Services Trade Liberalization and Manufacturing Firm Productivity: Evidence from Vietnam*

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Abstract

We investigate the impacts of services trade liberalization on the productivity of manufacturing firms. Combining detailed information on services trade liberalization in Vietnam between 2004-2012 with micro data on manufacturing firms, we find that liberalization in services industries that supply inputs to firms is associated with an increase in total factor productivity. Liberalization in services industries that source inputs from firms is associated with a decrease in total factor productivity. These effects are magnified for small and domestic firms. Decomposing various components of services liberalization reveals that reforms of non-discriminatory regulatory measures that foster competition and transparency have larger impacts than reforms of discriminatory measures that lower barriers for foreign services firms. Our findings highlight that services trade liberalization can generate productivity gains through linkages between the service sector and other sectors of the economy.

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1 Introduction

In spite of the services sector's prominent share in world GDP, employment, international trade and investment and its vital role in generating jobs and growth through linkages with other sectors of the economy (Nordås and Rouzet, 2015), studies on trade liberalization and its impacts have primarily focused on liberalization in goods trade. Few studies analyze the impacts of services trade liberalization on the economy, particularly through its interlinkages with other sectors such as manufacturing Arnold et al. (2008).[1]. We fill this gap in the literature by looking at the impact of services trade liberalization on manufacturing productivity utilizing rich, firm-level data from Vietnam combined with a measure of services restrictiveness for services industries over the time period spanning Vietnam's liberalization between 2004-2012.

We argue that services trade liberalization impacts manufacturing firm productivity through two channels. First, it spurs competition domestically and from the entry of foreign services firms, improving access to cheaper and better quality services inputs for manufacturing firms (Fernandes and Paunov, 2012) [2]. This channel operates through a forward linkage and we hereafter refer to it as the 'forward linkage channel'. Second, by altering the structure of the services sector, services trade liberalization impacts the demand for manufacturing products that are used as inputs into services. This channel operates through a backward linkage and we hereafter refer to it as the 'backward linkage channel'. A key contribution of our work is accounting for the backward linkage channel which is understudied in previous work. In fact, we show that not accounting for the backward linkage channel leads to an underestimate of the impact of services liberalization through the forward linkage channel.

Vietnam is a suitable case for our study for several reasons. In the last two decades, Vietnam has seen rapid economic growth with an increasingly important role for the services sector. Next, despite criticism on the effectiveness of the Generalized Agreement on Trade in Services (GATS) in producing services liberalization in many countries, Vietnam's experience has been different. As an acceding member of the World Trade Organization (WTO), Vietnam's binding commitments under the

[1]This lack of attention to services trade liberalization in the literature can be partly attributed to difficulties associated with quantifying non-tariff barriers to services trade, an exercise we undertake in this study

[2]Services trade liberalization includes non-discriminatory regulations, which apply not only to foreign-owned firms but also to local firms. For example, in distribution services, regulations on advertising, pre-packing of products, and opening hours are typically imposed on all suppliers regardless of ownership.

GATS resulted in significant liberalization of the services sector. Finally, this liberalization episode included negotiations with existing, advanced WTO members such as the United States (US) who exerted significant influence on how liberalization was undertaken. We develop an instrumental variables estimation strategy that exploits these conditions of joining to tackle the endogeneity of services liberalization.

To investigate the impacts of services reform on the performance of manufacturing firms, we construct a measure of firm total factor productivity (TFP) using firm-level data from the Vietnam Enterprise survey sourced from Vietnam's General Statistics Office (GSO). To capture services trade liberalization, we gather a large amount of qualitative information on regulations in services sectors and transform this information into a composite, time-varying index ranging from 0 to 1 at the industry level for five services industries based on the methodology developed by the OECD in Geloso Grosso et al. (2015). The index measures three aspects of liberalization related to the services sector: foreign entry (foreign ownership), the progress of privatisation, and the level of competition. This study is among the few to include services liberalization measures focused domestically in addition to more well-studied measures that lower barriers to foreign entry into services. Our index is thus a broad measure of services liberalization. The index is then employed to generate measures of services sector restrictiveness as weighted averages of restrictiveness in industries that a firm buys inputs from and supplies to, where weights are calculated using Vietnam's national Input-Output table (I-O table) that tracks input use across manufacturing and services sectors. These measures allow us to investigate services liberalization impacts on firm productivity operating through forward and backward linkages.

We find that services liberalization is associated with an increase in firm productivity via the forward linkage channel, which focuses on the use of services as intermediate inputs by manufacturing firms. A one standard deviation decrease in the services restrictiveness index (the opposite of services liberalization) is associated with a 9.6 percent increase in productivity. The magnitude of this impact is comparable and slightly larger than that in previous studies, such as 9.2 percent in Shepotylo and Vakhitov (2015) for Ukraine, 8.4 percent in Arnold et al. (2016) for India, and 7.7 percent in Arnold et al. (2011) for the Czech Republic. The effects are strongest for small and domestic firms. Further, a one standard deviation decrease in services restrictiveness corresponds to a decrease in productivity of 7.5 percent via the backward linkage channel, which focuses on manufacturing firms supplying inputs to services firms. Decomposing various components of services liberalization, we find that non-discriminatory measures such as regulating competition and

improving transparency matter more than discriminatory measures around foreign entry and movement of people.

We show that there is no relationship between services liberalization and firm markups, suggesting that though firm TFP is measured using a revenue production function, our results capture changes to physical productivity. Our findings are consistent with the idea that access to a wider variety of, and better quality intermediate inputs can lead to physical productivity gains, and that a decrease in demand for the final product can disincentivize firms from investing in productivity enhancements. Results are robust to different TFP estimation methods and alternative measures of services liberalization, including one that measures the extent of foreign presence in services. Furthermore, we implement an instrumental variables estimation strategy to tackle endogeneity of services liberalization by instrumenting for it using outward foreign direct investment (FDI) from the US to the rest of the world. While outward US FDI (capturing US comparative advantage in services) is likely to be correlated with services liberalization in Vietnam given US influence on Vietnam's negotiations during WTO accession, it is unlikely to be correlated with Vietnamese manufacturing firm performance. We find that our results are robust to this alternate estimation strategy.

We contribute to the literature in three ways. First, we add to the literature examining the impacts of services liberalization on the performance of manufacturing firms by focusing on Vietnam, a country transitioning from a planned to a market-oriented economy with a unique development pathway (Arnold et al., 2016)Arnold et al. (2011)Fernandes and Paunov (2012)Duggan et al. (2013)Van der Marel et al. (2016). Second, in examining the effects of services liberalization, we explore both conventional and unconventional channels: the manufacturing sector as a consumer of services products and as a supplier of inputs to firms in the services sector. While the role of services sector as a final product was an early focus (Baumol, 1967; Clark, 1940), services as an intermediate input into manufacturing began receiving attention in the literature much later (Markusen, 1989; Melvin, 1989). Third, our services liberalization index captures both discriminatory and non-discriminatory measures. This is in contrast with the existing literature that focuses primarily on decreases in barriers for foreign services firms.

Finally, our study relates to the literature on the impacts of trade liberalization on manufacturing performance more broadly. Manufacturing performance has been studied widely, given that the sector has long proven to be a crucial driving force of economic growth and productivity. Previous studies linking trade liberalization and manufacturing performance emphasize openness to trade in goods. We argue

that services trade liberalization can have equally important effects, given interlinkages between services and manufacturing. Understanding these effects is essential in formulating trade policies as it provides insights into structural adjustment as economies adapt to trade reform (Cai and Leung, 2004; Comin, 2010).

