparel and chemical industries.

Table 6: Estimated Productivity Premium for GVC participation and Service Imports by Sector

VARIABLES	(1) Automobile Industry	(2) Electronics Industry	(3) Textiles and Apparel	(4) Chemicals and Pharmaceuticals	(5) IT and ITeS
Limited GVC participation	0.1268* (0.0755)	0.1288*** (0.0332)	0.0990** (0.0467)	0.0611* (0.0355)	0.1470 (0.1006)
Low GVC participation	0.1500*** (0.0539)	0.1497*** (0.0420)	0.1065*** (0.0267)	0.0722** (0.0281)	0.1818* (0.1004)
Intermediate GVC participation	0.3822*** (0.1471)	0.1948*** (0.0549)	0.1141* (0.0616)	0.0834*** (0.0252)	0.2307** (0.0938)
High GVC participation		0.3024*** (0.1070)	0.1304* (0.0771)	0.0364 (0.0550)	0.3958** (0.1588)
(Log) Service Input Expenditures	-0.4907*** (0.0921)	-0.4217*** (0.0891)	-0.4682*** (0.0596)	-0.3899*** (0.0440)	-0.2204* (0.1178)
Service Intensity	0.0401 (0.0688)	0.0518 (0.0379)	0.0469 (0.0291)	0.0518** (0.0230)	0.0089 (0.0790)
Complex Service Intensity	0.1553*** (0.0358)	0.1666*** (0.0290)	0.1163*** (0.0238)	0.0873*** (0.0143)	0.0039 (0.0648)
Service Import Dummy	0.1372* (0.0750)	0.1180*** (0.0277)	0.0682*** (0.0220)	0.0857*** (0.0165)	0.0917* (0.0483)
Export Service Dummy	0.0392 (0.0355)	0.2053 (0.2665)	0.0279 (0.2790)	0.2464** (0.1164)	0.2289*** (0.0668)
Size	0.3854*** (0.0648)	0.3990*** (0.0481)	0.3238*** (0.0369)	0.3779*** (0.0295)	0.3878*** (0.1102)
Constant	0.8519 (0.5491)	0.2286 (0.3442)	0.3826 (0.3792)	0.0133 (0.2316)	-0.7903** (0.3504)
Observations	3,977	6,520	9,040	12,199	886
R-squared	0.260	0.308	0.145	0.294	0.1900
Number of company_code	543	1,144	1,329	1,759	260

Note: Firm size is measured by log annual sales. Complex services intensity is measured as share of expenditures of complex services and, respectively, ITeS on total service expenditures. Firm, industry and year fixed effects are included. The sample includes all manufacturing and service firms and spans the years from 1995 to 2016. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The R-squared corresponds to the overall adjusted R-squared.

Similar to the estimations shown in Tables 3 and 4, it is not the intensity of service input use, but the composition of services (complex services) and the origin of services (imports) that matter for productivity. The coefficient on services intensity is positive, and for most industries, it is statistically insignificant. An exception is the Chemicals and Pharmaceutical sector. An increase in service intensity in the pharmaceutical sector is associated with an increase in productivity. For other major manufacturing industries, a higher share of complex services is associated with higher productivity.

The use of imported services is positively correlated with productivity across manufacturing industries. Imports of services by firms in the electronics industry is associated with a 13 percent higher productivity relative to not importing services, while for firms in the textile and apparel industry the productivity premium associated with service imports is 7 percent. Firms in the Chemicals and pharmaceutical industry have a 9 percent productivity premium from importing services and firms in the automobile industry have a productivity premium of 15 percent. Exporting services is particularly important for firms in the electronics, chemicals and pharmaceuticals and IT service and ITES industries. Being internationally integrated in GVCs not only with goods, but also with importing and exporting services is particularly important for industries with highly sophisticated products and high technological content.

5. Concluding Remarks

The fragmentation of production across countries has allowed firms to increase specialization while reaching greater economies of scale through connecting to GVCs. This has enabled firms and countries to reap higher levels of productivity – an important factor for sustained per capita growth in the long run. Services play an important role as inputs as well as coordinators of the production process. Our findings indicate that Indian firms that are deeply integrated in GVCs are likely to be among the best performers and spend more on sophisticated services.

