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India's Linkages into Global Value Chains: The Role of Imported Services[§]

ABSTRACT Global trade patterns have changed considerably in the last three decades with the increasing international fragmentation of production. Global value chains (GVCs) drive international trade today, particularly in manufactures, in which services are also heavily involved. This paper examines the role of services in India's linkages into GVCs. Using the Trade in Value Added/World Input–Output Database, the value added by foreign services in India's manufactured exports is compared with that of other developing countries. This macro-level analysis is supplemented by a micro-level analysis of firm-(company)-level panel data for India for the period 2001–2015. We find: (a) services foreign value-added content of India's manufactured exports is lower than that of other major developing countries, (b) imported services content in India's exports is lower in more export-intensive industries, and (c) services input, particularly imported services, contributes significantly to the export intensity of Indian manufacturing firms. The paper stresses the need for more efficient provision of services to manufacturers to be achieved through further liberalizing identified services and boosting their exports through Mutual Recognition Agreements. Liberalizing services in India will improve their efficiency and make them globally competitive.

Keywords: *India, Global Value Chains, Role of Services, Imported Services, Firm-level Export Performance*

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1. Introduction

Global trade patterns have changed considerably in the last two or three decades with the increasing international fragmentation of production. With large reductions in transport costs (containerization radically changing maritime transport) and communication costs, many industrial firms are operating with units in various countries with a great deal of intra-firm trade—supplies being obtained from (or processing being done at) units located in a large number of countries and final product being delivered to consumers in many countries. These global value chains (GVCs) drive international trade today, particularly the trade in manufactures, and countries' success in enhancing their export earnings depends crucially on getting integrated into GVCs. This applies particularly to India, which needs to expand its exports of manufactured products rapidly in order to sustain rapid economic growth. However, rapid export expansion would be difficult unless India gets gainfully integrated into GVCs.

To be integrated into GVCs, it is important for countries to forge their own GVCs by exporting finished products, and sourcing intermediate products and services from the most efficient suppliers in the world. Studies have shown that the maximum value in GVCs is captured by the lead firms that export the final products (Banga 2014). Alternatively, countries can link into GVCs by exporting intermediate products and services. India has been found to have relatively low linkages in GVCs as compared to other developing countries in manufacturing industries (Goldar et al. 2017; Gupta 2015). Although India's imports of intermediate products that feed into manufacturing exports have been examined by several studies, few studies exist that compare India's import of services that go into manufacturing exports.

There is now a growing recognition that services are playing an important role in GVCs (see, e.g., Lanz and Maurer 2015; Miroudot and Cadestin 2017). A large number of services are involved in the production and sales of products, which applies to both goods and services. Consider the role played by services in the provision of manufactured products. Services are involved in the establishment stage (e.g., land clearing for construction and applications for licenses), pre-manufacturing stage (design, R&D, environmental clearance, and storage of inputs), and manufacturing stage (production management, quality control, factory cleaning, security, catering, and medical services) as well as in the post-manufacturing stage (transport, storage and warehousing, and retail trade), besides others such

as after-sales service (consumer complaint handling and technical support), and back-office and recurrent services (such as financial and insurance services, postal and communication services, and IT maintenance and support services).

To give one illustration, a case study of the value chain for the supply of construction machinery has brought out that 5 services enter in the establishment stage, 10 in the pre-manufacturing stage, 15 in the manufacturing stage, and 7 in the post-manufacturing stage (Low and Pasadilla 2015). In addition, there is a requirement for back-office and recurrent services, totaling 25 in number, and after-sales services, which add up to 10 services. There are other case studies that similarly show the involvement of a large number of services in the supply of manufactured products. Low and Pasadilla (2015) provide information on the number of services entering the value chain for manufacturing in 22 case studies of manufactured products in companies in the Asia-Pacific Economic Cooperation (APEC) region. They report that the number of services involved in value chains ranges from 37 in the case of automotive components in Japan and 38 in industrial welding in Thailand to 74 in power generation equipment in Japan, 74 in mining and construction equipment in Japan, and 72 in telecommunications equipment in China.

Going by the cases discussed in Low and Pasadilla (2015), it seems that the incidence of services input is the largest for the back-office and recurrent services category, followed by the services used for the manufacturing stage. These two together account for more than half of the services used by manufactured products. Another important point to note is that some of the services used by manufacturing firms are provided in-house. Then, there are services that are fully outsourced or partially outsourced. Out of the 22 case studies in Low and Pasadilla (2015), in-house provision was more than 50 percent in three cases and more than 60 percent in only one case. This shows that services used by manufacturing firms are mostly outsourced.

The role that services play as an input into manufactured goods production has been called as the *servicification* of manufacturing.[1] Lanz and Maurer (2015) note that services value added account for about one-third of manufactured exports in developed countries and about 26 percent in developing countries. There are several potential reasons why firms may use

1. For a discussion on servicification of manufacturing in the Indian context, see Chanda (2017).

more services inputs in their manufacturing, for example, the use of logistic and management services can improve coordination between production and sales leading to higher profits; firms may differentiate their products by bundling services along with their products; and in some cases, services help firms in linking into GVCs (Nordås 2010).

It should be pointed out here that while trade in services accounts for about one-fifth to one-fourth of global trade when one uses the balance of payments data, trade data based on the value added approach (e.g., OECD Trade in Value Added [TiVA] data) shows that services account for about half of global trade (Miroudot and Cadestin 2017). This is explained by the fact that services are embodied in the export of goods, and value-added trade data is better able to reveal the role played by services.

Miroudot and Cadestin (2017) draw attention to the importance of services in manufacturing firms. From a study of a sample of countries (mostly OECD), they find that the services input, domestic and foreign, accounts for 37 percent of the value of exports of the countries studied. When services activities that are taking place within manufacturing firms are taken into account, this proportion rises to 53 percent, and the overall contribution of services to exports of the countries studied is found to be about two-thirds.

The important role that services are playing in GVCs motivates this paper.[2] The focus here is on India's linkage to GVCs and contributions that the services input, particularly imported services, can make in enhancing India's export competitiveness in manufactured products. The paper compares the import content of services used as inputs in exported manufactured products across developing countries, including India. The analysis is carried out using data for developing countries in the TiVA database and World Input-Output Database (WIOD).[3] This analysis is supplemented by an analysis done with the help of firm-level panel data for India companies for the period 2001–2015. The questions asked are: (a) To what extent is the export performance of Indian manufacturing firms impacted by the use of services inputs and (b) Does higher import content of services lead to higher export intensity? An econometric model of export behavior of Indian manufacturing firms is estimated, taking the level of total factor productivity (TFP) in the firms, and domestically sourced and imported services inputs as explanatory variables along with

2. Earlier studies on India's linkages into GVCs and their consequences include Tewari et al. (2015), Gupta (2015), Banga (2016), and Goldar et al. (2017).

3. See Appendix-A for a discussion on these databases.

other controls. Policy conclusions are drawn based on this analysis and the findings of previous studies.

The rest of the paper is organized as follows. Section 2 presents an analysis of India's backward linkages into GVCs through imported services used in the export of manufactures based primarily on the WIOD. A comparison is made between India and some other important developing economies. To anticipate the key finding of the section, the analysis brings out that India is using relatively less services foreign value added (FVA) in its manufactured exports. This implies that as compared to other developing countries, India uses lower services FVA in its exports in integrating to other GVCs (if exporting intermediate products) or in forming its own GVCs (if exporting finished products). The questions that arise are: (a) can this fact of low use of services FVA in India's exports impact its export competitiveness and (b) which are the services with relatively less FVA content in India's manufactured exports? These two issues are examined in Sections 3 and 4 of the paper.

Section 3 is devoted to an analysis of the export performance of Indian manufacturing firms using panel data at the firm (i.e., company) level. The focus is on the contribution made by services input to export performance. Particular attention is paid to imported services. Section 4 examines the breakup of India's services FVA according to different categories of services to find out which type of services have a relatively less FVA component. For this analysis, as in Section 2, a comparison is made between India and some other important developing economies.

Finally, Section 5 sums up the main findings of the study and discusses some policy implications.

2. Role of Imported Services in Global Value Chains

Services are becoming increasingly important in international trade, especially following the exponential growth of GVCs. Their role in forming goods-GVCs is emerging as intrinsic and ever growing. Many studies have illustrated the role of services in GVCs using the "smiley curve," which demonstrates that services such as R&D, designing, branding, logistics, after-sales services, and marketing capture higher value as compared to the manufacturing component in the goods-GVCs (Miroudot and Cadestin 2017). Services therefore act like glue to make GVCs work and spread across different continents. This has necessitated improving competitiveness in services to be able to sustain a comparative advantage in

manufactured goods. Given the range of services that are now being used in trade in GVCs—legal services, financial services, wholesale and retail services, e-commerce, and logistics—to increase competitiveness, many countries are resorting to sourcing services from more efficient suppliers across the world. This has led to the higher content of imported services in the exports of manufactures. Although "servicification" of manufactures has been much discussed (De Backer et al. 2015), services import content in the exports of manufactures is a relatively less researched area, especially for India.

2.1. Services Foreign Value-added Content in Exports of Manufactures

In 2011, the imported content of services in exports of manufactures in the world amounted to around 31 percent, (estimated using TiVA 2016). India's imported content of services in its exports of manufactures was much lower, amounting to around 13 percent in the same year. Table 1 compares the imported services in exports of manufactures of several developing countries. Compared to India, countries like China, Malaysia, Singapore, Thailand, and Vietnam have a higher import content of services, while countries that have a higher share of natural resources in their exports, like Brazil and Indonesia, have lower services content in their exports of manufactures. Imported services content in the export of manufactures was higher for China in 2011, but over time has declined from 24 percent to 18 percent, while for India it has increased from 5 percent in 1995 to 13 percent in 2011.[4] Most other countries have also witnessed an increase in their imported services content (Table 1).

This phenomenon of rising imported services content in exports of manufactures has been experienced in many industries worldwide. According

4. A comparison between India and China on services valued added in manufactured exports shows that the total services content in the export of manufactures is nearly the same: 31 percent for China and 33 percent for India (TiVA database). However, the domestically sourced content of services is bigger in the case of India (61 percent as against 43 percent in China). The relatively low services FVA in India's manufactured exports is, therefore, not because the overall services content is low, but because services are being sourced domestically rather than being imported. China has had a greater dependence on imported services. However, since its accession to the WTO in 2001, China has liberalized its services sector; allowed foreign investment; ended restrictions on retail, wholesale, and distribution; and opened up banking, financial services, insurance, and telecommunications to foreign investment (Fan 2011). As a result, many services have been domestically sourced from foreign investors. While in India, foreign investments in many services sectors have remained restricted leading to a rising trend in imports.

TABLE 1. Percentage of Imports of Services in Exports of Manufactures, 2011

	1995	*2000*	*2005*	*2008*	*2009*	*2010*	*2011*
Brazil	4	6	6	6	5	6	6
China (People's Republic of)	24	23	22	18	18	18	18
India	5	6	9	10	11	11	13
Indonesia	9	10	9	8	7	7	7
Malaysia	19	28	25	23	23	21	22
The Philippines	19	17	20	16	15	14	11
Singapore	24	25	25	23	24	24	23
Thailand	15	18	19	20	19	19	20
Vietnam	15	18	20	21	20	19	20

Source: Trade in Value Added (TiVA), OECD (2016).

to Miroudot and Cadestin (2017), this phenomenon can be more accurately referred to as "internationalization" rather than "servicification" of manufacturing exports. According to them, all manufacturing industries have experienced a higher share of foreign services value added in 2011 with above four percentage points increase in industries such as chemicals, rubber and plastics, ICT and electronics, electrical machinery, motor vehicles, and utilities.

In order to identify the industries in India that use comparatively lower imported services content in their exports as compared to the same industries in other countries, we use WIOD. Box 1 details the methodology used to arrive at foreign services value-added content in exports of manufactures.

Table 2 reports the percentage of services FVA content in exports of different manufacturing industries in 2014. We find that in many industries, India uses higher or almost similar services FVA in exports as compared to other developing countries. Services FVA in exports of manufactures in India is found to be highest in manufacture of other transport equipment (59 percent), followed by manufacture of motor vehicles, trailers, and semi-trailers (24 percent) and manufacture of basic pharmaceutical products and pharmaceutical preparations (23 percent).

The manufacturing industries where India uses less services FVA in exports are mainly manufacture of computer, electronic, and optical products; manufacture of food products, beverages, and tobacco products; manufacture of furniture; other manufacturing; and manufacture of textiles, wearing apparel, and leather products. These are also the industries with comparatively higher export intensity in India, which probably explains the comparatively lower services FVA in total manufactured exports of India.

BOX 1. Methodology for Estimating Imported Services Value Added in Exports of Manufactures

The imported services value added in exports of manufactures is estimated using data from WIOD for the year 2014. This dataset provides input-output data for 43 countries, including 15 developing economies, and 56 sectors. Using gross flows from WIOD and the "decompr" package in R, developed by Quast and Kummritz (2015), we implement the Leontief decomposition in which gross export flows are decomposed into value added flows between industries across countries.[a] Mathematically, this is expressed as

$$VB = V(I - A)^{-1}$$

where V is an $N \times N$ matrix with the diagonal representing the direct value-added contribution of N industries, A is the Input-Output coefficient matrix with dimension $N \times N$, that is it gives the direct input flows between industries required for 1$ of output, and $B = (I - A)^{-1}$ is the Leontief inverse. VB gives an $N \times N$ matrix of value added multipliers, which denote the amount of value added that the production of an industry's 1$ of output or exports brings about in all other industries (Quast and Kummritz 2015).

Applying this to the world input-output tables, we have V_{1XGN} as a vector of direct value-added contributions of all industries across different countries, with G denoting the number of countries and N denoting the number of industries. A_{GNXGN} gives the industry flows including cross border relations. Since we are interested in the value added origins of exports, A and V are multiplied by E_{GNXGN} whose diagonal comprises each industry's exports. This gives us the output of the Leontief's decomposition, mathematically expressed as $V(I - A)^{-1}E$.

"Decompr" implements this algorithm in R to automate the process of deriving the matrix. The output is a $GN \times GN$ matrix that gives for each country and industry the value added origins of its exports by country and industry. To get the value of imported services in manufacture of exports for India, we choose India as the using country, the remaining 42 countries as the source countries, services sectors as the source industries, and manufacturing sectors as the using industries.

[a] Leontief's decomposition, based on national input-output data, proposes that output of industry X requires: (1) inputs from other industries as well as (2) X's own value added. While the latter represents X's direct value-added, the former represents the first round of X's indirect contribution to VA since the inputs required by X from other industries triggers the creation of VA in the supplying industries. These inputs from supplying industries further depend on inputs from other industries, and therefore, a second round of indirect VA creation in supplying industries of suppliers is generated. This goes on till VA is traced back to the original suppliers.

Later on in the paper, we identify the kind of services imported by these industries in India, as well as in selected developing countries.