The remainder of this paper is organised as follows. Section 2 presents a conceptual framework to analyze the impacts of services liberalization on manufacturing firm productivity. Section 3 describes the data and empirical estimation. Results and robustness tests are presented in Section 4. Section 5 discusses extensions to the core empirical analysis. Section 6 provides conclusion and policy implications.

2 Conceptual Framework

We posit that services liberalization lowers barriers to entry for foreign firms and creates a more competitive business environment domestically (for instance, by removing anti-competitive regulations). Greater presence of foreign firms increases competition because foreign firms tend to be more productive and closer to the technological frontier as compared to domestic firms. Focusing on the forward linkage channel, foreign services firms are more likely to introduce new, better quality and more reliable services into the domestic market. This means that manufacturing firms gain access to services inputs that are not only priced lower, but also are of a wider range and quality, generating improvements in profitability and scale (Fiorini et al., 2018; Francois and Hoekman, 2010).

For example, better quality transportation services can open up the export market and facilitate imports of more intermediate inputs from abroad. The same is true for other services such as telecommunications, finance, and professional business services, which play the role of facilitating international trade deals and transactions. The expansion of international trade (both exports and more efficient imports), can in turn allow firms to achieve productivity growth through economies of scale (Shepotylo and Vakhitov, 2015). Better quality inputs can enhance the firm's production possibility frontier, increasing physical productivity (Fiorini et al., 2021). In addition, a better variety of more knowledge-intensive and lower-cost services inputs can pave the way for fragmentation of production activity in manufacturing firms (Deardorff, 2001), allowing them to reallocate resources to manufacturing tasks in-house, thereby increasing gains from specialization.

Turning to the backward linkage channel, the presence of foreign firms in the services sector can generate knowledge and technology spillovers that can benefit manufacturing firms through interactions with them as suppliers of inputs (Fernan-

des and Paunov, 2012). Foreign firms may transfer know-how to their domestic suppliers on superior techniques of production and best-practices. This implies a positive relationship between services liberalization and manufacturing firm productivity. However, a second effect operates in the opposite direction. The altered market structure of a more liberalized services sector (with new foreign firms and more productive domestic ones) can result in changes to demand for inputs from local manufacturing firms. Foreign firms may source inputs from abroad, lowering demand for inputs from domestic manufacturing firms. A decrease in market-size for domestic manufacturing firms may lower firm incentives to enhance productivity (Fiorini et al. (2021)), resulting in a negative relationship between services liberalization and firm productivity through this channel. Thus, the relationship between services liberalization and productivity through the backward linkage channel is a priori ambiguous and is an empirical question.

3 Empirical Strategy and Data

To investigate the impact of services liberalization on the performance of manufacturing firms, we follow a two-stage approach. In the first stage, we estimate TFP of individual firms by estimating a production function at the industry level. In the second stage, we estimate the relationship between TFP and services liberalization. In the next subsections, we discuss construction of the services restrictiveness index at the industry level, measures of services restrictiveness in upstream and downstream industries (to capture impacts of liberalization through linkages) and estimation of firm TFP.

3.1 Measuring Services Liberalization

In goods trade, tariffs are a prominent form of trade barrier and reductions in tariffs are used as proxies for trade liberalization. Trade in services, however, encounter non-tariff barriers primarily in the form of government regulation. For that reason, we quantify non-tariff barriers in key services industries in Vietnam in a numerical services trade restrictiveness index to measure liberalization of trade in services. We utilize the methodology developed by the OECD as in Geloso Grosso et al. (2015). While most previous studies quantify non-tariff barriers in services based on commitments made by countries in free trade agreements, our quantification is based on actual regulations that are stated in official legal documents. Our index thus measures actual, as opposed to committed, levels of restrictiveness.

Each type of regulation is assigned a weight according to its assessed potential importance in restricting trade, and each individual regulation must be classified and scored according to whether it does restrict trade. These weighted scores are then aggregated to create a restrictiveness index for each services sector. A key feature of our index is that it varies over time, quantifying changes in restrictiveness over the period 2004 - 2012 as Vietnam acceded to the WTO (which occured in 2007). The index range from 0 to 1 where 0 is the most liberal and 1 is the most restrictive. It covers five sectors: commercial banking, telecommunications, transport (road freight and internal waterways), insurance and distribution services.[3]). It captures a range of liberalization measures implemented as a part of Vietnam's commitments under the GATS, such as allowing foreign investors to hold a higher ratio of capital in joint-ventures in telecommunications, eliminating capital ratio limits in commercial banking, unilaterally opening up broader trade channels by relaxing regulations affecting foreign firms and movement of people.

3.2 Forward and Backward Linkages

As discussed in Section 2, we propose that services liberalization impacts firm productivity in manufacturing through forward and backward linkages. The forward linkage channel captures the idea that with greater competition in the services sector, manufacturing firms are able to access cheaper, a wider variety and better quality of inputs. The backward linkage channel refers to the idea that with greater competition and presence of foreign firms in services, demand for manufacturing inputs into services is impacted, affecting firm scale and thus, productivity. In this section, we outline the construction of measures that pick up liberalization in industries that manufacturing firms buy from and supply to.

To capture the forward and backward linkage channels, we construct two measures using the services restrictiveness index. The first captures the forward linkage and for ease of interpretation, we call it the input (linkage) index. The second captures the backward linkage and we call it the demand (linkage) index. They are computed as follows:

$$Input\_index_j t = \sum_k \alpha_{jk} STRI_{kt} \tag{1}$$

[3]In this study, we construct the restrictiveness index for internal waterways as a proxy for restrictiveness in maritime transport. This is because the I-O table only contains the ratio of firm input from the internal waterway transport.

$$Demand\_index_j t = \sum_k \beta_{jk} STRI_{kt} \tag{2}$$

where α_{jk} is the share of services input k in total intermediate input usage of manufacturing industry j; β_{jk} is the share of manufacturing input j in total intermediate input usage of service industry k; $STRI_{kt}$ is the restrictiveness index of services industry k at time t.

Input shares are obtained from the national I-O table for the year 2000, which contains average inter-industry sourcing of inputs of firms in a given industry. The 112 industries of the I-O table are aggregated to the 2-digit VSIC (Vietnam Standard Industrial Classification) 2007 using a concordance table sourced from the GSO, Vietnam. Though it is ideal to use input shares at the firm level, the enterprise survey does not include such information. Besides, using industry-level input data has an advantage over firm-level data in that it avoids the possible correlation between firm performance and input use (Arnold et al., 2011). Further, our choice of the year 2000 for the I-O table is motivated by the need to avoid endogeneity concerns stemming from the fact that services liberalization, input use and firm performance are likely endogenous (Fiorini et al., 2018). The 2000 I-O table is close enough to our analysis period without being impacted changes in services liberalization.[4].

3.3 Measuring Firm TFP

To calculate TFP, we estimate a production function estimation at the 2-digit industry-level, as follows:

$$\widehat{\omega}_{it} = y_{it} - \widehat{\beta}_l l_{it} - \widehat{\beta}_k k_{it} \tag{3}$$

where ω_{it} is unobserved productivity of firm i at time t; y_{it} is the log of value added; l_{it} is the log of the labor input; $k + it$ is the log of the capital input.

To estimate the production function, we follow Olley and Pakes (1996) with the Ackerberg et al. (2015) correction, as used for Vietnamese firms by Newman et al. (2015). Value-added is computed using data on profits from production activities and wages of firms. Capital is the deflated value of assets at the beginning of the year, while labor is the total number of workers employed at the end of the year. Investment is measured as the change in the value of fixed and long-term assets over the year plus any accumulated depreciation. We assume a standard depreciation ratio of 10 percent (Ha and Kiyota, 2014; Kyburz and Nguyen, 2016). The real

[4]Appendix A.5 shows that our results are robust to using the I-O table for the year 2007, which lies approximately in the middle of the time period covered by the data sample, from 2004 to 2012.

values of these variables are calculated by deflating the nominal values by GDP deflators [5]. In all regressions, TFP is measured in logs.