The findings from the analysis of the firm data show that: *First*, firms integrated in GVCs have a productivity premium between 13 and 22 percent relative to domestic firms, with the productivity premium increasing with the extent of integration into GVCs. Double and triple mode firms, i.e., firms integrated at an intermediate and high level have a much higher productivity premium relative to firms participating in GVCs in a limited or low level. There is some variation across industries, with the productivity premium from deeper levels of GVC participation being higher in the auto, electronics and IT/ITeS industries compared to textiles and chemicals. *Second*, intensifying the share of spending on service inputs is not necessarily associated with an increase in productivity. The composition of service use matters more for productivity. *Third*, an increase in the share of service expenditures on complex services by 1 percent is associated with a 10 percent higher productivity. Thus, a firm's purchase of technological know-how, licenses or sophisticated professional services is associated with a higher productivity as these services involve using more sophisticated production licenses, better management tools or digital value-added services. In particular, the intensive use of IT and IT-enabling services, which are highly sophisticated, is associated with higher productivity. *Fourth*, the origin of services (domestic vs. foreign) also matters. Firms importing services have a 10 percent higher productivity compared to firms not importing services. Around three percentage points of this productivity premium can be attributed to imports of complex services. Complex services are characterized by a higher level of value-added that is created in their production

process and are typically high-skill intense. *Fifth*, our estimates from interacting GVC integration with service imports indicate that firms that are more deeply integrated in GVCs benefit more from importing services. Firms that are integrated at an intermediate level into GVCs have, on average, a 12 percent higher TFP than purely domestic firms. If these firms also import services, the total productivity premium reaches around 28 percent. Firms importing services and highly integrated into GVCs have on average a 54 percent higher productivity than purely domestic firms.

Indian firms integrated in GVCs play an important role in India's economy. They account for a disproportionate share of total output and exports. However, there is scope for Indian firms to further participate in GVCs and to increase overall productivity. Opening domestic markets to foreign services suppliers is likely to facilitate India's participation in GVCs through the improved provision of services. As countries liberalize their services markets, firms are able to source improved quality services at more competitive prices, which improves firm performance. Given the dual role of services in GVCs as an input as well as a coordination facilitator, relaxing services markets restrictions is also likely to further increase the GVC participation of Indian firms through these backward linkages in services, which in turn is expected to further increase their productivity performance. As services have increasingly become tradable due to lower trade costs and technological progress such as digital infrastructures, the services sector has also benefited from the possibility of increased specialization of production as part of GVCs. In this context, policy makers from developing countries may want to tap into the potential of new trade opportunities and firms' participation into GVCs.

Since FDI is largely associated with higher levels of GVC participation (UNCTAD, 2013), opening markets for FDI in both manufacturing and services warrants special focus. The access to services through allowing foreign affiliates to enter and sell services in the domestic market (Mode 3) and reforming FDI restrictions are important for the effective provision of network services that connect the various stages of the production process. India's level of FDI restrictions in services is relatively high compared to the OECD average and even some non-OECD countries.⁹ Reducing services policies' restrictiveness could potentially improve the country's participation in services GVCs.

Additional focus on other types of policy barriers in services is also needed. An enabling environment is essential to accompany regulatory policy reforms. Generally, strong factor endowments can enable participation in more sophisticated GVCs as they allow for more skills and capital to be exploited in the production process. Once regulators achieve this goal, services are most likely to be used as inputs further downstream by firms, which in turn makes these firms more productive (van der Marel 2016; Beverelli et al. 2017).¹⁰ The role of domestic institutions becomes even more important for services when it comes to regulators and the regulatory quality.¹¹ Services markets often suffer from market failures, such as

⁹ These include Brazil, Cambodia, China, the Lao People's Democratic Republic, South Africa, Vietnam etc., as per the OECD FDI restrictiveness index.

¹⁰ Besides regulations and domestic institutions, additional factors such as human capital, particularly know-how and managerial capabilities are also important to foster better linkages of services with other sectors and facilitate integration into global markets. For a discussion on the role of these enabling factors, we refer the interested reader to Huria et al. (2019).

¹¹ While the reforms introduced in 1991 in India considered the establishment of specialized regulators, the required institutional modernization of the country, which plays a critical role in a market economy, has been lagging (Lateef 2017). Roy et al. (2019) provide a road map to strengthen specialized regulators, starting with a better organizational design that fosters accountability under an active checks and balances system, and regulatory capabilities which induce regulators to do "the right things".

asymmetric information in finance and natural monopolies in transport services.¹² Given that participating in GVCs requires high levels of coordination between actors in the different stages of production across countries, and because suppliers are connected through a web of relational agreements, a strong contract enforcing mechanism in place will help stakeholders abide by different types of contracts. Although this connection between strong domestic institutions and GVC participation is positive for manufacturing (World Bank 2020), this is particularly important for services. The intangible nature of services makes the need for strong contract enforcement mechanisms even more important as invisible services are harder to define (Amin and Mattoo 2006).¹³

¹² These market failures make services markets different from goods markets, which therefore requires special attention from policy makers. Careful crafting of regulations is needed when reforming services markets.

¹³ Moreover, services cannot be stored and are highly differentiated, which makes them more sensitive to well-defined contracts and in turn, strong contract enforcing mechanisms.