Within the broad category of services, the services that are most used in manufactures, especially in the exports of manufactures, are "business services," including telecoms, computer services, professional services, R&D, consulting, advertising and marketing, technical testing, and environmental services. These business services have been further categorized by Gereffi and Fernandez-Stark (2010) in terms of horizontal services (e.g., business consulting, market intelligence, legal services, accounting, training, and marketing and sales) and vertical services (e.g., investment research in the

TABLE 2. Percentage of Foreign Value Added by Services in Exports of Manufactures, 2014

Industry	*Brazil*	*China*	*Indonesia*	*Russia*	*India*
Basic metals	8	8	8	4	11
Basic pharmaceutical products and pharmaceutical preparations	18	9	15		23
Chemicals and chemical products	11	8	10	7	10
Coke and refined petroleum products	14	10	5	4	21
Computer, electronic, and optical products	28	24	48	26	19
Electrical equipment	17	15	26		14
Fabricated metal products, except machinery and equipment	10	9	12		13
Food products, beverages, and tobacco products	14	22	9	19	13
Furniture and other manufacturing	27	23	47	33	20
Machinery and equipment n.e.c.	22	16	32	19	20
Motor vehicles, trailers, and semi-trailers	20	10	14	51	24
Other non-metallic mineral products	6	6	8	4	7
Other transport equipment	62	29	13		59
Paper and paper products	7	9	9	6	8
Rubber and plastic products	9	9	12	11	10
Textiles, wearing apparel and leather products	8	22	51	26	13
Wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	5	9	5	5	5

Source: Authors' estimates using WIOD.

finance sector, risk management for insurance services, industrial engineering for specific manufacturing sectors, and clinical tests in the health and pharmaceutical industry).

While vertical services may be linked to the product manufactured, horizontal services are provided across-the-board and aim at improving the productivity of firms and reducing their costs. These services, such as banking, legal, accounting, and marketing services are found to be more efficient and less costly when outsourced, thereby increasing the cost competitiveness of GVCs (Miroudot and Cadestin 2017). Other services such as transport, courier, and logistics services are found to be less costly when outsourced due to the scale economies involved. However, in recent years, it has been argued that there is a rising product digitalization that has made wholesale and retail services extremely important, especially cross-border e-commerce (Banga 2017). More and more products are now being converted into services, for example software and music CDs, which has also increased the importance of engaging competent

foreign services providers. Alibaba and Amazon are good examples of such service providers.

While services FVA in the export of manufactures has been found to be comparatively low in the case of India for industries with comparatively higher export intensity (such as computer, electronic and optical products; manufacture of food products, beverages, and tobacco products; and manufacture of textiles, wearing apparel, and leather products), an important question that arises is whether this can adversely impact the export intensity of Indian firms.

3. Export Performance of Indian Manufacturing Firms, Contribution of Services Input

This section ascertains how the use of services inputs, particularly imported services, contributes to the export competitiveness of Indian manufacturing firms and impacts their export intensity. For this purpose, econometric models are estimated using firm-level data.

There have been a large number of econometric studies on the export performance of Indian manufacturing firms using company-level data from the Prowess database in most cases. The majority of studies in the last 15 years have used a framework based on the "self-selection" hypothesis, the idea that there is heterogeneity among firms in terms of productivity, and it is the higher productivity firms that self-select themselves into export activity.[5] Most of these studies have found empirical support for this hypothesis. Thus, a firm's decision whether or not to enter export markets has been found to be significantly related to the TFP of the firm—the higher the TFP, the greater is the probability of the firm entering export markets. Some of the more recent studies have incorporated financial constraints in the model, and they have come up with empirical results that indicate that after controlling for firm heterogeneity in terms of TFP and the sunk costs of entering export markets, financial constraints impact both the intensive and export margin of exports, that is impacting the number of firms that decide to export and also impacting the export intensity (ratio of exports to sales) of the firms already engaged in exports. The analysis presented here extends this methodology by introducing variables reflecting the use of domestically sourced and imported services inputs.

5. Appendix-B contains a quick review of econometric studies on the export performance of Indian firms.

3.1. Econometric Model Specification and Estimation Strategy

To analyze the impact of services on firm-level exports, for the period 2000–01 to 2014–15, the following baseline model specification is used

$$\textit{Export intensity}_{it} = \phi_1\, \textit{Export intensity}_{i,t-1} + \phi_2\, \textit{Export intensity}_{i,t-2} + \alpha\, \textit{Log}(\textit{TFP})_{i,t-1} + \beta \textit{Log}(\textit{Services input intensity})_{i,t-1} + \gamma\{\textit{Log}(\textit{Services input intensity}) * \textit{Log}(\textit{Imported service intensity})_{i,t-1}\} + \sum \theta Z_{i,t} + \sum \varphi X_{i,t-1} + a_t + u_{it} \ldots \quad (1)$$

where export intensity of firm i at time t is regressed on lagged values of export intensity, TFP, services input intensity, and interaction of services input intensity with share of imported services in total services.[6] $\Sigma Z_{i,t}$ is a vector of firm-level control variables measured at time t, such as log(age), log(size), and log (capital/labor ratio) of the firm, $\Sigma X_{i,t-1}$, is a vector of controls measured at time $t-1$ such as log (imported capital goods intensity), log(R&D intensity), and log(imported raw materials and stores and spares [RM&SS] intensity),[7] a_t controls for time fixed-effects, and u_{it} is the error term.

Our study employs the system Generalized Method of Moments (GMM) estimator for estimating the above empirical model. The main issue in estimating the impact of services on export intensity using this model is that of endogeneity. Unobserved firm characteristics can be correlated with both export intensity and services input intensity, leading to omitted variable bias. The results can also be biased if there are unobserved time-invariant firm effects correlated with the regressors in the model. The possibility of endogeneity together with the presence of firm fixed effects implies that

6. An issue that may be raised about the model specification in Equation (1) is whether a standalone measure of imported services intensity should also be included in the model. This was tried in some specifications of the model. However, the estimated coefficient of the standalone measure of imported services intensity was found to be statistically insignificant when the interaction term was included. See the estimates of the model presented in Appendix-D, Table D.1. In the preferred model specification, therefore, the standalone measure of import services has not been included. This does not pose any difficulty in interpreting the parameter estimates. It may be easily seen from Equation (1) that the impact of services input intensity on export intensity, that is the derivative of export intensity with respect of log of services input intensity, is equal to $\beta + \{\gamma * \log(\text{imported services intensity})\}$. The estimates of β and γ are expected to be positive. This means that as the use of services input in a firm goes up it tends to raise the firm's export intensity, and more so when a higher portion of the services inputs used are imported.

7. Some of the control variables such as R&D intensity and capital goods import intensity have been taken with a one-year lag in the model on the consideration that the impact of a change in these variables on export intensity of firms may take some time to be realized.

ordinary least squares (OLS) results will not be consistent and will suffer from upward bias. Eliminating firm-specific heterogeneity using fixed effects models will also lead to inconsistent estimates due to the presence of the lagged values of dependent variables as regressors. In this case, an instrumental variable estimator is needed to deal with both persistency in the dependent variable and endogeneity in the model.

System GMM estimates the model in both levels and first-differences. It deals with endogeneity by using lagged values of first-differences as instruments for the level equation as well as lagged values of levels as instruments for first-differences (Arellano and Bover 1995). It also allows us to include lagged values of export intensity as explanatory variables,[8] enabling us to deal with problems of (a) autocorrelation of disturbances in panel estimation, (b) time-invariant firm effects correlated with regressors, and (c) the possibility that some variables may be pre-determined but may not be strictly exogenous.

To employ system GMM, Roodman's (2009) *xtabond2* command has been used, with two-step GMM estimation and robust standard errors clustered at the firm level. This ensures maximum efficiency and robustness to heteroskedasticity and autocorrelation. We also include time fixed effects in all our models.

The validity of system GMM estimations is checked using Hansen's J test of over-identifying restrictions (Arellano and Bond 1991). A p-value greater than 0.05 ensures that the instruments are exogenous. We also check for no second-order serial correlation in the first differenced residuals, that is at the AR(2) level. Following Roodman's (2009) suggestions and rule-of-thumb, we report the number of instruments and ensure that it is lower than the number of groups in the panel.

The model described above (hereafter referred to as Model-A) is the core model used for the study. An alternate model (hereafter Model-B), Equation (2) below, has also been estimated in which a zero-one variable reflecting the decision of firms to export or firms' export status (taking value one if firm *i* exports in year *t*, and zero otherwise) has been used as the dependent variable. With the dependent variable being taken as dichotomous, the lagged dependent variable, lagged by one year and two years, has been

8. Inclusion of the lagged value of export intensity in the model is essential because this captures sunk cost. Many studies have found that sunk cost has a significant role in explaining persistence of firm exports. See Padmaja and Sasidharan (2017). It should be pointed out here that in one of the models used by Padmaja and Sasidharan (2015), the previous year's export intensity has been taken as a factor explaining the current year's export intensity, which is similar to the model specification in Equation (1).

defined accordingly. The alternate model, as described, has been estimated by applying dynamic panel probit with *pa vce(robust)* options.

$$\textit{Export status}_{it} = \phi_1\, \textit{Export status}_{i,t-1} + \phi_2\, \textit{Export status}_{i,t-2} + \alpha\, \textit{Log}(\textit{TFP})_{i,t-1} + \beta \textit{Log}(\textit{Services input intensity})_{i,t-1} + \gamma\{\textit{Log}(\textit{Services input intensity}) * \textit{Log}(\textit{Imported service intensity})_{i,t-1}\} + \sum \theta Z_{i,t} + \sum \varphi X_{i,t-1} + a_t + u_{it} \ldots \quad (2)$$

It should be noted that most of the studies undertaken to verify the self-selection hypothesis with Indian firms' data have estimated models in which the dependent variable has been taken as dichotomous reflecting the decision to export or export status, as in Model-B. Very few recent studies on exports of Indian firms have used a model similar to Model-A.

One advantage of estimating both Model-A and Model-B is that Model-B shows the impact of the explanatory variables on the extensive margin of exports (since it captures how many firms decide to enter the export market), whereas Model-A basically captures the intensive margin of trade (since it captures the increases in exports that take place in firms that are continuing exporters).[9]

3.2. Data and Variables

Prowess data for the 15 years from 2000–01 (hereafter 2001) to 2014–15 (hereafter 2015) are used for the analysis.[10] Only data for manufacturing firms has been used (based on the NIC codes of companies in the database). Firms for which there are less than three observations during the period under study have been excluded.

3.2.1. Estimation of Total Factor Productivity

As discussed in Appendix-B, there is theoretical basis as well as empirical evidence to argue that more productive firms are more likely to export. To examine the export behavior of firms in such a self-selection framework, firm-level estimates of TFP are needed. One possibility is to take an OLS approach to production function estimation, and then measure the TFP of firms as the difference between the actual output and the predicted output. However, this may give biased results since the firms' choice of inputs is potentially correlated with unobserved productivity shocks. In most studies reviewed in Appendix-B, the Levinsohn-Petrin (L-P) method has been applied to estimate productivity (see Levinsohn

9. See Nagaraj (2014) and Padmaja and Sasidharan (2015).
10. See Appendix-A for a discussion of this data.

and Petrin 2003). In this study too, the L-P approach to estimation of TFP has been adopted.

Under the L-P approach, productivity is calculated by using firms' material inputs (or energy inputs) as a proxy for the part of unobserved productivity shocks that is correlated with the inputs. This technique improves upon the Olley and Pakes (O-P) (1996) methodology, which uses investment as a proxy and requires that the proxy is strictly increasing in productivity. Since this implies that only observations with positive investment values can be used for the estimation, using the O-P approach may result in significant loss in efficiency. The L-P approach imposes less stringent data requirements and allows most observations to be retained.

To estimate firm-level TFP using the L-P method, a value-added function has been estimated with two firm-level inputs, capital and labor, and real energy has been used as a proxy for productivity shocks. TFP estimates are obtained using the *levpet* command, developed by Petrin et al. (2004). The construction of variables used in the estimation of TFP is described in Table 3.

A remark may be added here on the estimation of the fixed capital stock that is taken as a measure of capital input. In industry-level productivity studies in India based on the Annual Survey of Industries (ASI), a fixed capital stock series is often constructed by the perpetual inventory method. In productivity studies based on company-level data in India, the perpetual inventory method has been used in some cases (e.g., Padmaja and Sasidharan 2017), while others have applied a blanket deflation procedure (e.g., Haidar 2012). In this study, the blanket deflation procedure has been applied despite its known limitations. The reported data on net fixed assets has been deflated directly by a deflator for fixed capital assets computed from data on fixed capital formation in manufacturing available in the National Accounts Statistics.

3.2.2. Variables Used in the Regression Analysis

Table 4 explains the variables used in the regression analysis. Export intensity, which is the key variable to be studied, has been obtained as the ratio of exports of goods to sales.

The key explanatory variables used for the econometric model are TFP, services input intensity, and imported services intensity. The measure of TFP has already been discussed above. The service input intensity variable has been formed by dividing the total expenditure on services purchased by sales (thus, in-house services are not taken into account). The imported services intensity variable is formed by taking the share of imported services in the total services purchased.

TABLE 3. Construction of Variables Used in TFP Estimation

Variable	*Construction*	*Method of Deflation*	*Data Sources*
Nominal gross output	Sum of sales, and change in stock of finished and semi-finished goods		Prowess
Nominal materials	Sum of the value of RM&SS, and the value of packaging and packing expenses, measured in current prices.		Prowess
Energy	Sum of expenses on power and fuel in current prices.	1. Energy deflator constructed using price indices of coal, petroleum products, natural gas, and electricity for industrial use. 2. Calculated weighted average for each two-digit industry, with weight for coal, oil, natural gas, and electricity collected from I-O table 2007–2008 on energy consumption. 3. Combined series with 1993–94 = 100 and 2004–05 = 100, spliced and rebased to 2004–05 = 100.	Prowess, I-O table for India for the year 2007–08
Services	Sum of expenses on heterogeneous services comprising rent and lease, repair and maintenance, outsourced manufacturing jobs, outsourced professional jobs, insurance, selling and distribution expenses, and financial services, measured in current prices		
Nominal value-added	Nominal value of gross output minus the nominal value of intermediate inputs (materials, energy, and services)	Three-digit industry-level price deflators constructed from the WPI series (1993/94 = 100 and 2004/05 = 100, spliced and rebased to 2004–05 = 100).	Prowess, WPI series obtained from the Office of the Economic Advisor, Ministry of Commerce and Industry
Labor	1. Calculated average wage rate (AWR) for National Industrial Classification (NIC) three-digit industries in ASI using total emolument/total employees. 2. Matched five-digit NIC in prowess to three-digit industry in ASI. 3. Divided wages and salaries in Prowess with industrial wage rate to get labor employed.		Prowess, ASI
Capital input	Net fixed assets	1. Implicit deflator for fixed capital formation in manufacturing has been computed from the National Accounts Statistics. 2. The net fixed asset figures for each firm for each year has been divided by the deflator to express the value of fixed assets at 2004–05 prices.	Prowess, National Accounts Statistics

Source: Prepared by authors.

TABLE 4. Construction of Variables Used in Regression Analysis

Variable	*Construction*	*Data Sources Used*
Export intensity	Export of goods/sales	Prowess
Size	Log(Total assets)	Prowess
Age of the firm	Reporting year—year of incorporation	Prowess
Service input intensity	Services purchased/sales	Prowess
Imported services intensity	Imported services/total services purchased	Prowess
R&D intensity	R&D expenditure/sales	Prowess
K/L ratio	Capital/labor employed in the firm	Prowess
Imported RMSS intensity	Imported RMSS/sales	Prowess
Imported capital goods intensity	Imported capital goods/sales	Prowess

Source: Prepared by authors.
Note: Assets and capital are deflated by three-digit WPI deflator and capital deflator, respectively. Services inputs include expenses on heterogeneous services comprising rent and lease, repair and maintenance, outsourced manufacturing jobs, outsourced professional jobs, insurance, selling and distribution expenses, and financial services.