Data for productivity estimation come from the Vietnam Enterprises Survey (VES), collected annually since 2000 by GSO, Vietnam. It is the only official data source and the most comprehensive primary database available on Vietnamese firms across all sectors of the economy. Every year, GSO Vietnam collects information from all firms via a survey. In the surveyed questionnaires, firms are asked to provide both financial statements and non-financial information on firm operations from January to December of the previous year. Financial statements include assets and liabilities; revenue; profit; taxes; and non-financial statements include location; industry codes; the number of employees; ownership; activities related to environment; and training. However, the VES does not contain information on intermediate materials and services inputs of firms. Merchandise export status and sales from export activities were not available until 2010 and information on research and development activities only appears in some of years.

We utilize data from 2004 to 2012. Each firm was given a unique identification number which allows us to construct the dataset as an unbalanced panel over nine years. In this study, industry 12 (the manufacture of tobacco products) and industry 19 (the manufacture of coke and refined petroleum products) are excluded because there are very few firms operating in these sectors. We also exclude industry 33 (repair and installation of machinery and equipment) because it is a service-based industry. The data cleaning process is described in Appendix A.1. After cleaning, we are left with 230,558 firm-year observations from 2004 to 2012 for analysis.

3.4 Empirical Specification

We start by estimation the following equation:

$$\begin{aligned} logTFP_{ijt} = \beta_1 Input\_index_{jt-1} + \beta_2 Tariff_{jt-1} + \beta_3 Inputtariff_{jt-1} \\ + foreign_{it} + X_{it} + \alpha_i + \alpha_t + \varepsilon_{it} \end{aligned} \tag{4}$$

Total Factor Productivity (TFP_{ijt}) refers to productivity of firm i in industry j at time t and is estimated as the residual of a industry specific Cobb-Douglas production function. The parameters of the production function are identified using the methodology in Olley and Pakes (1996) with the Ackerberg et al. (2015) correction.

[5] GDP deflators are based on prices in 2010, and the information on Vietnam's GDP is sourced from the World Bank's database.

The variable $Input_index_{jt-1}$ measures services restrictiveness in services industries used as inputs and captures the forward linkage channel. During the period 2004 to 2012, Vietnam also continued reducing manufacturing product tariffs rates as the country acceded to the WTO. To control for the impact of tariff reductions on the productivity of manufacturing firms, we followed Arnold et al. (2016) and add lagged output tariffs ($Tariff_{jt-1}$) and input tariffs ($Inputtariff_{jt-1}$) in the manufacturing sector.[6]. Input tariffs of manufacturing industry j are thus weighted measures of tariffs on inputs, including from other sectors, such as agriculture, fishery, forestry, mining, and other manufacturing industries. Weights are obtained from the 2000 I-O matrix for Vietnam. Tariff data are obtained from the World Bank's WITS database and are the Most-Favoured-Nation (MFN) tariffs based on HS2002 and HS2007 and converted to the 2-digit industry level of ISIC revision 4.

Equation 4 includes a $foreign_{it}$ variable, which is a dummy variable for foreign ownership of firms. Value of this variable is equal to 1 if firms are foreign-invested and zero if otherwise. X_{it} is a set of firm controls such as firm size. Finally, we include firm and year fixed effects to account for unobserved, firm specific heterogeneity and annual shocks that might be correlated with services liberalization and firm performance simultaneously. In all specifications, standard errors clustered at the industry-year level.

Note that so far, we have only accounted for services restrictiveness in industries with a forward linkage, in line with previous studies in the literature. A crucial contribution of our study is that we also account for the fact that manufacturing firms supply inputs to services firms and are thereby impacted by services liberalization through a backward linkage. We hence augment our estimation equation with the variable $Demand_index_{jt-1}$ as follows:

$$\begin{aligned} logTFP_{ijt} = {} & \beta_1 Input\_index_{jt-1} + \beta_2 Demand\_index_{jt-1} \\ & + \beta_3 Tariff_{jt-1} + \beta_4 Inputtariff_{jt-1} \\ & + foreign_{it} + X_{it} + \alpha_i + \alpha_t + \varepsilon_{it} \end{aligned} \tag{5}$$

For the convenience of interpretation and to make our study comparable with previous studies on this topic, the forward and backward linkage variables, as well as output tariffs and input tariffs are standardised to have a mean of zero and a standard deviation of one. Table 1 summarizes the main variables used in the estimation.

[6]Information on tariffs is not available in 2011. For that reason, we apply tariff and input tariff values in 2012 for the year of 2011. Input tariffs of industry j at time t are defined as $\tau^{input}_{jt} = \sum_k \alpha_{kt} \tau^{output}_{kt}$ where τ^{output}_{kt} is the tariff in manufacturing industry k at time t, and α_{kt} is the share of industry k used as an input into industry j.

Table 1: Descriptive statistics

Variables	Observation	Mean	Std Dev.
Log TFP	173855	0.315	0.711
Log value added	198867	6.519	1.987
Log capital	204095	8.56	1.895
Log labor	230623	3.156	1.588
Log investment	159789	6.084	2.196
Input index lagged	230658	0.061	0.018
Demand index lagged	230658	0.034	0.036
Output tariffs lagged	230658	18.436	11.985
Input tariffs lagged	230658	6.323	4.216

3.5 Identification

We tackle several empirical concerns related to our estimation. As noted earlier, input intensities in manufacturing and services sectors are likely to be influenced by services regulation. To mitigate this problem, we use the I-O table for 2000, before the beginning of services liberalization and before the first year of our analysis, 2004. Additionally, we follow the previous literature on the economic impacts of goods trade liberalization and use the I-O table of the US in a robustness test.

Next, it is plausible that manufacturing firms lobby for policy reforms in the services sector. As we discovered previously, services reform is associated with an increase in productivity of manufacturing firms. Given the potential benefit from removing barriers to services trade, manufacturing firms may have motives to encourage the government to liberalize services industries that they perceive benefit them the most. Thus, services liberalization is potentially endogeneous to manufacturing firm performance. To address this endogeneity concern, we exploit the institutional circumstances surrounding Vietnam's services liberalization. Specifically, in the case of Vietnam, a majority of policy reforms in the services sector was conducted as a result of implementing commitments under the GATS in the process of joining the WTO. In the WTO, Vietnam was an acceding member and was therefore subjected to external pressure to liberalize services industries by major trading partners during bilateral negotiations – especially the US. We therefore instrument for the services restrictiveness index of a services industry using the log of the industry specific outward FDI of the US to the rest of the world [7].

The idea is as follows. Outward FDI by the US in services is correlated Vietnamese services restrictiveness given that the US was a major negotiator in Viet-

[7]This exercise is similar as the practice in Shepotylo and Vakhitov (2015)

namese WTO negotiations. It is thus conceivable that the US encouraged openness in services industries where it has a comparative advantage, and hence greater outward FDI. Besides, outward FDI in services from the US to the rest of the world is driven by its comparative advantage and is unlikely to be correlated with factors influencing Vietnamese manufacturing performance. This argument is bolstered by the fact that Vietnam is a small recipient of FDI from the US in services relative to the rest of the world, so that changes in Vietnamese services regulations cannot impact outward FDI flows from the US. We discuss results from the instrumental variables section 4.3 on robustness tests and show that our results remain qualitatively robust to the instrumental variables estimation strategy.