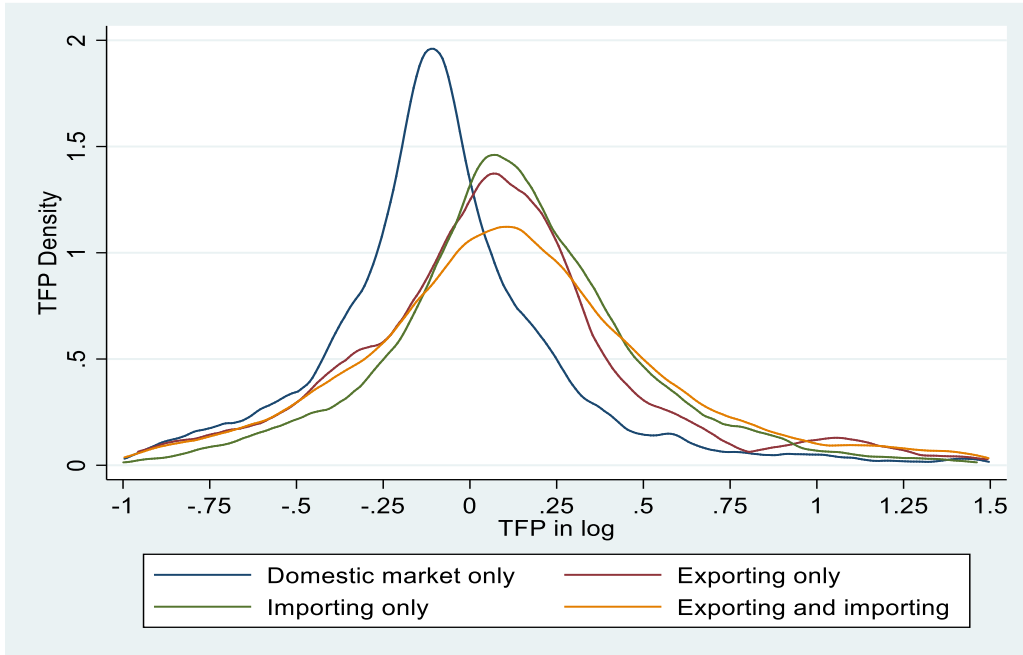
References

- Akerberg, D., K. Caves and G. Frazer (2015) "Identification Properties of Recent Production Function Estimators", *Econometrica*, Vol. 83, Issue 6, pages 2411-2451.
- Amin, M. and A. Mattoo (2006) "Do institutions Matter More for Services?" *World Bank Policy Research Working Paper* No. 4032. Washington, DC: World Bank.
- Amiti, Mary, and Jozef Konings. 2007. "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia." *American Economic Review*, 97 (5): 1611-1638.
- Arnold, J., B. Javorcik and A. Mattoo (2011) "The Productivity Effects of Services Liberalization: Evidence from the Czech Republic", *Journal of International Economics*, Vol. 85, No. 1, pages 136-146.
- Arnold, J., B. Javorcik, M. Lipscomb and A. Mattoo (2015) "Services Reform and Manufacturing Performance: Evidence from India", *The Economic Journal*, Vol. 126, Issue 590, pages 1-39.
- Baldwin, J. and B. Yan (2014), "Global value chains and the productivity of canadian manufacturing firms", *Economic Analysis Research Paper Series*, No. 090, Statistics Canada, Analytical Studies Branch. Goldar,
- Banga, K. (2016). Impact of Global Value Chains on Employment in India. *Journal of Economic Integration*, 31(3), 631-673.
- Beverelli, C., M. Fiorini and B. Hoekman (2017) "Services Trade Restrictiveness and Manufacturing Productivity: The Role of Institutions", *Journal of International Economics*, Vol. 104, No. 1, pages 166-82
- Costinot, A. (2009) "On the Origins of Comparative Advantage." *Journal of International Economics* 77 (2): 255-64.
- Gereffi, G., Humphrey J., and T. Sturgeon (2005) "The governance of global value chains", *Review of International Political Economy*, 12:1, 78-104
- Gereffi, G. and K. Fernances-Stark (2016) "Global Value Chain Analysis: A Primer", Duke University, North Carolina, USA: *Center on Globalization, Governance & Competitiveness* (CGGC).
- Goldberg, P. K., Khandelwal, A., Pavcnik, N. and Topalova, P. (2010a) "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India", *The Quarterly Journal of Economics*, Vol. 125, Issue, 4, pages 1727-1767.
- Goldberg, P. K., Khandelwal, A., Pavcnik, N. and Topalova, P. (2010b) "Multiproduct Firms and Product Turnover in the Developing World: Evidence from India", *The Review of Economics and Statistics*, Vol. 92, No. 4, pages 1042-1049.
- Goldar, Bishwanath; B., R Banga, Banga, K. (2018) "India's Linkage into Global Value Chains: The Role of Imported Services", *India Policy forum*
- Helpman, E., M. Melitz and S. Yeaple (2004) "Export Versus FDI with Heterogeneous Firms", *American Economic Review*, Vol. 94, No. 1, pages 300-16.
- Huria, S. R. Manghnani, S. Saez and E. van der Marel (2019) "India Services Competitiveness Analysis: An Assessment", *World Bank Report*, mimeo.