Data on imports of services is not readily available in Prowess. An estimate has been made by considering the data provided in Prowess under the head, "other foreign exchange payments (including services)," which includes expenditure incurred on foreign exchange in respect of certain items that could be identified as belonging to services. A more detailed discussion on this variable (including limitations of the measure used) is in Appendix-E.

Other explanatory variables used for the econometric models are firm size, age of the firm, capital intensity (or capital–labor ratio), R&D intensity, intensity of use of imported RM&SS, and capital goods import intensity.

While the core econometric analysis of export performance presented in the paper is based on variables listed in Table 4 along with TFP, which is based on variables listed in Table 3, for some additional analysis, three financial variables have been included in the models. This is discussed later in the paper.

3.2.3. Summary Statistics

The summary statistics for the variables used are presented in Tables 5 and 6.

Table 5 shows that there is wide inter-firm variation in real value added, employment, capital stock, and value of energy used. In certain cases, the reported figure for output, value added, or input is found to be zero. However, such observations get dropped from the analysis when the L-P method is applied for estimating TFP.

The sample average of export intensity is 12.2 percent (Table 6). The standard deviation is 23.12 percent. In a significant portion of the cases (49

TABLE 5. Summary Statistics for Variables Used in Estimation of TFP

Variables	*Observations*	*Mean*	*STD*	*Min*	*Max*	*Units*
Real sales	64,900	38.22	379.34	0	23,710	₹ million
Real value added	62,170	14.11	186.23	0	13,041	₹ million
Labor	36,301	1,108.78	4,923.42	0	1,93,628	No. of employees
Real energy	60,810	1.45	8.78	0	536	₹ million
Real capital (fixed)	62,585	1,296.24	13,274.48	0	12,38,902	₹ million
Service input	62,508	467.85	3,561.36	0	2,88,857	₹ million

Source: Authors' computations.

TABLE 6. Summary Statistics for Variables Used in Regression Analysis

Variable	*Observations*	*Mean*	*STD*	*Min*	*Max*	*Units*
Export intensity	65,510	12.20	23.12	0.00	132	Share (%)
TFP_LP	34,224	0.03	0.04	0.00	0.8	
Services input intensity	62,491	11.79	8.81	0.00	147	Share (%)
Imported services share in total services	62,203	1.24	7.58	0.00	150	Share (%)
R&D intensity	65,547	0.18	1.28	0.00	97	Ratio (%)
Capital/labor ratio	34,646	9.76	69.77	0.00	5,114	Capital in ₹ million per unit of labor
Total assets	62,422	37.58	299.49	0.00	18,416	₹ million
Age	65,014	24.86	17.82	0.00	136	Years
Share of imported RM&SS in sales	65,480	7.29	13.29	0.00	100	Share (%)
Imported capital goods intensity	65,509	0.94	4.70	0.00	150	Share (%)

Source: Authors' computations.

Note: TFP_LP = Total factor productivity estimated by the Levinsohn-Petrin method.

percent), the reported export intensity is zero. Only in 467 observations (out of over 65,000 observations) is the export intensity actually reported as zero, otherwise the missing values are taken as zero exports.[11]

The sample average of services input intensity is 11.79 percent, with a standard deviation of 8.81 percent. The 10th and 90th percentiles are 3.3 percent and 22.2 percent, respectively. Thus, in 80 percent of the observations, the services input intensity is in this range.

The sample average of the share of imported services in the total services purchased is only 1.24 percent. In a significant portion of the cases (58 percent in the sample), the imported services intensity variable takes the value zero. This aspect is discussed further in Appendix-E.

11. This practice is common among econometric studies on the export intensity of Indian firms using Prowess database.

3.3. Preliminary Analysis: TFP, Export Intensity and Services Input Intensity of Indian Firms

This sub-section presents a preliminary analysis of the data that is used later for the estimation of models. First, an analysis of trends is presented, followed by an analysis of estimated export premium.

3.3.1. Analysis of Trends

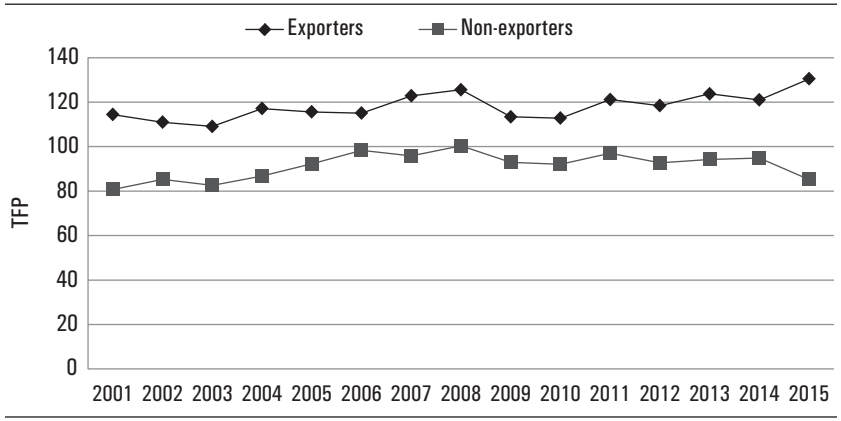
The TFP index, averaged across firms in the sample, is shown in Figure 1. The index has been formed by taking the average TFP of all firms in 2001 as 100. It is evident from the figure that there was an upward trend in TFP in Indian manufacturing firms from 2001 to 2015. Between 2001 and 2008, the TFP index rose by about 14 percent. The TFP index fell in 2009 and again in 2010. Between 2010 and 2015, the TFP index rose by about 11 percent. The trend growth rate in TFP from 2001 to 2015 was about 0.8 percent per annum.

Figure 2 compares TFP levels between exporters and non-exporters (i.e., firms reporting positive exports versus firms reporting zero exports or not reporting exports, which has been taken to be zero). The TFP index for the two groups is shown in the figure, with the average for all firms for 2001 being taken as 100. It is seen that the level of TFP was higher for exporters. The gap in TFP levels between exporters and non-exporters varies from year to year. The range is from 17 percent in 2006 to about 42 percent in 2001 and about 53 percent in 2015. There is no indication that the gap has significantly widened over the years.

FIGURE 1. TFP Index (All-firms Average TFP in 2001=100)

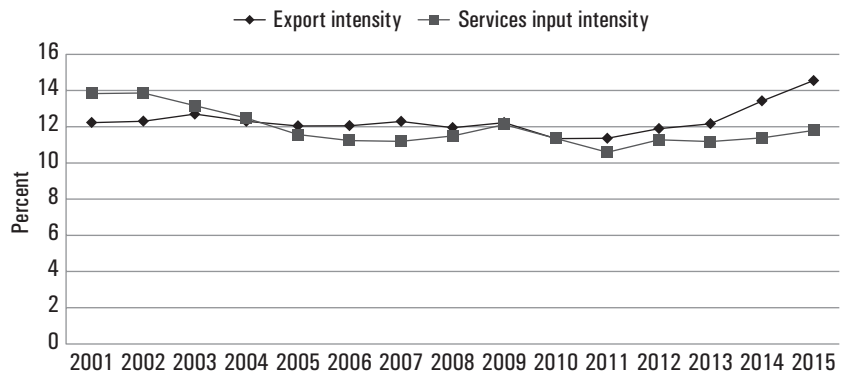
Source: Authors' computations.

FIGURE 2. TFP Index, Exporters and Non-exporters (All-firms Average TFP in 2001= 00)



Source: Authors' computations.

FIGURE 3. Export Intensity and Services Input Intensity (All-firms Average)

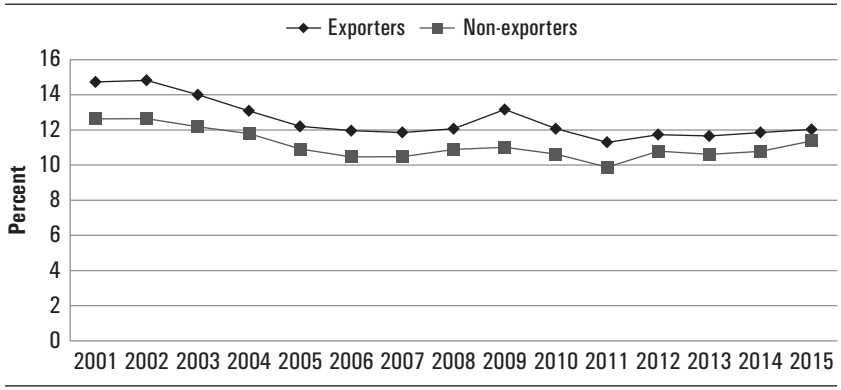


Source: Authors' computations.

The average exports intensity (exports by sales) and services input intensity (expenditure on services inputs divided by sales) across manufacturing firms have been computed for each year between 2001 and 2015. These are depicted in Figure 3. From 2001 to 2013, average exports intensity remains by and large around 12 percent, though there are some small variations. Between 2013 and 2015, there was an increase of about two percentage points in export intensity.

By contrast, there was a downward trend in services input intensity from 2001 to 2011. Since then, there has been some increase in services input intensity.

FIGURE 4 Services Input Intensity, Exporters versus Non-exporters (All-firms Average)



Source: Authors' computations.

A comparison of services input intensity between exporters and non-exporters is made in Figure 4. It is seen that services input intensity for exporters exceeds that for non-exporters. Services input intensity declined for both exporters and non-exporters from 2001 to 2011. Since then, there has been an upward trend, which is more pronounced for non-exporters than for exporters.

3.3.2. Export Premium

An interesting issue to investigate is whether exporters are significantly different from non-exporters in important firm characteristics, particularly size and productivity. In empirical studies on the export performance of firms following the framework of the self-selection hypothesis, such a comparison of firm characteristics between exporters and non-exporters is often made by applying regression analysis. Firm characteristics chosen for the analysis are regressed on an exporter dummy and a set of controls (see, e.g., Gupta et al. 2013; Haidar 2012; Ranjan and Raychaudhuri 2011). The coefficient of the exporter dummy shows the difference between exporters and non-exporters after controlling for industrial affiliation and such other differences. This is termed as the export premium.

For this analysis, we use a methodology similar to Bernard et al. (1995), which has been used in Gupta et al. (2013) and several other studies. It involves an OLS regression of a firm characteristic (say log of sales or log of assets) on the export status of the firm along with industry dummies and time dummies. This analysis has been done for five characteristics. The results are reported in Table 7.

TABLE 7. Export Premium, OLS Regression of Values of Firm Characteristics on Export Status

Variable	*Coefficient of Export Status Dummy*	*t-value*
Log(total assets)	1.722	137.58
Log(TFP)	0.356	30.29
Service input intensity (services purchased divided by sales)	1.646	28.60
Share of imported RMSS in sales	6.749	78.99
Share of imported services in total services purchased	0.369	11.08

Source: Authors' computations.

Note: Year dummies and industry dummies at five-digit NIC have been included in the regression equation.

The results presented in Table 7 bring out that exporters are much bigger in size than non-exporters (by about 172 percent).[12] A simple comparison of the mean of the total assets of the two groups reveals that the mean total assets of exporting firms is about eight times that of non-exporters. This, however, does not take into account the industrial distribution of exporters and non-exporters. Thus, the regression analysis brings out that after controlling for industrial affiliations of firms and time, the gap is about 172 percent.

A significant gap between exporters and non-exporters is found in the ratio of imported RM&SS to sales. The export premium is found to be about 6.75 percentage points. This is basically a reflection of the relative higher import dependence of exporters.[13]

The export premium in respect of TFP is found to be 35 percent, that is exporters have on average 35 percent higher TFP than non-exporters. This is consistent with the pattern observed in Figure 2.[14]

The export premium for services input intensity is found to be about 1.6 percentage points. The sample average of services input intensity is about 11.8 percent. The implication is that services input intensity of exporters is on average about 10 percent higher than that of non-exporters. This is consistent with the pattern observed in Figure 4. The estimates of export premium indicate that the difference in the TFP level between exporters and non-exporters is relatively bigger than the difference in service input intensity.

12. Haidar (2012) finds the difference in capital stock to be 136 percent, which is by and large in line with the results obtained in this study.

13. A simple comparison shows that the ratio of imported RM&SS to sales is about 4 percent for non-exporters and about 12 percent for exporters, implying that exporters have greater dependence on imported RM&SS. For a discussion on import intensity of India's manufacturing firms engaged in exports, and the inter-dependence between export decision and import decisions of firms, see Goldar (2013a).

14. Haidar (2012) finds the export premium in respect of TFP to be about 26 percent.

The gap between exporters and non-exporters in regard to the share of imported services in total services purchased is found to be 0.37 percentage point. The sample average of the share of imported services in total services used is about 1.24 percent. It may therefore be inferred that exporters have about 30 percent higher intensity of using imported services than non-exporters.

3.4. Model Estimates

The estimates of Model-A are presented in Table 8. Six alternate model estimates are shown. The dependent variable is export intensity. The key explanatory variables are lagged export intensity, TFP, firm size, service input intensity, and imported services input intensity.

The lagged export intensity captures the influence of sunk cost (see, e.g., Padmaja and Sasidharan 2015; 2017). While studies commonly use one lagged term, in this study, two lagged terms have been used.[15]

Firm size and TFP capture the effect of firm heterogeneity. For both variables, a positive coefficient is expected. Size is measured by the logarithm of total assets.

Services input is a variable of prime interest in this analysis. A positive effect of services input on export intensity is hypothesized, which would be consistent with the findings of Bas (2013) and Mukherjee (2015).[16] It is hypothesized further that the use of imported services will provide an edge to exporters in operating in international markets. To capture this aspect, an interaction term between services input intensity and the share of imported services in total services used is taken as an explanatory variable (refer to Footnote 6 on the issue of model specification connected with services

15. Nagaraj (2014) and Padmaja and Sasidharan (2017) have used two lagged terms of the dependent variable in estimating a model for explaining export status, that is a model similar to Model-B of this study.

16. Several empirical studies have found that liberalization of services and increased use of services by manufacturing firms have a positive effect on their export performance (see, e.g., Lodefalk 2012, a study of Swedish firms; Berulava 2012, a study of firms in transition economies; and Bas 2013, a study of Indian firms). The reasoning for such a relationship has been clarified in this literature. A major part of the effect occurs through cost saving and efficiency gains made possible by increased access to and use of efficient services. But the favorable effect of services input on export performance of firms may occur for reasons beyond the productivity enhancing effect of services. Lodefalk (2012), for example, argues that services may help firms overcome informal barriers such as asymmetric information in international trade. Also, by enhancing the services content of their offer, manufacturing firms may be able to generate higher demand for their products in international markets. Another argument is that firms in developing countries often export a better quality product than what they sell in the domestic market, and inasmuch as services deregulation helps improve product quality, it enhances export performance (as argued by Bas 2013).

input). The expected sign of the coefficient is positive. A positive coefficient of the interaction term will mean that the impact of services input on export intensity goes up as imported services form a greater proportion of the services used.[17]

A number of other controls have been included in the estimated model. These are R&D intensity (to capture technology orientation of the firms; higher R&D intensity is expected to raise export intensity), imports of capital goods[18] (representing technological inflow embodied in machines), imports of RM&SS, age, and capital–labor ratio.

The results presented in Table 8 clearly indicate that there are sunk costs associated with export activity, which cause persistence in firm exports. The basis for this inference is the positive and statistically significant coefficients of the two lagged terms of export intensity.

The coefficient of TFP is positive as expected and statistically significant at a 1 percent level. This shows that, other things remaining the same, a higher level of TFP leads to higher export intensity. This empirical result is consistent with the self-selection hypothesis.