4 Results

4.1 Baseline

Columns (1) and (2) in Table 2 show results of the baseline regression as in equation 4 with different combinations of fixed effects. In both columns, we find a negative and statistically significant coefficient on the input index, which captures the impact of services restrictiveness in industries that are used as inputs into manufacturing. This supports the hypothesis that services liberalization increases the productivity of manufacturing firms that use services as a source of inputs. In terms of the magnitude of the effects, a decrease in the input index by one standard deviation is associated with a 2.7-6.9 per cent increase in productivity. In percentage terms, a one percentage point reduction of the index corresponds to a 1.5-3.9 per cent increase in TFP of manufacturing firms. We use column (2) as our baseline estimation of equation 4.

Columns (3) and (4) present results of baseline regression equation 5 with the inclusion of both the input and demand indices and different combinations of fixed effects, with the latter index capturing impacts through a backward linkage - the channel whereby services liberalization in industries where manufacturing is used as an input impacts manufacturing firm productivity. In both columns, there is a significant and negative (positive) relationship between TFP and the input (demand) index. Focusing on the input index, a one standard deviation decrease in the index is associated with a 9.6 percent increase in TFP. In percentage terms, a one percentage point decrease of the index corresponds to a 5.2 per cent increase in TFP of manufacturing firms. Compared to the results in column (3), it is clear that the magnitude of the impact of services liberalization on the productivity of firms in manufacturing via the forward linkage is underestimated by not accounting for

Table 2: Baseline regression results

	(1)	(2)	(3)	(4)
Input index	-0.027**	-0.072***	-0.051***	-0.096**
	(0.012)	(0.026)	(0.014)	(0.027)
Demand index			0.082**	0.075**
			(0.033)	(0.031)
Output tariffs	-0.022*	-0.027**	-0.014	-0.020*
	(0.012)	(0.012)	(0.012)	(0.011)
Input tariffs	-0.001	0.005	0.002	0.009
	(0.012)	(0.013)	(0.012)	(0.012)
Observations	173855	173855	173855	173855
R-squared	0.675	0.676	0.675	0.676
Year fixed effect	No	Yes	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al.(2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specifications control for size and ownership of firms. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

impacts through the backward linkage. This is an important point we make in our paper.

Focusing on the demand index, a one standard deviation decrease in the index corresponds to a decrease in TFP of 7.5 per cent. In percentage terms, a one percentage point decrease in the index is associated with a 2.1 per cent decrease in productivity. This is consistent with foreign services firms sourcing their inputs overseas, switching demand away from local suppliers and reducing demand for their manufacturing inputs. For instance, foreign-owned logistics companies would prefer to use imported vehicles instead of locally made vehicles or foreign distributors might want to use equipment, such as cashier machines, purchased from overseas. A decrease in demand can decrease incentives to improve productivity by undertaking actions such as upgrading technology or improving efficiency. Across all columns, there is no significant relationship between productivity and input tariffs. Output tariffs have a negative and statistically significant impact on the productivity of manufacturing firms. Lowering output tariffs results in increased competition, causing firms to improve their efficiency, in line with (**?**).

Table 3: Services liberalization impacts on markup

	(1)	(2)
Input index	0.014	0.033
	(0.059)	(0.058)
Demand index		-0.061
		(0.045)
Output tariffs	-0.021	-0.017
	(0.025)	(0.021)
Input tariffs	0.02	0.017
	(0.022)	(0.023)
Observations	212,520	212,520
R-squared	0.732	0.732
Year fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes

Note: The dependent variable is logarithm of firm's markup, calculated using coefficients estimated by Olley and Pakes (1996) corrected using Ackerberg et al.(2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specifications control for size and ownership of firms. Robust standard errors clustered at industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

4.2 Firm Markups

To make sure that the estimated productivity changes are not driven by changes in price-cost margins (or profitability), we estimate the baseline model with firm markups as the dependent variable. De Loecker and Warzynski (2012) calculate the markup as the ratio of an input-output elasticity by estimating the production function. Following this approach, we use labor coefficients obtained from our production function estimation. The markup is computed as:

$$\mu_{it} = \theta_{it}^{X}(\alpha_{it}^{X})^{-1} \tag{6}$$

where μ_{it} is the markup of firm i at time t, α_{it} is the share of expenditures on input X_{it} (wage) in total sales (revenue), and $V\theta_{it}^{X}$ is the coefficient on labor from the production function estimation.

The results, presented in Table 3 indicate that firm markups are not related to the input or demand index. We also find that there is no significant impact of changes in output tariffs and input tariffs on markups of firms. This indicates that productivity impacts relate to impacts on physical productivity and not simply through changes in firm markups.

Table 4: An alternative method of productivity estimation

	(1)	(2)	(3)	(4)
Input index	-0.032***	-0.083***	-0.046***	-0.097***
	(0.011)	(0.024)	(0.011)	(0.025)
Demand index			0.047*	0.044*
			(0.028)	(0.026)
Output tariffs	-0.025**	-0.03***	-0.019*	-0.025**
	(0.01)	(0.01)	(0.011)	(0.01)
Input tariffs	0.001	0.008	0.003	0.01
	(0.011)	(0.011)	(0.01)	(0.011)
Observations	176089	176089	176089	176089
R-squared	0.731	0.731	0.731	0.731
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	No	Yes	No	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) method for 21 manufacturing industries (VSIC at 2-digit level).The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specifications control for size and ownership of firms. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

4.3 Robustness Tests

We conduct several robustness tests to ascertain the sensitivity of our baseline results. We present three types of tests including (1) using an alternative methodology to measure TFP; (2) using an alternative method to capture services restrictiveness; (3) using an alternative I-O table; Results reveal that the baseline results are robust to all of these additional tests. First, we test the robustness of our results using the Olley and Pakes (1996) method without the correction from Ackerberg et al. (2015).

Results of the regressions using Olley and Pakes (1996) as an alternative method of estimation of the production function are reported in Table 4. The baseline specification results in all four columns indicate a negative, strong significant coefficient on the input index, which reassures us as to the robustness of our results. When we control for the backward linkage between services and manufacturing industries, the results are consistent with results of the baseline specification presented in Table 2, though the magnitude of effect is smaller.

Second, we validate that the results are robust to using an alternate measure of services liberalization. Following the approach of Arnold et al. (2016); Shepotylo and Vakhitov (2015), we calculate an outcome-based measure, which reflects the degree of reform in the services sector. We construct the alternative measure based on (1) the average share of services industry revenue/employment of domestic private

firms; and (2) the average share of services industry revenue/employment of foreign firms. Since our data sample also includes state-owned firms, it is worth noting that the share in terms of revenue or employment of domestic private firms and foreign firms does not sum up to one. The alternative indices are computed as follows:

$$Input\_FDj_t = \sum_k \alpha_{jk} FDIshare_{kt} \tag{7}$$

$$Input\_Prj_t = \sum_k \alpha_{jk} PVTshare_{kt} \tag{8}$$

$$Demand\_FDj_t = \sum_k \beta_{jk} FDIshare_{kt} \tag{9}$$

$$Demand\_Prj_t = \sum_k \beta_{jk} PVTshare_{kt} \tag{10}$$

where $Input\_FDI_t$ and $Input\_Pri_t$ are the input linkage indices at time t; α_{jk} is the proportion of service industry k in total intermediate input of manufacturing industry j; $FDIshare_{kt}$ is the average share of revenue/employment of foreign firms in service industry k at time t; $PVTshare_{kt}$ is the average share of revenue/employment of domestic private firms in the services industry k at time t; $Demand\_FDI_t$ and $Demand\_Pri_t$ are the linkage indices at time t; β_{jk} is the ratio of manufacturing industry j in total intermediate input usage of service industry k. While the private share reflects the level of privatisation, the FDI share is a proxy of the degree of openness for foreign firms in the services sector. For equivalence with the baseline restrictiveness index, we transform the FDI share and private share into negative values so that a higher value represents less openness (more restrictiveness).