- Huria, S. R. Manghnani, S. Saez and E. van der Marel (2019) "Servicification of Indian Manufacturing", *World Bank Report*, mimeo.
- Lateef, S. (2019) "Indias's Governance Challenges: Why Institutions Matter", in R. Mohan (Ed.) *India Transformed: 25 Years of Economic Reforms*, *Brookings India*.
- Levinsohn, J. and A. Petrin (2003) "Estimating Production Functions using Inputs to Control for Unobservables", *The Review of Economic Studies*, Vol. 70, No. 2, pages 317-341.
- Manghnani, R., B. Meyer., S. Saez., E. van Der Marel (2021) "Integration in Global Value Chains - The Role of Service Inputs: Evidence from India", World Bank
- Melitz M. (2003) "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity", *Econometrica* Vol. 71, No. 6, pages 1695-1725.
- Miroudot, S. and C. Cadestin (2017), "Services in Global Value Chains: From Inputs to Value-Creating Activities", *OECD Trade Policy Papers*, No. 197, OECD Publishing, Paris.
- Roy, S., A. Shah, Justice (RETD) BN Srikrishna, and S. Sundaresan (2019) "Building State Capacity for Regulation", in D. Kapur and M. Khola (eds.) *Regulation in India: Design, Capacity, Performance*, Hart Bloomsbury, New Delhi
- UNCTAD (2013) *Global Value Chains: Investment and Trade for Development*", UNCTAD World Investment Report 2013, Geneva: UNCTAD.
- van der Marel, E. (2016) "Ricardo Does Services: Services Sector Regulation and Comparative Advantage in Goods", in P. Sauvé and M. Roy (eds.) *Research Handbook on Trade in Services*, Edward Elgar Publishing.
- Veugelers, R., F. Barbiero and M. Blanga-Gubbay (2013) "Meeting the Manufacturing Firms Involved in GVCs", in Veugelers, R. (ed), *Manufacturing Europe's future*. Brussels: Bruegel.
- World Bank (2020) "Global Value Chains Trading for Development", *World Bank World Development Report 2020*, Washington DC: World Bank.

Annex

Figure A.1: TFP density by mode of internationalization for the Apparel and Textiles Industry
Panel (a): International market integration