17. The role played by imported services in enhancing exports has received attention in a study by Marel (2017). In this study, the econometric modelling of export behavior is done by using cross-country firm-level data for 43 mostly developing countries for the period 2003 to 2010. The focus of the study is on the impact of intermediate input trade cost barriers on export performance. The tariff and non-tariff barriers on products and services barriers (for services trade in modes 1 and 3) are considered for the analysis. The results of the analysis indicate that non-tariff barriers and services restrictions impede export performance, signifying the importance of services trade liberalization for boosting exports. Somewhat similar conclusions regarding the impact of services restrictions on exports of manufactured products may be drawn from the results of a study undertaken by Wolfmayr (2012). In this study, cross-country data for 13 EU countries for 13 manufacturing industries for the years 1995, 2000, and 2005 are used. In the models estimated, the export market share of a particular country for a particular manufactured product category is taken as being dependent on a set of variables including services input linkages further segregated into imported and domestic components of services (based on input-output tables). The results obtained in the study indicate that the use of imported services has a significant positive effect on export market share. A positive effect is found for both knowledge-intensive business services as well as other services. Manufacturing firms' linkages to domestic service industries is not found to have a significant effect on export performance, though the coefficient is positive as expected. This appears to indicate that the use of imported services has a greater impact on the export performance of manufacturing firms than the use of domestically procured services.

18. Rijesh (2017) has examined the impact of imports of capital goods on the export performance of Indian manufacturing firms. He has used industry-level panel data based on the Prowess database for the years 1997–2016. He finds a significant positive effect of capital goods imports on exports of manufactured products, particularly for engineering industries (metals, machinery, and transport equipment) and for some traditional export industries such as textiles and leather products.

TABLE 8. Model-A Estimates, Explaining Export Intensity of Firms

Variables	*Model1*	*Model2*	*Model3*	*Model4*	*Model5*	*Model6*
L.exportintensity	0.471***	0.455***	0.496***	0.504***	0.503***	0.513***
	(0.0548)	(0.0574)	(0.0556)	(0.0593)	(0.0602)	(0.0743)
L2.exportintensity	0.0741***	0.0719***	0.0731**	0.0656**	0.0658**	0.0671**
	(0.0262)	(0.0261)	(0.0309)	(0.0315)	(0.0320)	(0.0339)
Log(age)	–1.408***	–1.579***	–1.624***	–1.522***	–1.578***	–1.175**
	(0.363)	(0.370)	(0.393)	(0.402)	(0.405)	(0.486)
L.log(tfp_lp)	2.096**	2.047**	1.929***	1.802**	1.820**	1.688*
	(0.866)	(0.874)	(0.735)	(0.789)	(0.786)	(0.919)
Log(total assets)	0.477**	0.179	0.0612	0.0414	–0.112	
	(0.188)	(0.170)	(0.191)	(0.227)	(0.213)	
L.log(S_int)	2.382***	3.506***	3.065***	3.005***	2.834***	2.741***
	(0.451)	(0.598)	(0.597)	(0.648)	(0.614)	(0.759)
L.log(S int.) #L.log(IMPS_int)		0.114***	0.0974***	0.0963***	0.0900***	0.0801***
		(0.0218)	(0.0222)	(0.0237)	(0.0221)	(0.0242)
L.log(R&D intensity)			0.0831	0.0657	0.0588	0.0609
			(0.0821)	(0.0888)	(0.0898)	(0.0974)
L.log(share_imported_RMSS)					0.0834***	0.0764**
					(0.0314)	(0.0328)
Log(K/L)				0.143	0.142	0.134
				(0.108)	(0.107)	(0.0948)
L.log(Sh. imp.cap.goods.)						0.0176
						(0.0228)
Constant	13.70***	14.92***	15.78***	0	15.53***	0
	(3.967)	(4.022)	(4.064)	(0)	(4.242)	(0)

Time fixed effects	Yes	Yes	Yes	Yes	Yes	yes
Industry fixed effects	No	No	No	No	No	yes
Observations	24,440	24,440	24,440	22,697	22,697	20,213
Number of firms	4,602	4,602	4,602	4,390	4,390	4,122
No. of instruments	26	27	31	32	33	56
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.440	0.509	0.410	0.282	0.276	0.368
Hansen p-val	0.809	0.857	0.414	0.359	0.352	0.077

Source: Authors' computations.

Note: Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. log(S_int) = log of share of services in sales. log(IMPS_int) = log of share of imported services in total services. log(share_imported_rmss) = log of share of imported raw material and stores and spares in sales. L.log(S_intn)#L.log(IMPS_intn.) is the interaction of services input intensity and imported services intensity. In some equations, one of the year dummies was dropped by STATA and an estimate of the constant term was provided. In other cases, all year dummies were retained by the software and the constant term was removed.

Turning now to the services input variables, the coefficient of both terms is found to be positive and statistically significant at the 1 percent level. It may be inferred accordingly that increased use of services input contributed to better export performance, more so if a greater part of the services is imported.

Among the other controls used in the model, only age and imports of RM&SS are found to be statistically significant in impacting export intensity. The coefficient of age is negative, which indicates that new firms have higher export intensity. The coefficient of imported RM&SS is positive and statistically significant at the 1 percent level in one model and at the 5 percent level in another model. The results indicate that the use of imported RMSS enhances export performance. This finding is in agreement with the findings of Goldar (2013b).

The estimates of the random effects probit model, that is Model-B, which explains the decision to export, are presented in Table 9. The coefficients of the lagged dependent variable with one-year and two-year lags are found to be positive and statistically significant at the 1 percent level. This signifies that there are substantial sunk costs of export activity. This finding is in conformity with the findings of Padmaja and Sasidharan (2017).

The coefficient of TFP is found to be positive and statistically significant, as in the results of Model-A presented in Table 8. This finding of a positive relationship between the TFP level and the decision to export reflects the influence of firm heterogeneity (as hypothesized), and it is in agreement with the findings of Tabrizy and Trofimenko (2010), Ranjan and Raychaudhuri (2011), Haidar (2012), and Gupta et al. (2013). It was mentioned earlier that Thomas and Narayanan (2016) found a positive effect of TFP on export status for the 1990s, but not for the 2000s. The results obtained in this study show that such a relation was also prevalent in the 2000s. This observation finds supports from the analysis done by Padmaja and Sasidharan (2017). They used firm-level data from Prowess for the years 1995 to 2010 and have estimated a model similar to Model-B in this study. Their results show a significant positive effect of TFP and labor productivity on the decision to export.

In the results presented in Table 9, the technology-related variables are found to be important in explaining the decision to export. The coefficients of R&D intensity and capital goods import intensity variables are positive and statistically significant. The coefficient of import intensity of RM&SS is positive and statistically significant, which matches the results reported in Table 8. Better access to imported intermediate inputs appears to contribute to improved export performance.

As regards the services input variable, the coefficient is positive and statistically significant at the 1 percent level. The same holds true for the

TABLE 9. Probit Model-B Estimates of Dependent Variable Exporter (*t*) (Decision to Export or Export Status)

Variables	*Model1*	*Model2*	*Model3*
L. exporter	2.069***	2.065***	1.990***
	(0.0342)	(0.0355)	(0.0358)
L2. exporter	0.874***	0.840***	0.822***
	(0.0365)	(0.0379)	(0.0381)
L. Log(tfp_lp)	0.0740***	0.0646***	0.0624***
	(0.0135)	(0.0141)	(0.0141)
L.Log(service__intensity)	0.177***	0.173***	0.146***
	(0.0206)	(0.0215)	(0.0216)
Log(age)	–0.0193	–0.0307	–0.0230
	(0.0216)	(0.0226)	(0.0226)
L.log(S_intn)# L.log(IMPS_intn.)	0.00721***	0.00705***	0.00605***
	(0.000750)	(0.000775)	(0.000774)
Log(total_assets)	0.112***	0.111***	0.0819***
	(0.00870)	(0.0107)	(0.0111)
L.log(R&D_intn.)		0.00991***	0.00748***
		(0.00208)	(0.00213)
Log(K/L)		–0.00267	–0.00503
		(0.00764)	(0.00765)
L.log(imp._rmss_intn.)			0.0101***
			(0.00148)
L.log(imp.cap_goods_intn.)			0.0121***
			(0.00219)
Constant	–1.210***	–1.059***	–0.806***
	(0.112)	(0.124)	(0.130)
Industry fixed effects	no	no	no
Time fixed effects	yes	yes	yes
Prob > Wald Chi2	0.000	0.000	0.000
Observations	24,440	22,697	22,697
Number of firm_id	4,602	4,390	4,390

Source: Authors' computations.

Note: Standard errors in parentheses; Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Exporter (*t*) =1 if firm's export intensity is greater than 0 at time *t*. L.log(S_intn)#L.log(IMPS_intn.) is interaction of services input intensity and imported services intensity. Results are robust to heteroskedasticity and are obtained using population averaged dynamic probit models.

interaction term involving imported services. These results are in agreement with the results for these two variables in Table 8. Thus, it appears that increased use of services input (especially imported services) increases not only the extensive margin of exports (i.e., entry of new exporters) but also the intensive margin of export (raising the export intensity of continuing exporters).

In Table 9, firm size is found to be an important determinant of the decision to export. The coefficient is positive and statistically significant at the

1 percent level. In the estimates of Model-A presented in Table 8, firm size has a statistically significant coefficient in only one of the regressions. In other cases, the coefficient is found to be either negative (contrary to expectations) or positive, but statistically insignificant. It may be mentioned in this context that a positive relationship between firm size and export intensity has been found in Agarwal (2001) and Goldar and Kato (2009), but Kumar and Siddharthan (1994) found an inverted-U relationship. As regards firm size and the decision to export, a positive relationship has been found by Ranjan and Raychaudhuri (2011).

There is a possibility that while bigger size increases the probability of entering the export market, once a firm starts exporting, size increases may not lead to higher export intensity. This, if true, would explain why the results in respect of size variable differ between Tables 8 and 9.

A key finding of the econometric analysis based on the firm-level data is that services input, particularly imported services, contributes significantly to the export intensity of Indian manufacturing firms. To check the robustness of this finding, three additional exercises have been carried out: (a) estimating Model-A by applying panel Tobit (Appendix-D) instead of system GMM, (b) introducing variables representing financial constraints as additional controls in the model (Appendix-D), and (c) estimating Model-A for a particular subset of manufacturing industries, namely the network product industries that are marked by relatively greater presence of GVCs (Appendix-F).

Table D.2 in Appendix-D presents estimates of Model-A obtained by applying a random effects panel Tobit instead of system GMM. The logic in applying a random effects panel Tobit is that it takes into account the fact that the dependent variable is truncated at zero and in nearly half of the observations, the export intensity is zero. It should be noted, however, that qualitatively, the results in Table D.2 in Appendix-D are similar to those in Table 8. The coefficients of lagged export intensity, TFP, and services variables are found to be statistically significant with the expected sign.

Table D.3 in Appendix-D presents the estimates of Model-A in which additional control variables have been introduced, which represent financial constraints faced by firms. Debt–equity ratio, liquidity, and leverage are the three financial variables used.[19] The estimated coefficients of these three

19. The debt–equity ratio may be treated as a measure of the financial constraints being faced by firms. The lower the ratio of debt to equity, the better is the scope for raising additional resources. An alternate measure of leverage used in this study is the ratio of short-term borrowings from banks to total assets, as also done by Padmaja and Sasidharan (2015). The third financial variable used for the econometric analysis is liquidity, which has been defined as the difference between current assets and current liabilities divided by total assets; the same definition has been used by Nagaraj (2014), and Padmaja and Sasidharan (2015).

variables are found to have the expected sign. The coefficients of liquidity and leverage are found to be statistically significant at the 10 percent level. Thus, from the results obtained, there is only weak support for the hypothesis that financial constraints adversely impact the export performance of Indian manufacturing firms, though several earlier studies undertaken for Indian firms have found a significant effect of financial constraint on export performance of firms (see Appendix-B).[20] What is more important to note is that even after controlling for variables representing financial constraints faced by the manufacturing firms, the basic findings of the analysis in respect of the impact of TFP, lagged export intensity, services input intensity, and imported services share in total services remains intact.

Estimates of Model-A for network product industries presented in Appendix-F are similar to those presented in Table 8, which covers all manufacturing industries. The coefficients of the services input variable and the interaction term involving imported services are positive and statistically significant, as in the results reported in Table 8, providing support to the finding that an increased use of the services input, particularly imported services, enhances the export performance of Indian manufacturing firms.

4. Types of Imported Services Used in Manufacturing Industries

The results of the above estimations show that services, especially imported services, provide an edge to exporters in operating in international markets by positively impacting export intensity of the firms. However, it has also been found that India uses less services FVA in the exports of its manufactures, though not for all industries. A disaggregated industry-level analysis shows that traditional export-intensive manufacturing industries (such as manufacture of food products, beverages, and tobacco products; manufacture of furniture; other manufacturing; manufacture of textiles, wearing apparel, and leather products; and manufacture of computer, electronic, and optical products) have comparatively lower services FVA in their exports. It is important to further investigate what kinds of services are being imported and used in manufacturing exports by India and other selected developing countries in the above-identified manufacturing industries. This analysis is undertaken using WIOD and using the "decompr" package in R.

20. There are studies for other countries that have found a significant effect of financial constraints on the probability of exporting (e.g., Minetti and Zhu 2011). Lancheros and Demirel (2012), who have examined the role of financing constraints in exports of service sector firms in India, do not find a significant impact of financial constraints on export performance.

Tables C.1, C.2, and C.3 in Appendix-C report the services FVA in the exports of three industries, namely the manufacture of computer, electronic, and optical products; the manufacture of textiles, wearing apparel, and leather products; and the manufacture of food products, beverages, and tobacco products.

There are 38 disaggregated services used in the exports of manufactures reported in WIOD. A comparison is made of the percentage of FVA of each of these services in the exports of the three selected manufacturing industries. In computer, electronic, and optical products, exports from India appear to use relatively less of horizontal services such as wholesale, retail, financial, and legal services as compared to other countries. One might argue that the imports of these services are lower in India because an efficient supply of these services is available in India and, therefore, domestic manufacturing firms do not need to use imported services. However, a counter argument would be that if this were the case, then India should have been exporting more of these services. Table C.4 reports the exports of legal and accounting services from India in the period 2000–14 as compared to other developing countries such as China, Brazil, and Indonesia, and shows that India's exports are much lower. It is possible that these services are not necessarily provided more efficiently in India. It may be noted further that imports of services such as programming, consulting, and related information services appear to be slightly lower than in other countries. However, this may be because such services are less costly in India given the competitiveness of Indian computer services.

A similar trend with respect to horizontal services is noticed in exports of manufacture of textiles, wearing apparel and leather products, which is one of the traditional export industries of India. The share of FVA of wholesale and retail trade in exports appears to be lower in the case of India (2.2 percent) as compared to other countries such as China (3 percent), Indonesia (9.1 percent), and Russia (5 percent; Table C.2). Given the rising importance of e-commerce, imported services under this category have gained importance in other countries, while in India, it is still under the category of comparatively less imported services. China, Indonesia, and Russia use more services FVA in exports of textiles, wearing apparel, and leather products in almost all services categories as compared to India.

In food, beverages and tobacco products, which are generally identified as the least servicified industry, India does not seem to have lower horizontal services, but has lower vertical services or services related to crop and animal production, hunting, and related service activities (Table C.3). As compared

to other horizontal services, legal service is the only service where the FVA in exports appears to be lower than that in China.