Panel A of Table 5 presents the results of the baseline specification using the average employment share at the industry level of foreign and domestic private services firms [8]. In all specifications, we find that private firm participation has a positive and strongly significant effect on firm productivity through the forward linkage channel. In the case of foreign firms, the effect is positive and statistically significant when entering the variable proxied for FDI separately in the baseline model. In the next regression, when including both FDI and privatisation, both the coefficients for FDI and privatisation are negative, which is consistent with the results of the baselines model. However, only coefficients for FDI is statistically significant.

[8] We also conduct the same exercise using the average share of revenue at the industry-level of foreign and domestic private services firms. The results are similar and are presented in Appendix A.4

Table 5: Productivity effects of services liberalization – Alternative measures of STRI

Panel A: Share of employee - baseline model (4)			
	(1)	**(2)**	**(3)**
Input FDI	-0.02**		-0.019**
	(0.009)		(0.009)
Input Privatisation		-0.041	-0.025
		(0.047)	(0.044)
Observations	173855	173855	173855
R-squared	0.694	0.694	0.694
Year fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
Panel B: Share of employee - baseline model (5)			
Input FDI	-0.027**		-0.034***
	(0.014)		(0.014)
Input Privatisation		-0.072*	-0.034
		(0.051)	(0.035)
Demand FDI	-0.013		-0.018
	(0.01)		(0.014)
Demand Privatisation		1.578***	1.895***
		(0.625)	(0.637)
Observations	173,855	173,855	173,855
R-squared	0.694	0.694	0.694
Year fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. Robust standard errors clustered at the industry-year level are reported in parentheses. Each estimation includes output tariffs, input tariffs, which are not reported for brevity. *** denotes significant at 1% level, ** at 5% level, and * at 10% level

In panel B, we present results of the baseline equation with both forward and backward linkage variables. In terms of the forward linkage, Columns (1) and (3) show consistent results with panel A. However, with the backward linkage, the coefficient for FDI is negative, which is as expected, but not statistically significant. Meanwhile, the coefficients for privatisation are strongly significant, but these parameters are neither realistic nor meaningful. The coefficients at values of 1.578 and 1.895 are interpreted as a one standard deviation increase in the openness in services policy for private sector resulting in a 384 per cent and 565 per cent increase in productivity of manufacturing firms.

Findings in the two panels in Table 5 have proven that baseline results are robust, at least as far as impacts through the forward linkage are concerned. The impacts are consistent and do not depend on how liberalization is measured.

Earlier discussion pointed out an endogeneity concern associated with the I-O component in the construction of the key indices while estimating the baseline model. The root of the problem is that input shares are likely affected by regulations in the services sector. When the sector becomes more liberalised, prices of services become cheaper and lead to an increase in services consumption of manufacturing firms and vice versa. The standard solution here is to use input-output coefficients that are independent of the reform in the services sector. Input-output of a reference country, and in most cases, the US, is commonly used as a proxy for the technical relationship between sectors (Fiorini et al., 2018; Van der Marel et al., 2016). The reason behind this is that the services sector in the US is unrestricted and thus the input-output data of the US is less likely influenced by services regulation. We thus check for robustness of results using input-output coefficients of the US in 1995.

Table 6 reveals that using the input-output table of the US in 1995 to compute the linkage indices generates the same results as using the version in 2000, though the magnitudes of effects are stronger. This result holds for the negative impacts of the input linkage index on productivity of manufacturing firms. When we control for other unobserved heterogeneity, including firm size and ownership of firms, the results are consistent as in the baseline regression model. In another test, we also use the input-output table of Vietnam in 2007, the year that lies in the middle of this study time-frame. The results are similar and presented in Appendix A.5.

4.4 Instrumental Variables Estimation

To address the endogeneity issue relating to potential lobbying by the manufacturing sector, as discussed in section 3.5, we use the log of industry specific outward FDI from the US to the rest of the world to instrument for services restrictiveness. Be-

Table 6: Productivity effects of services liberalisation – I-O table of the USA in 1995

	(1)	**(2)**	**(3)**	**(4)**
Input index	-0.026**	-0.100**	-0.021	-0.163***
	(0.013)	(0.043)	(0.015)	(0.044)
Demand index			0.018	0.086**
			(0.035)	(0.042)
Output tariffs	-0.018	-0.007	-0.020	-0.011
	(0.013)	(0.013)	(0.015)	(0.01)
Input tariffs	-0.009	0.004	-0.006	0.013
	(0.011)	(0.01)	(0.012)	(0.011)
Observations	173855	173855	173855	173855
R-squared	0.675	0.676	0.675	0.676
Year fixed effect	No	Yes	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

cause the US was a major bilateral negotiator over the WTO accession of Vietnam, it is likely that the US exerted pressure on Vietnam to open up services industries where the US has a comparative advantage. Outward FDI in services from the US is likely correlated with the liberalization of the services sector in Vietnam. Also, as Vietnam is a small country, manufacturing performance and economic policy of Vietnam cannot affect FDI of the US in services to the rest of the world. Therefore, we argue that US FDI is a valid instrument for services restrictiveness in Vietnam.

We use the I-O weights to construct weighted outward FDI measures for the input and demand index, substituting for services restrictiveness of each services industry with outward US FDI and using equations 2 and 3. Then, in the first stage of the IV regression, we regress the original indices on the log of aggregate weighted outward US FDI indices and obtain predicted values. Results of the first stage IV regression, presented in Table 7 show that outward FDI indices are good instruments for the original indices based on services restrictiveness. The null hypothesis of weak identification under the Stock-Yogo test is rejected and the F-statistic suggests that the instruments perform well.

In the second stage IV regression, we replace our original indices with predicted ones from the first stage in a standard 2SLS regression. The results of this second stage are presented in Table 7 and confirm the earlier findings. Services liberalization

Table 7: Instrumental Variables approach

Second stage regression	
Input index	-0.096***
	(0.011)
Demand index	0.057***
	(0.009)
Observations	159467
R-squared	0.01
Year fixed effect	Yes
Firm fixed effect	Yes
First stage regression	
Input index – US FDI	-61.834***
Demand index – US FDI	-36.539***
F-stat	942
p-value	0.0000

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. Coefficients of output and input tariffs are not reported for brevity. All specifications control for size of firms, ownership of firms. Robust standard errors are clustered at industry-year level and reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

has a positive impact on firm TFP through the forward linkage channel and a negative impact through the backward linkage channel. The instrumental variables estimation exercise gives us confidence that our main results are not contaminated by endogeneity of services liberalization.

5 Extensions

We explore heterogeneity of the impacts of services liberalization based on firm size and ownership. Additionally, we delve into various components of services restrictiveness to identify reforms that have the most impact on firm TFP.