Panel (b): GVC participation

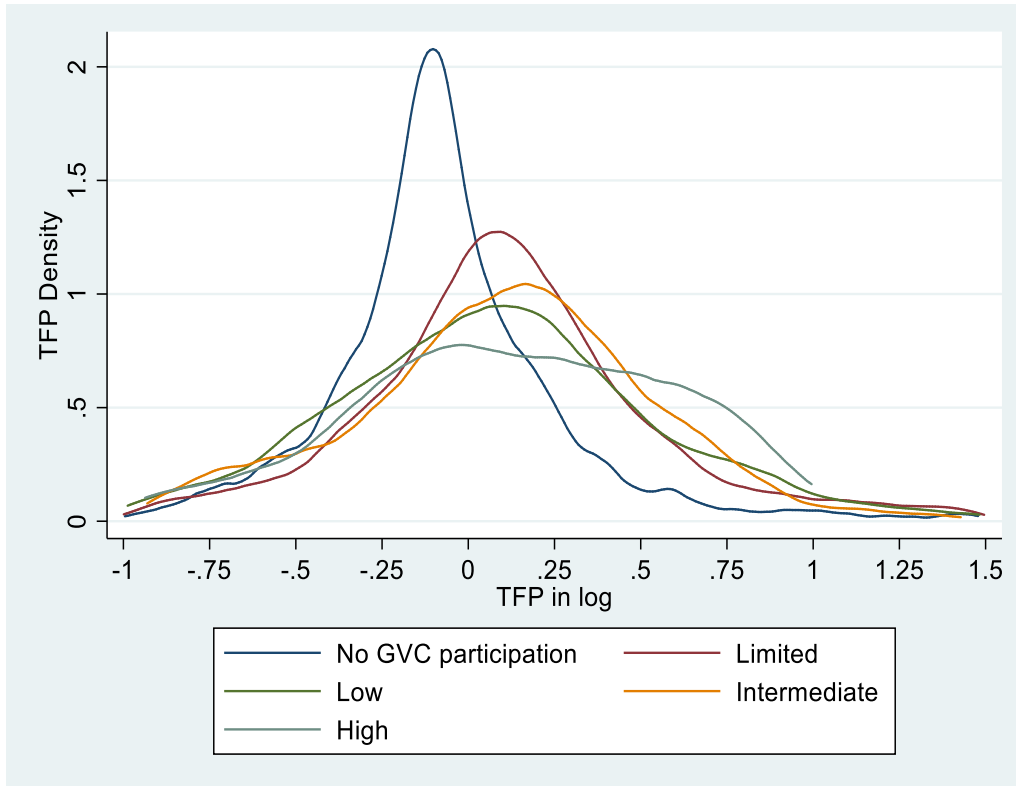
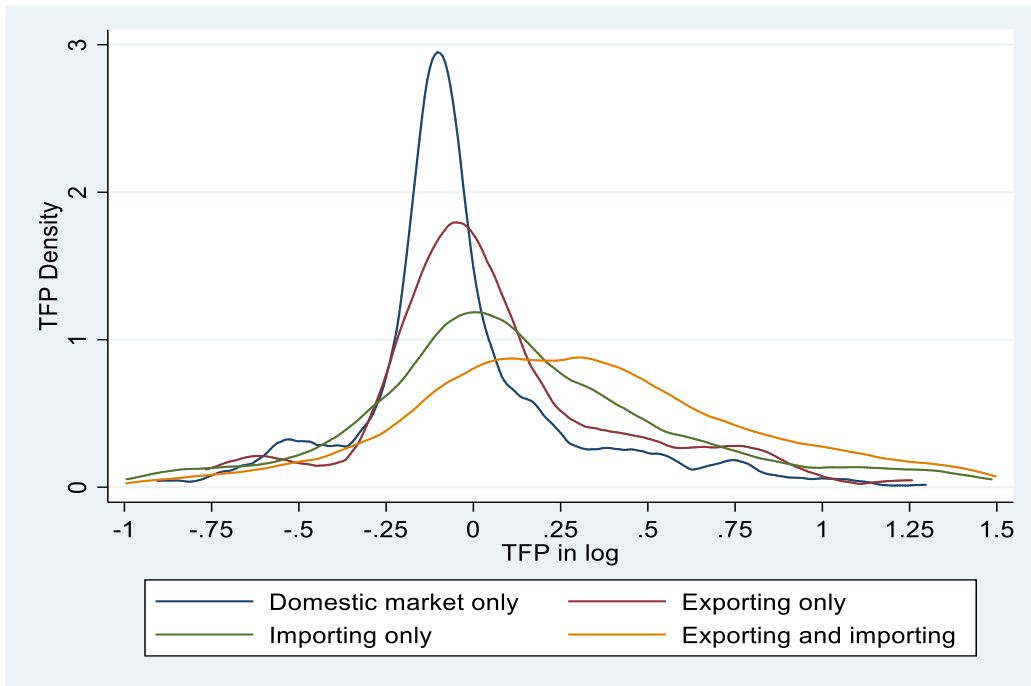