Similar results with respect to lower contribution of FVA by services in India's manufacturing exports have been highlighted by Chanda (2017). Chanda states that in India,

> [T]he main point of concern is that emerging areas such as R&D and business services and IT services, which can potentially create more value, increase business sophistication and raise technological depth in production—some of the stated goals of the "Make in India" program—show very low levels of contribution to manufacturing exports.

Using the OECD database on "Compare your Country," Chanda constructs trade restrictiveness indices for specific services sectors in India, China, and OECD countries, and finds that the level of protection in India still remains high as compared to other countries for services such as transport and logistics, legal, accounting, and distribution services, all of which are key enablers to participation in manufacturing GVCs. The study also finds that the FDI in services in India is more restricted than FDI in manufacturing.

5. Main Findings and Policy Implications

In this paper, we analyzed India's linkage into GVCs, and the role played by services in this regard. First, an analysis was carried out at the economy level and at the industry level using data for developing countries in the TiVA and WIOD databases. The services component of exports of manufactures was compared between India and several other developing countries. This analysis was supplemented by a firm-level econometric analysis using panel data for India for the period 2001–15. The aim of the firm-level analysis was to assess the impact of services inputs, particularly imported services, on the export performance of manufacturing firms.

Following are the main findings of the analysis undertaken at the economy and industry levels:

1. Services content of India's exports of manufactured products is relatively lower than that of several other major developing countries. China, Malaysia, Singapore, Thailand, and Vietnam had higher import content of services than India, while countries with a high share of natural resources in their exports, such as Brazil and Indonesia, had lower services content in their exports of manufactures.

2. Imported service content in India's exports is relatively low in products that are more export intensive. This explains why the foreign services component in India's exports of manufactures is relatively low at the aggregate level.
3. India uses lower services FVA in its exports. But this is not true across all industries. A services-level disaggregated analysis shows that it is mainly horizontal services such as financial, legal, accounting, wholesale, and retail services that are less imported as compared to vertical services in selected export-oriented industries.

The firm-level analysis was undertaken with the help of econometric models based on the self-section hypothesis. There is an underlying assumption of firm heterogeneity in terms of their productivity levels. The premise is that it is more productive firms that are likely to enter the export market. Similarly, it was hypothesized that an increase in the level of productivity would enhance export intensity. In the estimated econometric models, service input intensity and share of imported services out of total services were taken as two of the key explanatory variables. The main findings of the firm-level analysis are as follows:

1. Increased use of services input positively and significantly impacts firm-level export intensity, and this impact is higher as the share of imported services in total services increases.
2. Firms that have a higher ratio of services input to sales are more likely to enter the export market. This positive effect of services on the probability to export is higher for firms that have a higher share of imported services.
3. Empirical support is found for the self-selection hypothesis, confirming the findings of several earlier studies. TFP is found to be an important factor explaining the decision of firms to enter the export market. Also, a significant positive relationship was found between TFP and export intensity.

It is important to underscore here the key message emerging from the macro-level analysis and the micro analysis. The message is that for substantially enhancing India's manufactured exports, it is important that manufacturing firms get access to an efficient supply of intermediate inputs and capital goods. The trade reforms undertaken so far have considerably liberalized imports of capital goods as well as imports of materials, stores and spares, but significant restrictions on the use of imported services still remain. This

issue needs to be addressed for boosting India's manufactured exports. It should be pointed out that similar views have been expressed by Chanda (2017). In her recent paper, she asserts that if India is to move to higher value added manufacturing for the global market, the government must pay attention to transport and logistic services, and R&D and business support services. This requires, according to her, among other things, "measures aimed at reducing regulatory restrictions that affect services both at the border and behind the border and which hurt the quality of services."

5.1. Policy Implications of Findings of Economy and Industry-level Analysis

The growing servicification of the manufacturing sector and the rising product digitalization have increased the complexity of policymaking. The division between manufacturing exports and services exports is fast blurring, as manufactured exports are depending more and more on services to improve their competitiveness. Firms are unbundling the services component of their manufacturing output and are outsourcing services. However, services are considered to have lower productivity growth as compared to manufacturing. Therefore, a shift towards services in an economy has been regarded by some as "de-industrialization," which may lead to a slowdown of the growth of overall productivity and real output growth in the economy, resulting in stagnation (Baumol et al. 1985). A whole stream of the literature has emerged that has debated and tested this theory of lower productivity growth in the services sector, and the relevance of Baumol's Disease without reaching any consensus.[21]

The growing contribution of services in exports has also been witnessed by India. However, as compared to other developing countries, a higher proportion of these services are being domestically sourced by Indian firms. It has been argued, with respect to India, that the domestic value-added content in exports of the manufacturing sector is declining and that India is experiencing a "hollowing-out" of its manufacturing sector (Banga 2016). However, it has been found that the domestic value-added content in exports has declined more for domestically sourced intermediate products as compared to domestically sourced services. The importance of efficient services in raising exports of manufactures cannot be doubted. The question that presents itself here is whether Indian policymakers should encourage imported services content in manufactured exports to improve the competitiveness of India's manufacturing exports, or encourage domestic sourcing of services in order to boost domestic value-added content in exports.

21. See Nordhaus (2006).

The analysis presented above in this section of the paper highlights that India uses lower services FVA in its exports. But this is not true across all industries. A disaggregated industry-level estimation showed that this is true for some traditional export-oriented industries as well as for computers and electrical industries. A further services-level disaggregated analysis showed that it is mainly horizontal services such as financial, legal, accounting, wholesale, and retail services that are less imported as compared to vertical services in selected export-oriented industries. Further, the firm-level analysis highlighted that a higher extent of imported services in total output positively impacts export intensity.

The reason for lower imported services FVA in exports of some industries in the identified horizontal services arises from the fact that these services in general face higher trade restrictions as compared to other services. Further, in India, the trade restrictions on these services are much higher as compared to other countries. The Services Trade Restrictiveness Index (STRI), as estimated by OECD[22] in 2015, is found to be less trade friendly in 19 out of 22 services sectors. The highest STRI scores for India are found for services such as accounting, legal, and rail freights. The imports of accounting and auditing services are banned as these services are reserved for Indian nationals only and require a license. Legal services are also reserved similarly for Indian lawyers. Corporates or partnerships with foreign firms are not allowed in these services. Only "fly-in–fly-out" access is provided to foreign legal services providers to provide legal advice.

There have been some attempts to liberalize legal services in India. In January 2017, the Ministry of Commerce and Industry, along with the Ministry of Law and Justice, revoked a ban on the practice of law from special economic zones (SEZs), by issuing a notification in the Gazette of India amending the Special Economic Rules governing SEZs. The amendment deletes "excluding legal services and accounting" from Rule 76 of The Special Economic Zones Rules, 2006, which specifies some of the businesses that are allowed to be set up in such zones. The new amendment will allow both Indian law and/or accountancy firms to set up a base in SEZs, and even foreign law firms can directly advise on international disputes or arbitration by setting up a base there.

22. Launched in 2014, the OECD STRI presents an up-to-date snapshot of services regulatory regimes in 22 sectors across 44 countries, accounting for over 80 percent of the global services trade. For a briefing note on STRI, see http://www.oecd.org/tad/policynotes/STRI%20trade%20policy%20note.pdf.

With growing product digitalization, expanding cross-border e-commerce as well as growing trade under GVCs, trade restrictiveness in horizontal services can severely limit the competitiveness of manufacturing exports. Further, this restrictiveness may also be adversely impacting exports of these services from India. There is an urgent need to improve the efficiency of these services through policy interventions. Trade agreements have largely ignored these services in an attempt to protect them from competition. A pro-active agenda in forging mutual recognition agreements (MRAs) in legal, accounting, and financial services in trade agreements is needed so as to provide an opportunity to national lawyers, accountants and auditors, and other financial service providers to engage more in GVCs and provide their services in other countries, which would recognize their qualifications.

Distribution services are forming new ways of trading through e-commerce. Efficient networks are needed along with comprehensive digital industrialization policies to develop domestic e-commerce platforms that can compete successfully with the growing marketing giants like Amazon and Alibaba. Exports through e-platforms are fast growing in importance; however; India faces many constraints in this regards. Forging GVCs and e-networks needs special policy interventions and support at the national level. Protecting policy space in the WTO to be able to design digital policies is extremely important for developing countries.

This may also require importing advanced services in order to learn cutting-edge technologies like remote additive manufacturing services or 3-D printing. With rapidly changing technologies and associated services, India will need to provide a two-pronged policy support: first, substantive services support to its manufacturing sector by further liberalizing horizontal services, and second, a competitive push to these services through MRAs. This support will require India to take some critical policy decisions that, on the one hand, will increase competition in horizontal services domestically but, on the other hand, will also provide an opportunity to domestic services providers to link into GVCs and provide services internationally. Both manufacturing exports and services exports will be boosted with this two-pronged strategy.

5.2. Policy Implications of Findings of Firm-level Analysis

The main point emerging from the firm-level analysis is that services inputs make a significant positive contribution to the export performance of Indian manufacturing firms, having a favorable impact on both the extensive and

intensive margins of exports. Arguably, a more efficient provision of services to manufacturing firms would help in raising India's manufactured exports.

It may be added here that services input use has the potential of raising TFP. There is the literature to suggest that services reforms, enabling a more efficient supply of services, have a positive effect on manufacturing sector productivity. This is the finding of the study of Arnold et al. (2016) on India. Similarly, Banga and Goldar (2007) found that services input contributes to productivity in Indian manufacturing. The implication of these findings is that making improvements in regard to the provision of services input to Indian manufacturing would raise TFP, which would in turn lead to better export performance.

One possible area for policy action is restrictions on FDI into services. According to OECD FDI Regulatory Restrictiveness Index, while the index for India in regard to FDI in financial services was 0.279 in 2016, the corresponding index value for Brazil was 0.108. The index values for some of the other developing countries were: China (0.493), Korea (0.05), Malaysia (0.2), the Philippines (0.112), and Vietnam (0.04). Similarly, for business services, the index for India was 0.563. For some of the other developing countries, the index was: Brazil (0.025), China (0.25), Korea (0.0), and Vietnam (0.026). This points to a restrictive regulatory regime on FDI into financial and business services in India. Needless to say, opening up the domestic market of financial and business services to foreign players has the potential of making the markets more competitive. Market liberalization is expected to result in efficient and cost-effective provision of such services to domestic manufacturing firms, helping them enhance their export competitiveness. The argument is basically for creating a more competitive environment for the provision of horizontal services in India that can help domestic manufacturing firms become more competitive.

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Appendix-A: Data Sources

A.1. WIOD and TiVA[23]

The World Input-Output Tables (WIOT) provide continuous time series input-output data for 42 countries and the "rest of the world" from the year 1995 to the year 2014. WIOT is an integration of national input-output tables across countries, using bilateral international trade flows. It covers 56 sectors, compatible with the two-digit ISIC sectors (Revision 4), and includes an extensive coverage of the services sector. As the schematic outline of WIOT shows, the inputs used by industry 1 in country 1 are categorized according to the industry and the country of origin of inputs (Figure A.1). The total intermediate consumption and gross output produced by each industry is given in the last rows of each column.

While the WIOT provides input-output data that can be used to estimate forward and backward linkages into GVCs, the TiVA dataset provides the actual value of these linkages for the years 1995–2011. The updated 2016 version of TiVA contains data on 34 industries, including 14 service sectors, for 63 economies covering OECD, EU28, G20, most of East and Southeast Asian economies, and a selection of South American countries. It overcomes the problem of "double counting" by breaking down trade flows and providing industry-level value-added data for each country, including information on: FVA in gross exports, domestic value added in exports of intermediate goods, and services value-added content in exports.

FIGURE A.1. Schematic Outline of WIOT

			Use by country-industries							Final use by countries			Total use
			Country 1			...	Country M			Country 1	...	Country M	
			Industry 1	...	Industry N	...	Industry 1	...	Industry N		...		
Supply from country-industries	Country 1	Industry 1											
		...											
		Industry N											
	.....												
	Country M	Industry 1											
		...											
		Industry N											
Value added by labour and capital													
Gross output													

Source: World Input-Output Dataset.

23. TiVA database is available at: http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm. WIOD database is described in Timmer et al. (2015). WIOD data are available at: http://www.wiod.org/home.

A.2. Firm-level Data

To analyze the export behavior of Indian firms, the study primarily uses the Prowess data, compiled from annual reports by CMIE. Prowess provides data on listed companies, as well as some unlisted public and private limited companies. The output of manufacturing companies in Prowess covers around 60 percent of India's manufacturing output. In regards to international trade, Prowess covers around 50 percent of Indian exports and nearly 60 percent of imports (this is for the year 2013–2014).

We restrict ourselves to manufacturing firms and collect firm-level data on identification indicators, sales, output, value added, exports of goods and services, import capital goods, import of RM&SS, liquidity and leverage, purchase of services, net fixed assets, labor, materials, etc.

We compile a firm-level panel dataset for 7,338 manufacturing firms for the period 2000–01 to 2014–15. As part of data cleaning, we drop observations with negative values of value added and remove observations with real value added to labor or value added to capital ratio in the 1st or 99th percentile. We also drop firms belonging to the following two-digit industries; NIC 34 (diversified), NIC 35 (electricity), NIC 42 (civil engineering), NIC 68 (real estate), and NIC 98 (undifferentiated goods). Finally, we include only those firms that are reporting data for at least three years in our panel.

Appendix-B: Econometric Studies of Export Performance of Indian Firms

A number of econometric studies have been undertaken on export performance of Indian manufacturing firms, covering diverse aspects, such as the impact of R&D and technology (Kumar and Siddharthan 1994) or the impact of firm size on export intensity (Aggarwal 2001; Kumar and Siddharthan 1994). This literature is briefly reviewed here. The review is selective, and only those studies that have relevance to the econometric analysis undertaken in Section 3 are covered.

A majority of studies on export performance of Indian manufacturing firms done in the last 15 years have focused on the inter-relationship between export performance and productivity: how a firm's entry and participation in export markets impact its level of productivity, also known in the literature as "learning by exporting." Econometric evidence in favor of this hypothesis in the context of Indian manufacturing firms has been found in some studies, for example, Ranjan and Raychaudhuri (2011).

But in some other studies, for example, Tabrizy and Trofimenko (2010), Haidar (2012) and Gupta et al. (2013), the learning effect of exports has not been found.

More relevant to the discussion here is the set of studies that have tried to relate exports of manufacturing firms to their level of productivity, which is known in the literature as the "self-selection" hypothesis. The self-selection hypothesis is essentially based on the idea that there is heterogeneity among firms, and it is the more productive firms that self-select themselves into export activity. The essential argument underlying the process is that there are significant costs of selling in foreign markets,[24] and it is the more productive firms that can bear such costs.

The self-selection hypothesis can be traced to Bernard et al. (1995). This study by Bernard and associates and a number of other empirical studies done subsequently have shown that exporters are more productive than non-exporters. The argument that more productive firms self-select themselves into export market because export activity involves costs that only a more productive firm afford to bear can be traced to Melitz (2003) and Bernard et al. (2003). Other important papers in this area include Bernard and Jenson (1999, 2006).

Several studies have found evidence in support of the self-selection hypothesis in the context of Indian manufacturing firms. This is, for instance, indicated by the econometric results obtained in the studies undertaken by Tabrizy and Trofimenko (2010), Ranjan and Raychaudhuri (2011), Haidar (2012), Gupta et al. (2013), and Thomas and Narayanan (2016). These studies have used Prowess data. The period covered in these studies are: Haider, 1991 to 2004; Thomas and Narayanan, 1990 to 2009; Ranjan and Raychaudhuri, 1990 to 2006; Gupta et al., 1990 to 2011; and Tabrizy and Trofimenko, 1998 to 2008.