5.1 Foreign Firms

From a policy perspective, it is important to reform in a way in which domestics firms can benefit just as much as foreign firms, even though these foreign firms may already have links with foreign services suppliers (Arnold et al., 2011). Besides, foreign manufacturing firms could possibly perform better than local producers in price negotiations with services suppliers. These advantages could provide more

Table 8: Productivity effects of services liberalisation - Different effects based on firm's ownership

	(1)	**(2)**
Input index	-0.138***	-0.102***
	(0.038)	(0.036)
Demand index	0.051	0.04*
	(0.086)	(0.079)
Input index*DP	0.054**	0.05*
	(0.026)	(0.026)
Demand index*FIE	-0.023	-0.034
	(0.03)	(0.029)
Input index*DP	0.012	0.01
	(0.063)	(0.062)
Demand index*FIE	0.11	0.121
	(0.093)	(0.092)
Observations	173855	173855
R-squared	0.676	0.677
Year fixed effect	No	Yes
Firm fixed effect	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. Each estimation includes output tariffs, input tariffs, which are not reported for brevity. All specifications control for size and age of firms. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

cost savings and higher productivity gains to foreign producers. The case of India supports this argument where foreign affiliates, as a result of services liberalization, gain about 12 per cent more than the local manufacturing firms (Arnold et al., 2011). In other cases, Duggan et al. (2013); Fernandes and Paunov (2012) found that domestic and foreign-owned firms seem to derive a similar benefit from services liberalization. Ukraine is a different example where significant effects of services liberalization were only found in a sub-sample comprising domestic firms – not the sub-sample containing foreign-owned firms (Shepotylo and Vakhitov, 2015).

To assess whether the impacts of services liberalization are different across foreign and domestic manufacturing firms, all specifications control for foreign ownership of firms. In this section, to study heterogenous effects across firm ownership types, we interact ownership indicator variables with our key independent variables. Previous studies such as Arnold et al. (2016, 2011) define a firm as foreign-owned if the foreign capital participation in a firm is above 10 per cent. However, in the VES,

information on the foreign ownership share in each firm is not included. Instead, firms were asked to identify their legal forms, which were categorised into 14 types indicated in the VES questionnaires. Based on the characteristics of these ownership types, these legal forms are further broken down into three groups.

SOE is a dummy for State-Owned Enterprises, and it takes the value of 1 if the firm is in one of these forms: Central State-owned, Local State-owned, Central State-owned Limited liability, Local share Limited liability, and Joint-stock company with more than 50 percent state capital. DP is a dummy for Domestic private firm, and it takes the value of 1 if the firm is in one of these forms: Collective, Private enterprise, Collective name, Private Limited liability, Joint-stock company without state capital, and Joint-stock company with less than 50 percent state capital. FIE is a dummy for Foreign-invested Enterprises, and it takes the value of 1 if the firm is in one of these forms: 100 percent Foreign capital, Joint-venture between State-owned and foreign firms, and Joint-venture between private and foreign firms. SOE dummy is used as the baseline.

The estimated impacts from Table 8 for State-Owned firms are consistent with results for the pooled sample. While barriers to services trade have a negative impact on the productivity of manufacturing firms that use services as intermediate inputs, these barriers have a positive link with the productivity of manufacturing firms that provide input for services firms.

In relation to impacts on domestic private firms and foreign-invested firms, the estimated coefficients of the interaction terms between the input index and the dummy for domestic private firms is negative, while the same coefficients for FIE is positive, with only the former being statistically significant. It indicates that through the forward linkage, compared to SOE, relaxing barriers to trade services or services reform generates a smaller increase in the productivity of private domestic firms. It is likely that when services become more liberalised, SOEs see the largest benefits from low cost and high-quality services to increase productivity.

Turning to the backward linkage, the estimated coefficient of the interaction terms with the domestic private dummy and the FIE dummy have positive signs, and yet are not statistically significant at the conventional levels of confidence. Thus, there is no statistical evidence to suggest differential effects by ownership type.

5.2 Firm Size

This section tests the potentially different impacts of services liberalization on firm sizes. In the existing literature (Arnold et al., 2008; Shepotylo and Vakhitov, 2015), firms are split into two types, small and large firms. In this study, a small firm is

Table 9: Productivity effects of services liberalisation - Different effects based on firms sizes

	(1)	**(2)**
Input index	-0.112***	-0.099***
	(0.034)	(0.032)
Demand index	0.089**	0.078**
	(0.043)	(0.038)
Input index*Medium firms	0.036***	0.037***
	(0.014)	(0.014)
Demand index*Large firms	-0.001	-0.001
	(0.017)	(0.017)
Input index*Medium firms	-0.03*	-0.029*
	(0.017)	(0.016)
Demand index*Large firms	0.009	0.011
	(0.026)	(0.026)
Observations	173855	173855
R-squared	0.675	0.676
Year fixed effect	No	Yes
Firm fixed effect	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. Each estimation includes output tariffs, input tariffs, which are not reported for brevity. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

defined as having less than 10 workers, a medium firm between 10-50 workers, and large otherwise. We use the small firms category as the reference group.

Similar to previous studies, we expect that with the acceleration of services reform, small firms gain the most, followed by medium and large firms. Compared to small firms, medium and large firms tend to have resources to produce in-house services, while small firms usually rely heavily on external services. For example, medium and large firms often have their own transportation departments or distribution systems, while small firms must outsource these services.

Table 9 reveals results for the full baseline model with different combinations of fixed effects. Focusing on column (2) with time fixed effects, we find that for the forward linkage, services liberalization has a positive impact on the productivity of small firms, which is consistent with the results of the pooled sample. In other words, it means that when services industries become less restrictive or more liberal, small firms gain in productivity. Similar effects are found in the case of medium firms, yet the magnitude of effects is smaller than for small firms. The coefficient

for large firms is not statistically significant.

With regard to the backward linkage, results are similar to impacts through the forward linkage. Medium sized face a smaller loss of productivity than small firms. Medium firms tend to have stronger competitiveness in the market compared to small firms, so that they may be able to better retain their existing customers from the services sector. The coefficient of demand index for large firms is not statistically significant.

5.3 Types of Regulations

The services restrictiveness indices constructed comprise five groups of regulation: restrictions on foreign entry, restrictions to movement of people, other discriminatory measures, barriers to competition, and regulatory transparency. The way we construct these groups allows us to define regulations that are imposed exclusively on foreign-invested firms, and regulations that are applied to both domestic and foreign-invested firms. In this exercise, we test whether different types of regulation exert differential impacts on manufacturing firm productivity. Table 10 presents results from estimating specifications for two groups of regulations - discriminatory, and non-discriminatory [9]. Table 11 reports results from estimating the baseline model with five components of the services restrictiveness indices.

In Table 10, column (1) and column (2) show that through the forward linkage, the effects of lowering discriminatory regulations on the productivity of manufacturing firms are positive, while they are negative for the backward linkage. We find similar results for the case of nondiscriminatory regulations, which are all consistent with baseline results. The coefficients on both the non-discriminatory indices and discriminatory indices are found to have strong, significant impacts at 5 per cent and 10 per cent levels of confidence.

In terms of magnitudes, we find that the productivity effects of non-discriminatory measures are stronger than that of discriminatory measures. These results indicate that the effect of services liberalization on the performance of manufacturing firms comes from the elimination of non-discriminatory regulations that are imposed on both domestic and foreign firms. In column (3), including both proxies in the same specification, the signs of effects are similar as in columns (1) and (3), however, the effects are not statistically significant in the case of discriminatory measures. Given that the two groups of measures are highly correlated (correlation coefficients between input index and demand index are 0.8 and 0.87 respectively), this result is

[9] In the Appendix A.6, we also present results of the baseline model using establishment groups and operations restrictions.