Figure A.2: TFP density by mode of internationalization for Electronics

Panel (a): International market integration



Panel (b): GVC participation

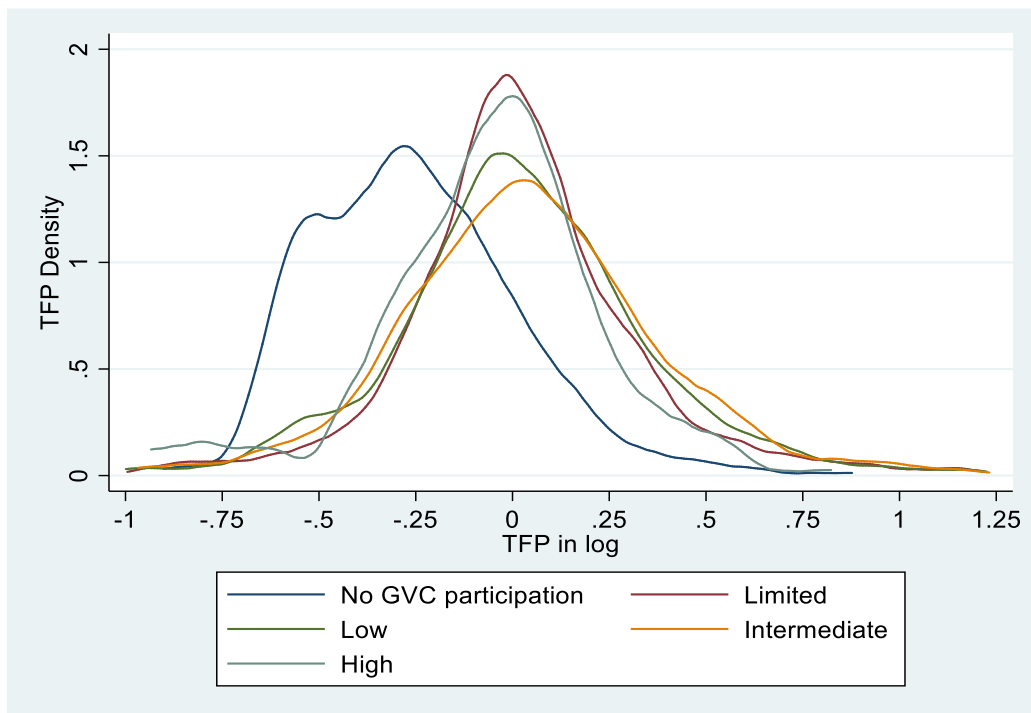
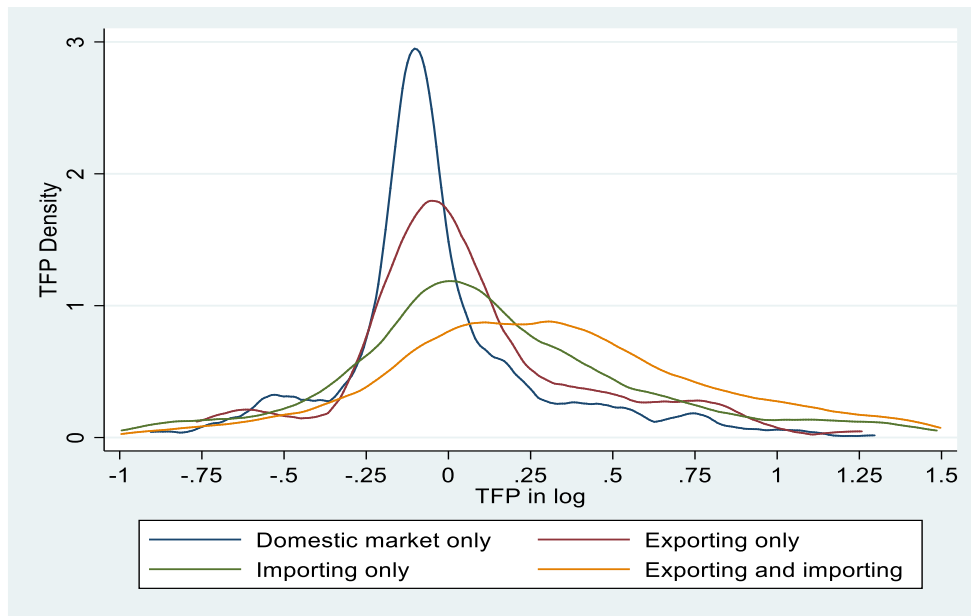


Figure A.3: TFP density by of internationalization for the automobile and transport industry
 Panel (a): International market integration