Ranjan and Raychaudhuri (2011) have estimated a model in which export status is regressed on one-year lagged TFP, and other explanatory variables (controls) including lagged export status and lagged capital intensity. They find a significant positive effect of TFP on firms' decision to enter the export market.

Gupta et al. (2013) have estimated a similar model. In the model estimated by them to explain firms' entry into the export market, they take TFP as an explanatory variable along with size, wage bill, and ownership. Their

24. According to Wagner (2007), these costs include the costs of identifying and informing potential foreign customers, learning about relevant foreign laws and standards, and forming relationships with distributors.

results show a significant positive effect of firm TFP on its decision to enter the export market.

In the model estimated by Haider (2012) to explain firms' decision to start exporting, the explanatory variables used are TFP, firm size measured in sales and capital stock, and unit labor cost. A significant positive effect of TFP on the decision to start exporting is found.

Thomas and Narayanan (2016) have used a model similar to that used by Bernard and Jensen (1999). This is similar to the specification used by Ranjan and Raychaudhuri (2011). They find that the self-selection hypothesis was valid in the 1990s, but not in the 2000s. In the model estimated by them using data for the period 2000 to 2009, they do not find a significant positive effect of productivity on firms' decision to export their products.

A favorable effect of productivity and export performance was also found by Goldar and Kato (2009). To understand the factors that influence the export intensity of manufacturing firms, they carried out an econometric analysis using a panel dataset of manufacturing companies belonging to eight major industry groups, covering the period 1992–93 to 2001–02. A particular issue being investigated is the impact of import competition on the export intensity of domestic firms. Their analysis reveals that the level of productivity achieved determines how increased import competition will impact the export intensity of firms. While increased import competition is expected to raise the export intensity of high productivity firms, it may not have an effect or may have an adverse effect on the export intensity of low productivity firms. This is consistent with the theoretical analysis of Melitz and Ottaviano (2008).

In several studies, the impact of financial constraints on the firms' decision to enter the export market has been analyzed for Indian firms. The underlying theoretical framework is basically an extension of Melitz (2003). The Melitz model assumes that technology is the same for all firms and the firms are not financially constrained to meet the cost of entering the export market. However, given the condition of financial markets in developing countries, firms may face considerable difficulties in raising funds for meeting the cost of export market entry. This introduces a different element of heterogeneity among firms, other than heterogeneity rooted in productivity. This idea has led to extension of the Melitz model by incorporating financial constraints faced by firms as an additional factor determining the firms' decision to enter export markets (Chaney 2005; Manova 2013; Muuls 2008).

Nagaraj (2014) has studied the impact of financial constraint on export performance. She has used firm-level data for India for the period 1989 to 2008. In the model estimated, the exporting status is taken as the dependent variable. The explanatory variables include TFP, firm size, age of the firm, and two measures of financial constraint, namely leverage and liquidity. From her analysis, Nagaraj finds a strong relationship between financial constraint and the firms' decision to enter the export market—a firm facing serious financial constraint would not enter the export market. The paper presents evidence to indicate that financial health is the cause and not the effect of exports. Another important finding is that financial health matters in regard to external margin of exports, that is inducing more firms to enter the export market, but it does not have much effect on the intensive margin of exports, that is increasing the exports of continuing exporters.

A similar study done by Padmaja and Sasidharan (2015) using firm-level data for India brings out that financial constraints have a significant impact on export performance. The impact is found on both internal and external margin of exports.

Another study on the impact of financial constraint based on data on Indian firms is Kapoor et al. (2012). The model specification is different from that adopted by Nagaraj (2014) and Padmaja and Sasidharan (2015). However, the conclusion of the study is basically the same. Kapoor et al. find that expansion of subsidized credit for small-scale firms because of a policy change led to faster growth in bank borrowings and in growth of exports of such firms. This is in conformity with the findings of Nagaraj (2014) and Padmaja and Sasidharan (2015). However, Kapoor et al. find that when the policy was reversed, there was no impact on growth in bank borrowings and exports.

Another study that merits mention here is Kumarasamy and Singh (2017). Firm-level data from the World Bank enterprise survey in respect of 16 Asia-Pacific countries (covering India as well as other developing countries) were used for the study. The model estimated is similar to that used by Nagaraj (2014) and Padmaja and Sasidharan (2015). Since data on firms belonging to different countries are used in the study, financial development (at the country level) and access to finance (at the firm level) are used as explanatory variables, along with other explanatory variables such as TFP. The results of this study indicate that improving firms' access to finance and expanding the reach of the banking sector help in raising exports since they make entry into export markets easier.

Before concluding this section, two papers that have dealt with the effect of services inputs on export performance in Indian firms may be briefly discussed. Since this study is concerned with the impact of services input use on the export performance of Indian manufacturing firms, these studies are relevant to the analysis.

Bas (2013) has considered the impact of reforms of energy, telecommunications, and transports services in India in the mid-1990s and how that had impacted the export performance of Indian firms. Firm-level data for 1994–2004 are used for the analysis. The results of the analysis indicate that services reforms had a positive effect on the export performance of firms. Also, the gain was more for initially more productive firms.

Mukherjee (2015) has estimated an export function for Indian firms using panel data for the years 2000–01 to 2011–12. The export function was estimated separately for different two-digit manufacturing industries. The dependent variable is the export intensity of firms, that is the export to sales ratio. The explanatory variables include firm size, age, labor productivity, export intensity lagged by one year, and a variable to measure the extent of use of services input. The results indicate that use of services had a significant positive effect on export intensity.

Appendix-C: Services Foreign Value-added Content in Exports of Manufactures of Selected Industries

TABLE C.1. Services Foreign Value Added in Exports of Manufactures of Computer, Electronic and Optical Products (in %)

Source_Industry	*India*	*China*	*Indonesia*	*Brazil*	*Russia*
Wholesale trade, except of motor vehicles and motorcycles	3.6	4.8	10.0	5.5	4.6
Land transport and transport via pipelines	1.3	1.5	3.3	1.6	2.1
Financial service activities, except insurance and pension funding	1.9	2.2	5.2	2.9	1.9
Electricity, gas, steam, and air conditioning supply	1.7	1.9	3.9	1.7	1.9
Legal and accounting activities; activities of head offices; management consultancy activities	1.2	1.6	2.8	1.6	1.6
Administrative and support service activities	0.8	1.2	1.7	2.2	1.5
Retail trade, except of motor vehicles and motorcycles	1.0	1.7	2.8	2.1	1.3
Real estate activities	0.7	0.8	1.7	1.1	1.1
Warehousing and support activities for transportation	0.5	0.7	1.3	0.8	1.0

Source_Industry	*India*	*China*	*Indonesia*	*Brazil*	*Russia*
Crop and animal production, hunting, and related service activities		0.7	1.7	0.8	0.9
Construction	0.4	0.5	0.9	0.4	0.7
Wholesale and retail trade, and repair of motor vehicles and motorcycles	0.2	0.3	0.6	0.3	0.6
Computer programming, consultancy, and related activities; information service activities	0.5	0.7	1.3	0.7	0.6
Telecommunications	0.6	0.5	1.0	0.5	0.5
Printing and reproduction of recorded media	0.1	0.2	0.4	0.2	0.5
Architectural and engineering activities; technical testing and analysis	1.0	0.3	0.5	0.7	0.5
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	0.2	0.2	0.4	0.2	0.4
Other service activities	0.4	0.5	1.0	0.5	0.4
Public administration and defence; compulsory social security	0.3	0.3	0.6	0.3	0.4
Other professional, scientific, and technical activities; veterinary activities	0.4	0.6	1.3	0.6	0.4
Accommodation and food service activities	0.4	0.5	1.2	0.7	0.4
Water transport	0.3	0.3	0.8	0.3	0.3
Repair and installation of machinery and equipment	0.1	0.1	0.2	0.2	0.3
Forestry and logging	0.2	0.3	0.3	0.2	0.2
Insurance, reinsurance, and pension funding, except compulsory social security	0.2	0.2	0.4	0.2	0.2
Advertising and market research	0.1	0.1	0.2	0.1	0.2
Education	0.2	0.1	0.3	0.2	0.2
Fishing and aquaculture	0.0	0.0	0.1	0.1	0.2
Activities auxiliary to financial services and insurance activities	0.1	0.2	0.2	0.2	0.2
Scientific research and development	0.2	0.4	0.6	0.4	0.2
Postal and courier activities	0.1	0.1	0.2	0.1	0.2
Publishing activities	0.1	0.2	0.3	0.2	0.1
Air transport	0.3	0.5	0.4	0.3	0.1
Water collection, treatment and supply	0.1	0.1	0.3	0.1	0.1
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	0.1	0.2	0.3	0.2	0.1
Human health and social work activities	0.1	0.1	0.2	0.1	0.1
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0.0	0.0	0.0	0.0	0.0
Activities of extraterritorial organizations and bodies		0.0	0.0	0.0	0.0

Source: Authors' estimations based on WIOD.

TABLE C.2 Services Foreign Value-added Content in Exports of Manufactures of Textiles, Wearing Apparel and Leather Products (in %)

Source_Industry	*India*	*China*	*Indonesia*	*Brazil*	*Russia*
Wholesale trade, except of motor vehicles and motorcycles	2.2	3.0	9.1	1.3	5.0
Crop and animal production, hunting, and related service activities		4.6	9.0	1.2	4.2
Land transport and transport via pipelines	0.9	1.4	3.3	0.5	2.1
Retail trade, except of motor vehicles and motorcycles	0.6	1.1	3.5	0.4	1.9
Financial service activities, except insurance and pension funding	1.2	1.5	4.1	0.7	1.7
Electricity, gas, steam, and air conditioning supply	1.3	1.5	4.0	0.5	1.4
Legal and accounting activities; activities of head offices; management consultancy activities	0.8	1.6	2.1	0.4	1.1
Real estate activities	0.4	0.6	1.8	0.3	1.0
Administrative and support service activities	0.5	0.9	1.5	0.6	0.9
Warehousing and support activities for transportation	0.4	0.5	1.3	0.2	0.8
Wholesale and retail trade, and repair of motor vehicles and motorcycles	0.1	0.3	0.5	0.1	0.5
Other professional, scientific, and technical activities; veterinary activities	0.2	0.3	0.8	0.1	0.5
Telecommunications	0.2	0.3	0.7	0.1	0.4
Construction	0.3	0.4	0.7	0.1	0.4
Other service activities	0.2	0.4	0.9	0.1	0.4
Computer programming, consultancy, and related activities; information service activities	0.3	0.4	0.7	0.1	0.3
Accommodation and food service activities	0.2	0.4	1.1	0.2	0.3
Water transport	0.2	0.3	0.6	0.1	0.3
Printing and reproduction of recorded media	0.1	0.1	0.3	0.0	0.3
Architectural and engineering activities; technical testing and analysis	0.8	0.2	0.4	0.2	0.2
Public administration and defence; compulsory social security	0.2	0.3	0.5	0.1	0.2
Insurance, reinsurance, and pension funding, except compulsory social security	0.2	0.2	0.4	0.1	0.2
Fishing and aquaculture	0.0	0.1	0.2	0.0	0.2
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	0.1	0.2	0.4	0.1	0.2
Forestry and logging	0.2	0.5	0.4	0.1	0.1
Activities auxiliary to financial services and insurance activities	0.1	0.1	0.3	0.0	0.1
Advertising and market research	0.0	0.1	0.2	0.0	0.1
Education	0.2	0.1	0.2	0.0	0.1
Air transport	0.1	0.4	0.3	0.1	0.1

Source_Industry	*India*	*China*	*Indonesia*	*Brazil*	*Russia*
Postal and courier activities	0.1	0.1	0.2	0.0	0.1
Water collection, treatment, and supply	0.1	0.1	0.3	0.0	0.1
Repair and installation of machinery and equipment	0.0	0.1	0.1	0.1	0.1
Scientific research and development	0.1	0.1	0.2	0.0	0.1
Publishing activities	0.1	0.1	0.3	0.0	0.1
Motion picture, video and television programme production, sound recording, and music publishing activities; programming and broadcasting activities	0.1	0.1	0.3	0.0	0.1
Human health and social work activities	0.0	0.1	0.2	0.0	0.1
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0.0	0.0	0.0	0.0	0.0
Activities of extraterritorial organizations and bodies		0.0	0.0	0.0	0.0

Source: Authors' estimations based on WIOD.

TABLE C.3. Services Foreign Value-Added in Exports of Manufactures of Food Products, Beverages, and Tobacco Products (%)

Source_Industry	*India*	*China*	*Indonesia*	*Brazil*	*Russia*
Crop and animal production, hunting, and related service activities	0.1	8.5		2.8	4.4
Wholesale trade, except of motor vehicles and motorcycles	2.1	2.0	2.1	1.6	2.5
Fishing and aquaculture	0.3	0.2	0.3	0.1	2.0
Land transport and transport via pipelines	0.9	1.1	0.9	0.7	1.3
Financial service activities, except insurance and pension funding	1.1	1.1	1.1	1.0	0.9
Retail trade, except of motor vehicles and motorcycles	0.8	0.8	0.8	0.5	0.9
Electricity, gas, steam, and air conditioning supply	1.1	1.0	1.1	0.8	0.8
Legal and accounting activities; activities of head offices; management consultancy activities	0.7	1.4	0.7	0.7	0.8
Administrative and support service activities	0.5	0.8	0.5	1.5	0.7
Warehousing and support activities for transportation	0.5	0.4	0.5	0.4	0.6
Real estate activities	0.4	0.5	0.4	0.4	0.5
Construction	0.3	0.3	0.3	0.2	0.4
Printing and reproduction of recorded media	0.1	0.1	0.1	0.1	0.4
Wholesale and retail trade, and repair of motor vehicles and motorcycles	0.2	0.2	0.2	0.1	0.3
Telecommunications	0.2	0.2	0.2	0.2	0.3
Computer programming, consultancy, and related activities; information service activities	0.3	0.3	0.3	0.3	0.3

(Table C.3 Continued)

(Table C.3 Continued)

Source_Industry	*India*	*China*	*Indonesia*	*Brazil*	*Russia*
Public administration and defence; compulsory social security	0.2	0.3	0.2	0.2	0.2
Other professional, scientific, and technical activities; veterinary activities	0.1	0.2	0.1	0.1	0.2
Other service activities	0.2	0.3	0.2	0.2	0.2
Architectural and engineering activities; technical testing and analysis	0.7	0.2	0.7	0.4	0.2
Accommodation and food service activities	0.2	0.4	0.2	0.3	0.2
Water transport	0.3	0.2	0.3	0.1	0.2
Forestry and logging	0.3	0.4	0.3	0.2	0.2
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	0.1	0.1	0.1	0.1	0.2
Repair and installation of machinery and equipment	0.0	0.0	0.0	0.2	0.1
Insurance, reinsurance, and pension funding, except compulsory social security	0.1	0.2	0.1	0.1	0.1
Advertising and market research	0.0	0.1	0.0	0.1	0.1
Education	0.1	0.1	0.1	0.1	0.1
Activities auxiliary to financial services and insurance activities	0.1	0.1	0.1	0.1	0.1
Air transport	0.1	0.3	0.1	0.1	0.1
Postal and courier activities	0.1	0.1	0.1	0.1	0.1
Publishing activities	0.1	0.1	0.1	0.1	0.1
Scientific research and development	0.1	0.1	0.1	0.1	0.1
Motion picture, video and television programme production, sound recording, and music publishing activities; programming and broadcasting activities	0.1	0.1	0.1	0.1	0.1
Water collection, treatment and supply	0.1	0.1	0.1	0.0	0.1
Human health and social work activities	0.0	0.0	0.0	0.0	0.0
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0.0	0.0	0.0	0.0	0.0
Activities of extraterritorial organizations and bodies		0.0	0.0	0.0	0.0

Source: Authors' estimations based on WIOD.