Table 10: Productivity effects of services liberalisation - Result by types of regulation

	(1)	**(2)**	**(3)**
Input index- Discriminatory	-0.065***		-0.029
	(0.022)		(0.024)
Demand index - Discriminatory	0.043**		0.008
	(0.019)		(0.024)
Input index - Nondiscriminatory		-0.152***	-0.122***
		(0.04)	(0.044)
Demand index - Nondiscriminatory		0.165***	0.156**
		(0.058)	(0.069)
Observations	173855	173855	173855
R-squared	0.676	0.676	0.676
Year fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al0. (2015) method for 21 manufacturing industries (VSIC at 2-digit level)0. The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specifications control for size and ownership of firms. Coefficient of output tariffs and input tariffs are not reported for brevity. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

not unreasonable.

Table 11: Productivity effects of services liberalization – Effects of different policy area

	(1)	(2)	(3)	(4)	(5)
Input index – Restrictions on Foreign entry	-0.067***				
	(0.023)				
Demand index – Restrictions on Foreign entry	0.036				
	(0.023)				
Input index – Restrictions to Movement of Foreign labor		-0.046			
		(0.033)			
Demand index – Restrictions to Movement of Foreign labor		0.074*			
		(0.041)			
Input index – Discriminatory measures			-0.068**		
			(0.031)		
Demand index – Discriminatory measures			0.022		
			(0.018)		
Input index – Barriers to competition				-0.084***	
				(0.032)	
Demand index – Barriers to competition				0.175***	
				(0.062)	
Input index – Regulatory transparency					-0.086***
					(0.025)
Demand index – Regulatory transparency					0.065**
					(0.028)
Observations	173855	173855	173855	173855	173855
R-squared	0.676	0.676	0.676	0.676	0.676
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing industries (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services industries that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. Robust standard errors clustered at the industry-year level are reported in parentheses. All regressors are lagged one year. Each estimation includes output tariffs, input tariffs, which are not reported for brevity. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

In Table 11, we look at each component of regulations. The results presented in Table 11 show that, in terms of the forward linkage, the coefficient for all of the five policy areas is negative, which is consistent with the result of the baseline model. All of the coefficients are significant, except the one for 'Restriction to movement of foreign labor'. The reason might be because of its minimal changes during the study period, and according to existing expert opinion, this policy area has a lower weight than other areas. We find consistent results with the baseline model in the case of the backward linkage, except for the estimated coefficients of restrictions on foreign entry and the discriminatory measures, which are not statistically significant.

6 Conclusion

The services sector is a driving force of economic growth globally. Its importance is underscored by interlinkages with other sectors in the economy. This study is the first attempt to investigate the impact of services sector reform on the productivity of Vietnamese manufacturing firms by taking these interlinkages into account.

The paper utilizes detailed information on services liberalization in Vietnam to explore its impacts on manufacturing firm productivity through forward and backward linkages. It finds evidence that while services liberalization in industries that supply inputs to manufacturing firms raises productivity, liberalization in industries that use manufacturing products as inputs depresses productivity. Given that firm markups do not change, these changes in TFP are likely to be changes in physical productivity. Non-discriminatory reform measures are more important than discriminatory-reform measures. Smaller firms and state-owned firms gain more.

Our results have several policy implications. First, services liberalization can have spillover effects on other sectors of the economy such as manufacturing, which is in turn a driver of economic growth and productivity. Second, it could be an effective policy strategy for the government to accelerate the growth of small manufacturers and state-owned firms. Finally, besides removing regulatory barriers affecting only foreign firms that tends to attract the most attention, policy makers might want to focus on reforming regulations that also hinder domestic firms.

References

Ackerberg, D. A., Caves, K., and Frazer, G. (2015). Identification properties of recent production function estimators. *Econometrica*, 83(6):2411–2451.

Arnold, J., Javorcik, B., and Mattoo, A. (2011). Does the services of the liberalization of recovery companies: Evidence from the czech republic. *Journal of International Economics*, (85):1.

Arnold, J. M., Javorcik, B., Lipscomb, M., and Mattoo, A. (2016). Services reform and manufacturing performance: Evidence from india. *The Economic Journal*, 126(590):1–39.

Arnold, J. M., Mattoo, A., and Narciso, G. (2008). Services inputs and firm productivity in sub-saharan africa: Evidence from firm-level data. *Journal of African Economies*, 17(4):578–599.

Baumol, W. J. (1967). Macroeconomics of unbalanced growth: the anatomy of urban crisis. *The American economic review*, 57(3):415–426.

Cai, J. and Leung, P. (2004). Linkage measures: a revisit and a suggested alternative. *Technology Analysis & Strategic Management*, 16(1):63–83.

Clark, J. M. (1940). Toward a concept of workable competition. *The American Economic Review*, pages 241–256.

Comin, D. (2010). Total factor productivity.

De Loecker, J. and Warzynski, F. (2012). Markups and firm-level export status. *American economic review*, 102(6):2437–71.

Deardorff, A. V. (2001). International provision of trade services, trade, and fragmentation. *Review of International Economics*, 9(2):233–248.

Duggan, V., Rahardja, S., and Varela, G. (2013). *Service sector reform and manufacturing productivity: evidence from Indonesia*. The World Bank.

Fernandes, A. M. and Paunov, C. (2012). Foreign direct investment in services and manufacturing productivity: Evidence for chile. *Journal of Development Economics*, 97(2):305–321.

Fiorini, M., Hoekman, B., and Malgouyres, C. (2018). Services policy reform and manufacturing employment: evidence from transition economies. *The World Economy*, 41(9):2320–2348.

Fiorini, M., Sanfilippo, M., and Sundaram, A. (2021). Trade liberalization, roads and firm productivity. *Journal of Development Economics*, 153:102712.

Francois, J. and Hoekman, B. (2010). Services trade and policy. *Journal of economic literature*, 48(3):642–92.

Geloso Grosso, M., Gonzales, F., Miroudot, S., Nordås, H. K., Rouzet, D., and Ueno, A. (2015). Services trade restrictiveness index (stri): Scoring and weighting methodology.

Ha, D. T. T. and Kiyota, K. (2014). Firm-level evidence on productivity differentials and turnover in vietnamese manufacturing. *The Japanese Economic Review*, 65(2):193–217.

Kyburz, S. D. and Nguyen, H. Q. (2016). Does proximity to foreign invested firms stimulate productivity growth of domestic firms? firm-level evidence from vietnam.

Markusen, J. R. (1989). Trade in producer services and in other specialized intermediate inputs. *The American Economic Review*, pages 85–95.

Melvin, J. R. (1989). Trade in producer services: a heckscher-ohlin approach. *Journal of Political Economy*, 97(5):1180–1196.

Newman, C., Rand, J., Talbot, T., and Tarp, F. (2015). Technology transfers, foreign investment and productivity spillovers. *European Economic Review*, 76:168–187.

Nordås, H. K. and Rouzet, D. (2015). The impact of services trade restrictiveness on trade flows: First estimates. *OECD Trade Policy Papers*, (178):1–40.

Olley, G. S. and Pakes, A. (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, 64(6):1263–1297.

Shepotylo, O. and Vakhitov, V. (2015). Services liberalization and productivity of manufacturing firms: Evidence from ukraine. *Economics of Transition*, 23(1):1–44.

Van der Marel, E., Kren, J., and Iootty, M. (2016). *Services in the European Union: what kinds of regulatory policies enhance productivity?* The World Bank.

A Appendix

A.1 Data cleaning

In this Appendix, we describe the cleaning process for the VES sample to estimate the firm-level productivity in manufacturing industries.

Sector codes: The year 2004 to 2006, the data used VSIC 1993 to classify sectors of firms, while from 2007 to 2011, VSIC 2007 was used. Therefore, sector codes in 2004, 2005, and 2006 have been converted from VSIC 1993 to VSIC 2007. The sector classification system here is based on VSIC 2007. The construction of this classification was based on ISIC revision 4, and at the 2-digit level, VSIC 2007 is fully in accordance with ISIC revision 4. Codes for other variables used in regressions are made consistent across years.