Panel (b): GVC participation

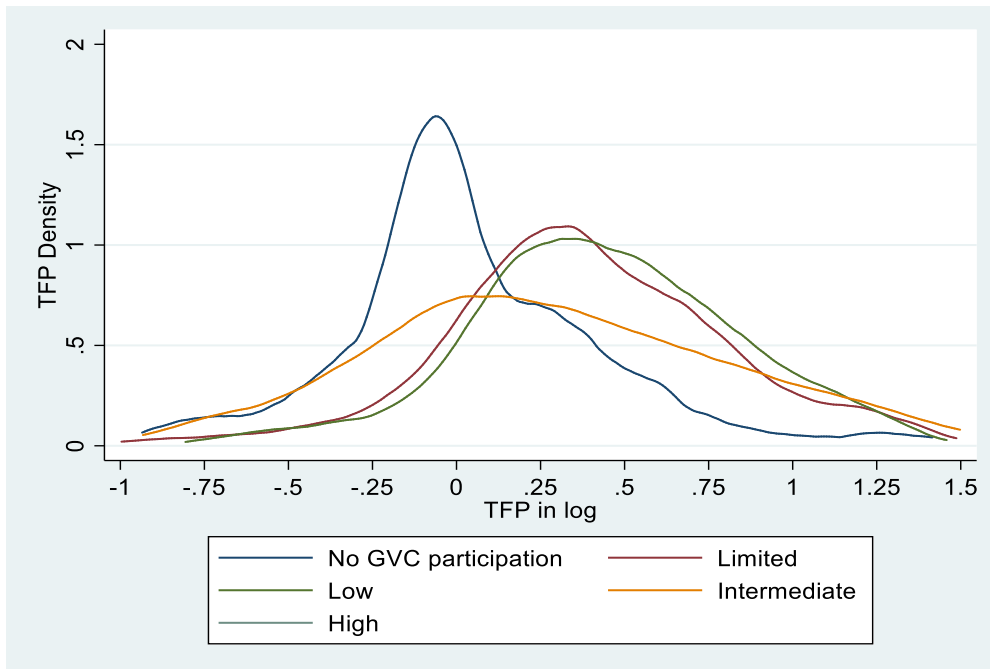
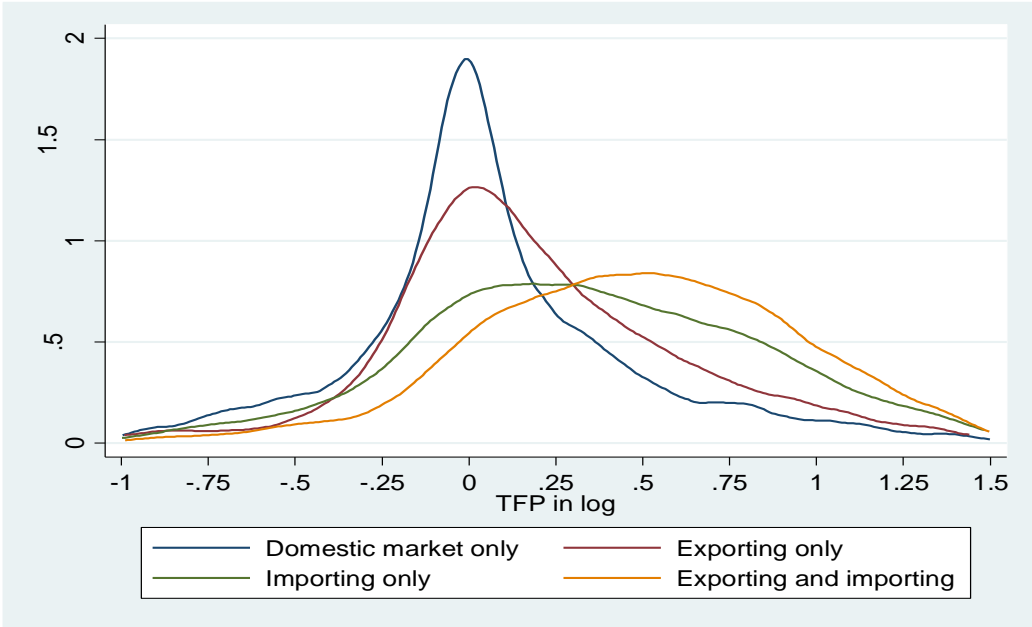


Figure A.4: TFP density by mode of internationalization for the chemical and pharmaceutical industry
Panel (a): International market integration



Panel (b): GVC participation

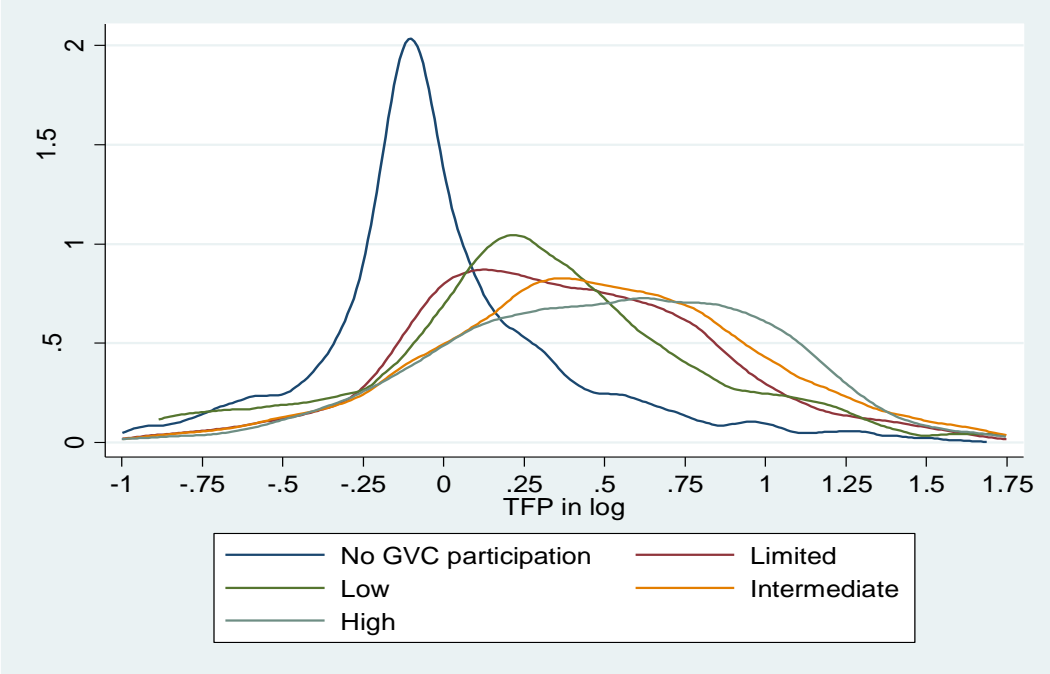


Table A.1: Estimated productivity premium accounting for export, import and foreign ownership