In food, beverages and tobacco products, which are generally identified as the least servicified industry, India does not seem to have lower horizontal services but has lower vertical services, or services related to crop and animal production, hunting, and related service activities (Table C.3). As compared to other horizontal services, legal services is the only service where the FVA in exports appears to be lower than that in China.

TABLE C.4. Exports of Legal and Accounting Activities, Activities of Head Offices, and Management Consultancy Activities (in US$ million)

	India	*Brazil*	*China*	*Indonesia*
2000	119	1,097	8,026	66
2001	110	771	8,739	63
2002	122	544	11,386	101
2003	156	521	13,625	140
2004	271	650	17,780	151
2005	341	1,242	22,974	170
2006	395	1,883	31,546	326
2007	625	2,747	45,580	540
2008	632	4,149	56,823	845
2009	454	3,260	51,345	962
2010	711	3,767	56,706	2,269
2011	819	4,292	64,905	2,990
2012	701	4,477	63,220	3,078
2013	587	4,165	58,889	2,267
2014	570	3,993	63,777	1,720

Source: Authors' computations using National Input-Output Tables from WIOD.

Appendix-D: Additional Model Results, Firm-level Analysis of Export Performance

TABLE D.1. Model Estimation, Checking Specification for Services Input Variables

Variables	*Model1*	*Model2*	*Model3*	*Model4*
L.export intensity	0.468***	0.464***	0.458***	0.453***
	(0.0637)	(0.0644)	(0.0651)	(0.0662)
L2.export intensity	0.0743***	0.0752***	0.0731***	0.0722***
	(0.0261)	(0.0256)	(0.0257)	(0.0259)
Log(age)	–1.413***	–1.270***	–1.573***	–1.586***
	(0.368)	(0.334)	(0.375)	(0.377)
log_totalassets	0.482**	0.328**	0.184	0.179
	(0.195)	(0.163)	(0.171)	(0.171)
L.log(tfp_lp)	2.100**	1.410*	2.009**	2.045**
	(0.868)	(0.792)	(0.874)	(0.878)
L.log(service_ intensity)	2.396***		2.172***	3.395***
	(0.478)		(0.453)	(0.764)
L.Log(sh_imported services in total services)		0.270***	0.258***	0.0269
		(0.0541)	(0.0528)	(0.0624)
L.log(SI)#L.log(IMPS inten.)				0.104***
				(0.0349)
Constant	0	0	0	14.60***
	(0)	(0)	(0)	(3.889)

(Table D.1 Continued)

(Table D.1 Continued)

Variables	*Model1*	*Model2*	*Model3*	*Model4*
Number of instruments	25	25	26	27
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.392	0.40	0.431	0.470
Hansen p val.	0.66	0.76	0.72	0.72
Industry fixed effects	no	no	no	no
Time fixed effects	yes	yes	yes	yes
Observations	24,440	24,440	24,440	24,440
Number of firms	4,602	4,602	4,602	4,602

Source: Authors' computations.

Note: Dependent variable is export intensity. Standard errors in parentheses $***p < 0.01$, $**p < 0.05$, $*p < 0.1$.

log(S_int) = log of share of services in sales. log(IMPS_int) = log of share of imported services in total services. log(share_imported_rmss) = log of share of imported raw material and stores and spares in sales.

TABLE D.2. Tobit Model Results with Left Censoring

Variables	*(1) Model1*	*(2) Model2*	*(3) Model3*
L1.Export intensity	0.874***	0.720***	0.707***
	(0.00847)	(0.0101)	(0.00943)
L2.Export intensity		0.215***	0.223***
		(0.00926)	(0.00860)
L.Log(tfp_lp)	1.148***	1.026***	0.856***
	(0.132)	(0.133)	(0.129)
L.Log(service inten.)	3.154***	2.778***	2.407***
	(0.219)	(0.213)	(0.204)
L.log(SI)#L.log(IMPS inten.)	0.0806***	0.0758***	0.0583***
	(0.00641)	(0.00645)	(0.00635)
L.log(Import. RMSS inten.)	0.238***	0.237***	0.190***
	(0.0135)	(0.0133)	(0.0138)
L.log(Leverage)	0.0949	0.0993	
	(0.0640)	(0.0636)	
L.log(Total Assets)			1.027***
			(0.0947)
L.Log(imp. Capitalgoods inten.)			0.104***
			(0.0160)
Constant	–4.479***	–4.166***	–6.374***
	(0.660)	(0.669)	(0.682)
Rho	0.309	0.251	0.275
Prob > =chibar2	0.000	0.000	0.000
Left censored observations	10189	8237	10689
Uncensored observations	13621	11937	13881
Total Observations	23,810	20,174	24,570
Number of firms	4,469	4,137	4,649

Source: Authors' computations.

Note: Dependent variable is export intensity. Standard errors in parentheses $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. log(S_int) = log of share of services in sales. log(IMPS_int) = log of share of imported services in total services. log(share_imported_rmss) = log of share of imported raw material and stores and spares in sales.

TABLE D.3. Model Estimates Explaining Export Intensity of Firms

Variables	*Model1*	*Model2*	*Model3*
L.exportintensity1	0.476***	0.461***	0.516***
	(0.0717)	(0.0782)	(0.0747)
L2.exportintensity1	0.0767**	0.0627*	0.0676**
	(0.0361)	(0.0335)	(0.0340)
Log(age)	−1.962***	−1.806***	−1.187**
	(0.577)	(0.550)	(0.485)
L.log(tfp_lp)	2.156**	1.603*	1.654*
	(1.040)	(0.948)	(0.918)
Log(total assets)			
L.log(S_int)	3.275***	3.602***	2.734***
	(0.776)	(0.789)	(0.762)
L.log(S int.) #L.log(IMPS_int)	0.0990***	0.111***	0.0801***
	(0.0262)	(0.0276)	(0.0243)
L.log(R&D intensity)	0.0396	0.00870	0.0623
	(0.102)	(0.104)	(0.0971)
L.log(share_imported_RMSS)	0.0727**	0.0951**	0.0779**
	(0.0367)	(0.0402)	(0.0330)
Log(K/L)			
L.log(Sh. imp.cap.goods.)	0.0600**	0.0573**	0.0223
	(0.0254)	(0.0278)	(0.0232)
Log(Liquidity)	0.127	0.388*	
	(0.184)	(0.222)	
Log(debt/equity ratio)		−0.120	
		(0.425)	
Log(leverage)			−0.856*
			(0.462)
Constant	0	0	0
	(0)	(0)	(0)
Time fixed effects	yes	Yes	Yes
Industry fixed effects	no	no	yes
Observations	19,842	18,258	20,213
Number of firms	4,087	3,871	4,122
No. of instruments	31	35	55
AR(1)	0.000	0.001	0.000
AR(2)	0.665	0.469	0.370
Hansen p-val	0.418	0.59	0.075

Source: Authors' computations.

Note: Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. log(S_int) = log of share of services in sales. log(IMPS_int) = log of share of imported services in total services. log(share_imported_rmss) = log of share of imported raw material and stores and spares in sales. L.log(S_intn)#L.log(IMPS_intn.) is interaction of services input intensity and imported services intensity. Since all the year dummies have been kept in the estimated model by the STATA software used, the constant term has been removed.

Appendix-E: Imported Services Input Intensity in Firm-level Analysis

While Prowess provides data for expenditure on various services procured domestically, such data on imports of services are not available. An estimate of imports of services by manufacturing firms has therefore been made

by considering the Prowess data provided under the head "other foreign exchange payments (including services)." This includes payments on various expense heads such as services received, reimbursement of expenses, rent, management fees, services shared, inter-corporate deposits repaid, processing and other charges, employee welfare expenses, technical services, payments on behalf of related parties, marketing expenses, loan given, expenses recharged by other companies, payment of service fee and commission, purchase of services, legal and professional expenses, discounting charges, etc. (see Verma 2015). Though there are miscellaneous items under the above-mentioned head, services imports do get covered and are likely to form a substantial portion. Accordingly, this variable has been taken as a measure of services imports. This has been divided by the total services purchased to form services import intensity.

The mean value of services import intensity, that is the share of imported services in total services purchased is found to be only 1.24 percent. In a significant portion of the cases (58 percent in the sample), the imported services intensity variable takes a value of zero (in most of these cases the data under the relevant head is missing and has therefore been taken to be zero). Thus, it appears from the data that in a majority of manufacturing firms, there is no direct import of services. By contrast, a majority of firms report that they are importing raw materials, stores and spares. The share of imported raw materials, stores and spares out of total purchase of RM&SS among manufacturing firms in the sample is about 14 percent. This divergence between the import share in materials and the import share in services appears to be a sign of certain restrictions on imports of services, which tends to keep imports of services by manufacturing firms at nil or low levels.

Certain limitations of the measure of imported services intensity need to be recognized. One of the limitations is that the measure is based on expenditure in foreign exchange, and therefore purchase of services from foreign players providing services in the Indian market through commercial presence is not included. The inability to capture services provided by foreign firms in India is no doubt a limitation of the measure used, but since FDI is restricted in many of the services, the measure of imported services variable used for the analysis may not have missed much.

Another limitation of the measure of imported services intensity is that it does not take into account the services embodied in imported intermediate materials used for production activity. From the Prowess data, it is not possible to measure the services content in imported goods, and this, therefore, remains a limitation of the measure of imported service intensity used for

the analysis. It should be pointed out, however, that services embodied in imported goods are generally not horizontal services like legal and accountancy services, which are the main focus of this study.

An interesting issue that may be raised in this context is that outward FDI (OFDI) done by Indian firms may have a bearing on the extent and nature of imported services purchased by such firms. There is a possibility that an Indian firm that has made substantial investments abroad may use its affiliate(s) to buy the foreign services it requires, and these expenditures therefore do not show up in the accounts of the Indian firm. It is not known how large this phenomenon is, but the resultant undercounting of expenditure on imported services definitely cannot be ruled out. A correction for services purchased through affiliates is difficult to make from the data available in Prowess and has therefore not been attempted. Hence, the measure of imported services used for the analysis does not take into account the indirect imports of services done by OFDI firms through their foreign affiliates.

A question that presents itself here is whether the above-mentioned deficiency of the measure of services import intensity caused by OFDI makes a difference to the estimates of the econometric model of export intensity. This issue has been examined in Appendix-F where an analysis of export intensity is carried out for firms belonging to network industries. Estimation of Model-A, which explains export intensity, has been done first by taking all firms belonging to network industries and then by dropping from the sample the firms with significant OFDI. A comparison of the two sets of results helps in assessing if exclusion of OFDI firms makes a big difference to results. The two sets of results are found to be similar, which suggests that the deficiency noted above is perhaps not a serious one.

Appendix-F: Econometric Analysis of Firm Export Intensity in Network Product Industries

To validate the findings that emerge from the model results presented in Table 8, the same model has been estimated for a particular subgroup of industries, namely the network product industries. The results are reported in Table F.1.

Network products may be defined as those products in which network trade is heavily concentrated; these generally do not contain any end-products that are produced from start to finish in a given country (Athukorala 2011; Tewari et al. 2015). Network products include parts and components

as well as assembled end-products.[25] Given the high level of network trade in network product industries, and the relatively greater presence of GVCs in such industries, it would be interesting to find out whether the model results for network industries are similar to those reported in Table 8, which covers all manufacturing industries, especially in respect of the services input variable and the imported services input variable. The estimates of Model-A are for network product industries.

From Table F.1, it is seen that lagged export intensity is an important determinant of export intensity of the current year. The services input related variables have positive and statistically significant coefficients. These results match the results reported in Table 8.

The model results shown in the last three columns of the table have been obtained after dropping the firms with outward FDI. The reason for making model estimates after removing OFDI firms is given in Appendix-E. Comparing the two sets of results (Models 1–4) and (Models 5–7), it is found that these are quite similar.

Two important points may be noted regarding the model results for network product industries. First, imported RM&SS is not found to be a significant factor for explaining export intensity in network product industries (e.g., electronic products). The explanation probably lies in the fact that a large portion of imports of RM&SS in network product industries takes place mainly to serve the domestic markets in India (see Tewari et al. 2015).[26] Second, the coefficient of TFP is found to be positive but it is not statistically significant in explaining exports. In this regard, the results reported in Table F.1 are different from those in Table 8. Why relatively high productivity firms in network product industries do not have relatively higher export intensity as compared to low productivity firms is an interesting question. Perhaps, a sizeable portion of the firms with high productivity are foreign firms operating in India primarily with the object of serving the domestic market in India. This matter needs further investigation.

25. Athukorala (2011) has identified the following product categories as being part of network product industries: office machines and automatic data processing machines (SITC 75), telecommunication and sound recording equipment (SITC 76), electrical machinery (SITC 77), road vehicles (SITC 78), professional and scientific equipment (SITC 87), and photographic apparatus (SITC 88). For this study, four two-digit industries among these industries have been treated as being part of the network product industries group [see Note (1) below Table F.1].

26. Tewari et al. (2015, p. 17) note that while the share of parts and components in India's imports has increased significantly, the share of final assembled products in India's exports has stagnated, based on which they infer that assembly activities in manufacturing in India are oriented towards the domestic market in India rather than the exports market.

TABLE F.1. Results for Network Product Industries: Dependent Variable: Export Intensity

Variables	*Model1*	*Model2*	*Model3*	*Model4*	*Model5*	*Model6*	*Model7*
L.export intensity	0.491***	0.510***	0.479***	0.477***	0.495***	0.493***	0.494***
	(0.0757)	(0.0720)	(0.0731)	(0.0731)	(0.0695)	(0.0688)	(0.0703)
L2.export intensity	0.127*	0.126*	0.0947	0.0970	0.135**	0.132**	0.133**
	(0.0696)	(0.0663)	(0.0715)	(0.0708)	(0.0539)	(0.0543)	(0.0540)
L.log(tfp_lp)	1.282	0.983	0.312	0.278	1.225	1.248	1.132
	(1.417)	(1.267)	(1.232)	(1.233)	(1.149)	(1.150)	(1.151)
L.log(Service_inten.)	2.526**	2.134**	2.270**	2.149**	2.516**	2.549**	2.441**
	(1.074)	(0.928)	(0.996)	(0.967)	(1.008)	(1.006)	(1.007)
L.log(SI)#l.log(IMPS intn).	0.0617***	0.0686***	0.0673***	0.0613***	0.0530***	0.0536***	0.0558***
	(0.0203)	(0.0236)	(0.0212)	(0.0197)	(0.0178)	(0.0179)	(0.0182)
Log(age)		–0.684	–0.855	–0.756	–1.258**	–1.265**	–1.086*
		(0.537)	(0.634)	(0.631)	(0.622)	(0.626)	(0.601)
Log(total assets)		–0.522	–0.305	–0.425			
		(0.582)	(0.332)	(0.345)			
L.Log(R&D intensity)			0.105	0.0901	0.0521	0.0522	0.0598
			(0.130)	(0.130)	(0.103)	(0.104)	(0.103)
Log(K/L)			0.0516	0.0240			
			(0.152)	(0.156)			
L.Log(imp. RMSS inten.)				0.0302	–0.0040	–0.0015	–0.0097
				(0.0416)	(0.0355)	(0.0369)	(0.0350)
L.Log(imp.Capitalgoods inten.)				0.0629**	0.0258	0.0258	0.0334
				(0.0285)	(0.0271)	(0.0274)	(0.0276)
Constant	0	8.765*	7.790	8.283	0	10.11**	0
	(0)	(5.276)	(5.689)	(5.686)	(0)	(4.743)	(0)

(Table F.1 Continued)

(Table F.1 Continued)

Variables	*Model1*	*Model2*	*Model3*	*Model4*	*Model5*	*Model6*	*Model7*
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	no	no	no	no	no	no	Yes
Observations	4,424	4,414	4,113	4,113	4,159	4,159	4,159
Number of firms	793	787	755	755	750	750	750
No. of instruments	23	28	38	40	48	47	51
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.615	0.565	0.517	0.512	0.766	0.732	0.752
Hansen p val	0.051	0.147	0.069	.072	0.067	0.051	0.051

Source: Authors' computations.