Provincial codes: As Ha Tay province merged with the city of Hanoi in 2008, from the survey in 2008 and onwards, Ha Tay became omitted. Also, the number of provinces reduced from 64 to 63. For the consistency of data, from the first year of the data sample (2004) to the year of 2007, we switched the provincial code of Ha Tay (28) to the provincial of Hanoi (01).

Identification of firms: Although each firm has a unique tax code, this code is not sufficient to ensure ID uniqueness. Instead, up to 2009, in the data, to identify a firm, the combination between 'tinh' and 'macs', and 'tinh' and 'madn' are needed. From 2010 and onwards, the 'tinh' and 'macs' combination ensures that a firm has a unique ID. Therefore, for the consistency, we group 'tinh', 'macs' and 'madn' into one variable to create a new and unique IDfor the firm. Prior to that, we removed observations that were missing one of the identifiers 'tinh', 'macs' and 'madn'. Also, firms that have the same new ID have been dropped off of the data sample.

Within year duplicates and inaccurate value of variables: Firms with identical characteristics within the year (exact value of revenues, wages, profits, assets, employments, sectors...) have been removed. We also removed observations that contain the negative value of wages, revenue, total assets, fixed assets, and depreciation.

One-time surveyed firms: In the case that a firm was surveyed in only one year, there is no variance in the productivity of that firm. Therefore, for the purpose of this study, we excluded firms that appear only once in the dataset.

Missing values: we excluded observations where accounting variables are all missing (wages, profit, revenue, fixed assets, total assets, depreciation, employment...) on the assumption that the firms were not in operation that year or it was faulty in entering data from the survey.

A.2 Production Function Coefficients

	Olley and Pake (1996)			Woodrigde (2009)			Olley and Pake (1996) Ackerberg et al (2015) correction		
Code	Labour	Capital	Sum	Labour	Capital	Sum	Labour	Capital	Sum
10-11	0.7309	0.2357	0.9666	0.6700	0.2211	0.8912	0.8408	0.2339	1.0747
13	0.7313	0.3573	1.0886	0.7446	0.1949	0.9396	0.7653	0.3265	1.0919
14	0.8917	0.2044	1.0961	0.9182	0.0464	0.9647	0.8887	0.1722	1.0609
15	0.8868	0.1854	1.0722	0.9195	0.0707	0.9902	0.8831	0.1433	1.0264
16	0.8451	0.2948	1.1399	0.7764	0.1441	0.9205	0.8833	0.2733	1.1566
17	0.8401	0.3116	1.1518	0.7826	0.1289	0.9116	0.9355	0.1178	1.0533
18	0.8174	0.2173	1.0347	0.8668	0.1624	1.0291	0.8739	0.2762	1.1501
20-21	0.7219	0.5096	1.2314	0.5847	0.3474	0.9322	0.7607	0.5142	1.2748
22	0.8148	0.3613	1.1761	0.7518	0.2050	0.9568	0.8493	0.3241	1.1735
23	0.8647	0.2158	1.0805	0.8205	0.2011	1.0216	0.8709	0.3078	1.1787
24	0.8350	0.1860	1.0210	0.7900	0.1970	0.9870	0.8642	0.2765	1.1407
26-28	0.7426	0.4236	1.1661	0.6697	0.2143	0.8840	0.8112	0.3877	1.1990
29,30,32	0.8326	0.3572	1.1898	0.7596	0.1929	0.9525	0.9143	0.3524	1.2667
31	0.8890	0.1548	1.0439	0.8344	0.1399	0.9743	0.9010	0.1928	1.0937

A.3 Productivity effects of services liberalisation - Results using Wooldridge (2002) methodology to estimate TFP

	(1)	(2)	(3)	(4)
Input index	-0.025***	-0.056***	-0.039***	-0.069***
	(0.007)	(0.019)	(0.008)	(0.019)
Demand index			0.048**	0.042**
			(0.015)	(0.013)
Output tariffs	-0.012*	-0.016**	-0.007	-0.012*
	(0.007)	(0.006)	(0.007)	(0.007)
Input tariffs	0	0.002	0.001	0.004
	(0.008)	(0.008)	(0.007)	(0.)007
Observations	185355	185355	185355	185355
R-squared	0.631	0.633	0.631	0.633
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	No	Yes	No	Yes

Note: The dependent variable is the logarithm of TFP estimated using production functions methodology from Wooldridge (2009) method for 21 manufacturing sectors (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services sectors that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specification control for size and ownership of firms. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

A.4 Productivity effects of services liberalisation – Alternative measures of STRI

	(1)	(2)	(3)
Panel A: Share of revenue - baseline model (4)			
Input index FDI	-0.014		-0.016
	(0.012)		(0.012)
Input index Privatisation		-0.045*	-0.051*
		(0.043)	(0.044)
Observations	173,855	173,855	173,855
R-squared	0.694	0.694	0.694
Year fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
Panel B: Share of revenue - baseline model (5)			
Input index FDI	-0.008		-0.017
	(0.011)		(0.012)
Input index Privatisation		-0.056**	-0.063
		(0.021)	(0.044)
Demand index FDI	1.157		0.26
	(0.77)		(0.896)
Demand index Privatisation		2.247***	2.256**
		(0.746)	(0.926)
Observations	173,855	173,855	173,855
R-squared	0.694	0.694	0.694
Year fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing sectors (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services sectors that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. Robust standard errors clustered at the industry-year level are reported in parentheses. Each estimation includes output output tariffs, input tariffs, which are not reported for brevity. *** denotes significant at 1% level, ** at 5% level, and * at 10% level

A.5 Productivity effects of services liberalisation - Using Input-Output table version in 2007

	(1)	(2)	(3)	(4)
Input index	-0.037*	-0.102**	-0.032*	-0.097**
	(0.019)	(0.043)	(0.019)	(0.035)
Demand index			-0.014	-0.035
			(0.032)	(0.039)
Output tariffs	-0.02*	-0.024***	-0.02*	-0.024**
	(0.011)	(0.008)	(0.011)	(0.008)
Input tariffs	-0.001	0.005	-0.005	0.005
	(0.009)	(0.01)	(0.009)	(0.01)
Observations	173,855	173,855	173,855	173,855
R-squared	0.007	0.01	0.007	0.01
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	No	Yes	No	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al.(2015) method for 21 manufacturing sectors (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services sectors that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specifications control for size and ownership of firms. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.

A.6 Productivity effects of services liberalisation: Result by types of regulation - Establishment and Operation

	(1)	(2)	(3)
Input index- Establishment	-0.058***		-0.051**
	(0.02)		(0.025)
Input- Operation		-0.064**	-0.014
		(0.032)	(0.035)
Output tariffs	-0.028*	-0.024*	-0.028*
	(0.012)	(0.011)	(0.012)
Input tariffs	0.006	0.001	0.006
	(0.013)	(0.013)	(0.012)
Observations	173,855	173,855	173,855
R-squared	0.676	0.676	0.676
Year fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes

Note: The dependent variable is the logarithm of TFP estimated using Olley and Pakes (1996) corrected using Ackerberg et al. (2015) method for 21 manufacturing sectors (VSIC at 2-digit level). The input and demand indices capture restrictiveness in services sectors that supply inputs to and buy inputs from the manufacturing firms, respectively. All regressors are lagged one year. All specifications control for size and ownership of firms. Robust standard errors clustered at the industry-year level are reported in parentheses. *** denotes significant at 1% level, ** at 5% level, and * at 10% level.