VARIABLES	(1)	(2)	(3)	(4)	(5)
Export dummy	0.0353*** (0.0089)	0.0439*** (0.0084)	0.0442*** (0.0083)	0.0439*** (0.0084)	0.0443*** (0.0083)
Import dummy	0.1438*** (0.0083)	0.1461*** (0.0079)	0.1448*** (0.0078)	0.1461*** (0.0079)	0.1447*** (0.0078)
Foreign ownership dummy	0.1516*** (0.0293)	0.1376*** (0.0259)	0.1389*** (0.0255)	0.1381*** (0.0259)	0.1403*** (0.0254)
(Log) Service Input Expenditures		-0.3963*** (0.0183)	-0.3952*** (0.0181)	-0.3960*** (0.0183)	-0.3941*** (0.0181)
Service Intensity		0.0003 (0.0096)	0.0023 (0.0095)	0.0002 (0.0096)	0.0038 (0.0095)
Complex Service Intensity			0.1027*** (0.0074)		0.1081*** (0.0076)
ITES Intensity				0.0066* (0.0034)	0.0147*** (0.0035)
Size	0.1836*** (0.0076)	0.3761*** (0.0115)	0.3742*** (0.0114)	0.3765*** (0.0115)	0.3756*** (0.0114)
Constant	-0.1048 (0.0748)	-0.1588** (0.0798)	0.2643*** (0.0845)	-0.1633** (0.0800)	0.2725*** (0.0845)
Observations	89,804	89,521	89,521	89,521	89,521
R-squared	0.196	0.344	0.355	0.343	0.352
Number firms in sample	13,937	13,919	13,919	13,919	13,919

Note: Size is measured by log annual sales, complex services intensity as log share of expenditures of complex services and, IT intensity as log share of expenditure on IT related services. Firm, industry and year fixed effects are included. The sample includes manufacturing and service firms and spans the years from 1995 to 2016. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The R-squared corresponds to the overall adjusted R-squared.

Table A.2: Estimated productivity premium and service imports accounting for export, import and foreign ownership

VARIABLES	(1)	(2)	(3)	(4)
Export dummy	0.0397*** (0.0084)	0.0219** (0.0100)	0.0387*** (0.0084)	0.0392*** (0.0083)
Import dummy	0.1062*** (0.0095)	0.1156* (0.0610)	0.1061*** (0.0095)	0.1060*** (0.0094)
Foreign ownership dummy	0.1381*** (0.0259)	0.1394*** (0.0258)	0.1378*** (0.0259)	0.1390*** (0.0255)
(Log) Service Input Expenditures	-0.3965*** (0.0182)	-0.3959*** (0.0183)	-0.3974*** (0.0182)	-0.3964*** (0.0181)
Service Intensity	0.0007 (0.0096)	-0.0005 (0.0096)	0.0006 (0.0096)	0.0020 (0.0095)
Service Import Dummy	0.0591*** (0.0090)	0.2977*** (0.0614)	0.0463*** (0.0099)	0.0443*** (0.0099)
Export dummy x Service Import Dummy		0.0447 (0.0563)		
Import dummy x Service Import Dummy		0.0486*** (0.0127)		
Foreign ownership dummy x Service Import Dummy		0.2209*** (0.0623)		
Complex service Intensity				0.1023*** (0.0074)
Complex Service Import Dummy			0.0220** (0.0088)	0.0223** (0.0087)
Export Service Dummy	0.0455 (0.0563)	0.0219** (0.0100)	0.0456 (0.0562)	0.0405 (0.0557)
Size	0.3743*** (0.0114)	0.3745*** (0.0114)	0.3739*** (0.0114)	0.3721*** (0.0114)
Constant	-0.2020** (0.0981)	-0.2092** (0.0981)	-0.2004** (0.0980)	0.2260** (0.1014)
Observations	89,521	89,521	89,521	89,521
R-squared	0.344	0.345	0.343	0.354
Number firms in sample	13,919	13,919	13,919	13,919

Note: The size of a firm is measured by log annual sales. Complex services intensity is measured as log share of expenditures of complex services and, respectively, ITES on total service expenditures. Firm, industry and year fixed effects are included in all regressions. The sample includes all manufacturing and service firms and spans the years from 1995 to 2016. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The R-squared corresponds to the overall adjusted R-squared.