Notes: Standard errors in parentheses $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

(1) Network product industries include NIC 26 (Manufacture of computer, electronic and optical products), NIC 28 (Manufacture of machinery and equipment n.e.c.), NIC 29 (Manufacture of motor vehicles, trailers and semi-trailers), and NIC 30 (Manufacture of other transport equipment). (2) In some equations, one of the year dummies has been dropped by the software used (STATA) and an estimate of constant term is provided. In other cases, all year dummies have been kept by the software and the constant term has been removed. (3) In models 5–7, the firms with OFDI have been excluded. This has been done for firms that had total assets of Rs. 100 crore or more in March 2011, and the ratio of investment outside India exceeded 1.5 percent of the total assets.

Comments and Discussion*

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I am standing in for Poonam Gupta, whose flight was canceled. My discussion will be framed around Poonam's slides and notes, though I will mix my own comments with Poonam's. I found this paper to be very interesting, relevant, and provocative. I have some points of confusion, and I would like to raise those as I go along.

I will begin with some background on the growth in services and their contribution to GDP growth. The first is that services comprise an increasing share of GDP around the world. The importance of services in production and consumption is rising. This is true for countries at all levels of income per capita. Barry Eichengreen and Poonam Gupta analyzed these trends in a pair of papers in 2011 and 2013 (Eichengreen and Gupta 2011, 2013). (One of these papers is specific to India and it was presented at the IPF in 2011.) Services production, consumption, and trade are of increasing importance for India.

A second observation is that growth in services is correlated with positive development outcomes. In the past, poverty reduction, employment creation, and productivity increases were largely attributed to productivity growth in agriculture and manufacturing. As Poonam's slide notes, Datt, Murgai, and Ravallion (2016) show that growth in services contributes similarly to productivity growth in other sectors in India.

A third point is that services play an increasing role in value chains. This is a consequence of the rising tradability of services in the global economy. This applies to both domestic and global value chains. The paper focuses on global value chains and emphasizes the importance of services as inputs to production for export in India. This contrasts with the typical emphasis on the export of services by India. Imported and local services also contribute to the production of import competing goods, and home-produced services also enter the global value chain.

* To preserve the sense of the discussions at the India Policy Forum, these discussants' comments reflect the views expressed at the IPF and do not necessarily take into account revisions to the conference version of the paper in response to these and other comments in preparing the final, revised version published in this volume. The original conference version of the paper is available on www.ncaer.org.

Fourth, productivity growth in the manufacturing and service sectors are interrelated. The post-liberalization expansion of services was closely associated with productivity increases in manufacturing (e.g., Arnold, Javorcik, Libscomb, and Mattoo 2016), and in the liberalization of manufacturing contributed to productivity growth in the services sector (Dehejia and Panagariya 2016). The evidence suggests that manufacturing imports help raise productivity in the production of services, and imported services increase domestic manufacturing productivity.

Poonam notes that there are three stylized facts that are probably useful in talking about global value chains in services. The first is the increasing use of services in the production and export of manufacturing goods. This includes the increasing use of imported services in domestic production, and the expanding use of services as tradable intermediate goods. The intensity of services, however, differs across industries and across countries. Some industries use services more intensively; some countries use services more heavily. This variation in the importance of global value chain linkages across industries and countries is a central theme in the paper. Global value chains concern the disaggregation of the production process. Although it may be easiest to think of this vertically, we need to remember product differentiation in intermediate goods, and its relationship to comparative advantage and returns to scale. The services used more intensively in global value chains are distribution and business services.

Turning to the paper, its thesis can be given in four key points. The first is that the intensity of the use of imported services is correlated with the exportability of firms, and firm exportability is correlated with factor productivity. Let me state this a little differently as the intensity of imported services, as well as the intensity of the use of such services, is positively related to firm productivity. The empirical trade literature shows us that more productive firms export, and that higher firm-level productivity increases the likelihood that a firm exports. However, the causal relationship between the intensity of imported services use and firm entry into exporting is not clear.

The second part is that Indian firms do not currently use imported services as intensively as other emerging market economies. One thing I noticed looking at Table 1 is that some of the countries compared to India actually experienced decreases in the percentage of value added in manufacturing exports due to imported services. Although the level of value added by imports of services is lower for India than several other Asian economies, this share has been increasing over time for India. The differences in trends for import shares in value added may be more informative than differences in levels for understanding the relationship between service imports and export shares.

In Table 2, there are four highlighted Indian sectors in manufacturing that use imported services less intensively than in China (there are actually six sectors, but two are just barely less). But there are 11 sectors in which India uses services more intensively. I think the text needs to refer more clearly to the tables and needs to make a more nuanced case that Indian exporters are using services less intensively than the comparison economies.

Poonam's third point provides the authors' main argument. This is that Indian manufacturing firms need to import more services to succeed as exporters. In order to claim this, we need to see evidence that barriers to importing services inhibit the export intensity of the Indian manufacturing sector. Services are an important part of India's exports. So, it is quite possible that a low share of imported services in value added in exports does not indicate a low share of value added from tradable services. The tradable services may just be produced at home.

In the presentation, Rashmi Banga emphasized that India is at a disadvantage producing certain services, such as legal services, that are essential to entering export markets and increasing export volumes. This brings us to the paper's fourth argument: reducing barriers to service imports could promote exports and firm entry into exporting.

My first comment is whether it is the use of services, or the use of imported services, that matters most. Even if we are convinced that Indian firms use imported services less intensively, could this be due to the higher productivity of Indian service firms? If the domestic service sector is more productive in India, we should observe lower service imports and more intensive use of home services. India has established itself as a successful exporter of services, and this could well reflect India having a competitive advantage as a producer of service inputs into tradable goods production. Thus, there may not be large unexploited advantages in importing services.

Among imported services, what matters more: services imported through the presence of foreign direct investment or imported directly? The discussion at the end of the paper on policy implications argues that barriers to FDI in the service sector may be important. But there is very little in the paper comparing FDI in services and direct imports of services.

It would be pertinent to consider domestic services use and imported services use separately, rather than just use total services, imported services, and their interaction. In a sense this is in the paper—some of the analysis in the Appendix includes both service intensity and share of imports in services. However, the probit regressions on entry into exporting at the firm level reported in Table 9 include only total service intensity and its interaction with the import share of service intensity. I find it harder to interpret a

coefficient on the interaction term than one on the share of imported services in total services. In the regression in the Appendix, the share of imported services has a significant positive effect on the firm's propensity to export.

One of Poonam's slides shows that it is difficult to measure domestic versus foreign services value added, particularly the way it is derived in the paper. I would like to see more in the paper detailing how these are broken down in the Prowess dataset, and a clear explanation of how imported services, foreign services value added, and domestic services value added are calculated. Adding some robustness tests would be helpful.

My second comment concerns whether the core question is about productivity or about exportability. The paper shows us that a firm is more likely to enter into exporting if it is more productive, the services value added is higher, and if the share of imported services interacted with services intensity is greater. The contribution of services imports to export expansion is interesting, but firm productivity is the primary determinant of exporting at both the extensive and intensive margins. If imported and domestic service inputs raise firm productivity, then the contribution of services to trade can include these indirect effects. This could be directly analyzed using the same data. From a policy perspective, what matters more may be TFP growth, and whether a firm exports or not is of secondary importance.

The last comment is that the paper's policy recommendations should be more specific. Which services are more important as intermediate inputs in production and exporting, and which of these need to be liberalized more? How important is liberalization of FDI in specific services? What is the role of liberalizing service imports, including domestic pro-competitive effects? A more detailed explanation of the case for liberalizing imports and domestic service provision would be very helpful.

In sum, this paper addresses an interesting and relevant issue, but the exposition could be strengthened some. The regression results deserve to be interpreted a bit more, and separating domestic and imported services value added can be helpful. The results suggest that barriers to inward services trade matter, but the contribution of domestic services and the difference between FDI and direct imports of services should be drawn out more. The rationale for only looking at how services imports affect export entry and intensity could benefit from elaboration. Relating this to the direct contribution of services to TFP at the firm level may help clarify the role of trade in services for production and trade. In addition to adding specificity to the policy discussion, I think the case that India is using imported services less intensively needs to be more granular, using the data presented in the tables. The variation across sectors and types of services ought to inform the policy implications of the analysis.

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My comments overlap with Ken Kletzer's. I recommend the paper to you. Global value chains are important, and by combining aggregate cross-country data with some firm-level analysis, the paper illuminates some big facts.

What are the points the paper makes? India's manufacturing exports tend to have a lower service intensity, India's export strengths are not in service-intensive sectors, and imported services intensity leads to greater exports at both the extensive and intensive margins. A couple of suggestions to start with. First, the paper operates at a level of generality that is hard to fully understand. I found myself grasping for an example of what these services are, and how they are being used in manufactured goods. Services such as business consulting, legal services, and accounting have little to do with manufacturing exports. But there are other things, like market intelligence or distribution, which would seem to be very much about exports. So the paper needs a fully articulated example of what the authors have in mind when talking about services.

Second, when we go through a fully articulated example, it should become clear that the implied choices for services in manufacturing are not clear. There are at least two operative choices. One can use either imported or domestic services in manufacturing. It is also possible to import goods with less or more services embedded in them. That is an additional margin

that would not show up as an imported service. Take two different types of importers: one imports lots of raw materials and separately imports services, while another imports an intermediate product that is close to the final product and that has a lot of services embedded in it. So a service import is really something that can be imported as a service, but it can also be embedded in another product. This would all be a little clearer if one goes deeper into these services and first understands what they are.

Third, there is a lot of talk about the servicification of manufacturing. It was not entirely obvious to me what the authors had in mind here—perhaps things such as legal services, accounting or financial services, and risk management—or why their use had gone up over time. When I think of servicification of manufacturing, I think of manufactured goods that are now being classified as services. An example would be the Rolls-Royce aircraft engines, which are no longer being exported or imported but are being provided as services via service contracts.

The authors stress that India is lagging in the service intensity of its exports. That conclusion wasn't apparent to me in the data provided. By the end of the time period the paper considers, India is roughly at the average of the six developing countries mentioned. The paper makes the point that some of these are natural-resource-intensive countries so they do not count. It would be useful to explain a little more what that means, because in many ways India does not look different. I was a little flummoxed by Footnote 4, which suggests that India is actually using more services than China. So it would be good to know if this is for real, or if India is like the others, which is what some parts of the paper suggest. India also has a lot of industrial heterogeneity, so the paper makes the point correctly that the areas where India is low on service intensity are the areas where it is export-intensive. This helps account for the overall story of the paper but does not give much comfort in understanding whether India is low in service intensity.

The firm-level analysis is much more helpful. The authors do an admirable job of identifying the intensive margin and extensive margin. A big result that comes out is on TFP. Ken Kletzer pushed the authors in his remarks to model TFP separately using total and imported services, but I am okay with their approach. The paper estimates a trend growth of TFP of almost 1 percent a year, with a clear delineation between exporters and non-exporters, and on service imports between exporters and non-exporters. It was disappointing to see how small the numbers were on imported services. The authors don't provide medians, but I assume the median is zero for most of these, and that imported services have a mean of 1 percent. So it would be nice to know more about why those numbers are as low as they are, and how they might impact the modeling and econometric strategies.

The big question I found myself really trying to figure out was why the authors believe that more services give rise to more exports, and in particular why more imported services give rise to more exports. That is the hypothesis that is being tested at the firm level. I think what matters is, and this is also what the authors said at the beginning of their presentation, that we want more globally competitive inputs, generally speaking. An exporter definitely wants and needs to have more globally competitive inputs if she herself is to be competitive. But Ken's point, which I agree with, was that Indian service providers may well be globally competitive, so there is no privileged status for imported services. But the paper maintains that imported services give rise to exports, and this leads it to the slightly disjunctive conclusion that India should liberalize its services sector. It would be more straightforward to say that we want globally competitive inputs, and domestic liberalization is good for globally competitive inputs. Overall, I confess I struggled with why the authors believed service intensity was good for exports, unless I could better understand what services they had in mind and how they actually entered into the production function.

Finally, in terms of editing the paper, the network and non-network discussion could usefully be dropped. Even the financial constraint material is not central to the paper. The paper has interesting things to say about services and imported services, and just focusing on them would be better. Most importantly, I would flesh out the production decision involved when you choose to import a service, or choose to import a good that has services embedded in it, or produce a good, for example, that might have services embedded in it.

General Discussion

Anup Wadhawan**,** the chair of the session, highlighted the increasing fragmentation of manufacturing across the globe. He saw it as part of the trend by which manufacturing processes have evolved since the beginning of history. He said that we began with very self-sufficient producers in manufacturing, and slowly, as products became more complex and intricate, the degree of self-sufficiency within a manufacturing enterprise and within an economy tended to come down. Global value chains are the next stage in the process, but the underlying factors remain the same—successful firms need to be competitive and they have to be productive.

He noted that the paper argues that the foreign services content of exported manufactured products is low, and it attributes that to barriers

to accessing foreign services and a resulting lack of competitiveness. It prescribes liberalization of the services sectors, which would increase the competitiveness of the services sector, therefore increasing the competitiveness of the export sectors. That fundamental element of competitiveness is related in turn to a conducive, regulatory, and policy environment—whether it is policies, regulations, physical infrastructure, or access to raw materials inputs. He emphasized that it is only the environment in which firms operate which is ever-changing, and that is a part of a long-standing historical trend.

However, he questioned the authors' interpretation that there were widespread barriers to the provision of foreign services and a lack of competition in the domestic services sector, pointing to the outsourcing of many services to India. He was fearful of a hollowing out of the domestic services industries, similar to that which he believed has occurred in manufacturing. He argued that in the empirical work, imported services could be a proxy for a large number of other factors that might explain the trend in export competitiveness.

Rana Hasan expressed his concern about the problems of measuring total factor productivity at the firm level, and suggested that it might be interesting to explore the correlation with a simpler concept such as labor productivity. He also agreed that there was a question about how to account for services that were embedded in the imports of intermediate materials.

Dilip Mookherjee questioned the extent to which the paper's analysis supported its recommendation for a liberalization of imports of services. He thought it was possible that service-sector imports were low because domestic service providers were more competitive than their foreign counterparts. Also, similarities of language and culture may necessitate lower Indian employment of foreign accountants and foreign marketing experts because India exports to countries that speak the same language as in India and have similar legal and accounting systems. While there was disagreement about whether India actually had higher restrictions on service import than existed in other countries, he thought such measures could be defended as infant industry protections. Thus, he believed a large number of issues needed to be resolved before the adoption of any specific policy recommendations.