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Servicification and Productivity of Manufacturing Enterprises in Cambodia

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Abstract: *This paper examines the effects of servicification on productivity from the perspectives of service inputs (demand-side) and service outputs (supply-side) for firms in Cambodia. The empirical analysis adopts the firm-level data from the 2014 Inter-censal Economic Survey of Cambodia. The unique data contain a vast array of annual corporate information and allow us to differentiate between the share of service input to total inputs (our first proxy of servicification) and the share of service revenues to total output (another proxy of servicification). The empirical analysis examines the productivity effects of servicification controlling for firm heterogeneity, such as year of operation, foreign ownership, registration, female manager, and skill intensity.*

Keywords: servicification, productivity, skill intensity, firm-level analysis

JEL Classification: D240

1. Introduction

Over the past 10 years, Cambodia has seen growth in the manufacturing sector's service activities. The effects of services are increasing both supply-side and demand-side manufacturing activities, thereby strengthening the connections between manufacturing and services activities. From supply, the intensity of service factors utilised in manufacturing production and the adoption of service-based technologies has increased. The global value chain (GVC) activities in particular have widened the service connections between manufacturing activities in regional and global activities. Through the use of communication and social media platforms, services also improved the profit margins of manufacturing activities by attracting and growing a customer base. There is substantial evidence of supply-side effects of services in manufacturing, as an increasing number of manufacturing firms use a higher proportion of service inputs in their production processes. Firms acquire more business services, information and communications technology services, and financial services to coordinate and operate production; they consume transport, logistics, wholesale, and retail services to facilitate the flow of goods between stages of production. Some of these services are performed in-house, whilst others are outsourced. Consequently, the aggregate share of service inputs in manufacturing is rising in most regions of the world, including the Organisation for Economic Co-operation and Development (OECD) countries (Nordås, 2010; Miroudot and Cadestin, 2017), European countries (Kommerskollegium, 2016), and Asian countries (Baldwin, Ito, and Sato, 2014; Thangavelu, Wenxiao, and Oum, 2017; Mercer-Blackman and Ablaza, 2018), and most other individual economies.

In addition, we observe demand-side effects as a result of the incorporation of services into the core products by manufacturing companies. This strategy is prevalent in the majority of industries and regions of the world, including OECD economies, Europe, North America, and Asia (Vandermerwe and Rada, 1988; Kelle and Kleinert, 2010; Baldwin, Ito, and Sato, 2014; Kommerskollegium, 2016; Crozet and Milet, 2017; Cadestin and Miroudot, 2020). This phenomenon was labelled ‘servitisation’ by Vandermerwe and Rada (1988) as a new market strategy adopted by high-performing companies to differentiate their products and increase their competitive edge. The growing importance of services in manufacturing is termed by the National Board of Trade Sweden as ‘servicification’ (Kommerskollegium, 2010) and academic and policy circles have since adopted the term wisely (Low, 2013; Baldwin, Forslid, and Ito,

2015; Lanz and Maurer, 2015 Lodefalk, 2017; Miroudot and Cadestin, 2017). Conceptually, servicification of manufacturing pertains to three dimensions of linkages: (i) the increasing use of service inputs in the production process, (ii) the shift towards service activities in manufacturing, and (iii) the bundle of services with products to add value and sharpen customer relationship.

The majority of empirical research on the effects of servicification on productivity has focused on the outsourcing and offshoring of services, whilst the services revenue dimension has received the least attention. Offshoring services are commonly defined as a service that is produced in one country and consumed in another (Gereffi and Fernandez-Stark, 2010) and it is commonly measured by the proportion of imported services to total firm inputs. Recent research such as that conducted by Girma and Görg (2004) used establishment-level data from the United Kingdom's manufacturing industries to determine whether outsourcing contributes to productivity growth. Similar research has been conducted by Görg, Hanley, and Strobl (2008) on Irish manufacturing firms, Amiti and Wei (2009) on United States' (US) firms, Winkler (2010) on German manufacturing, Schwörer (2013) on European firms, and Kang et al., (2010) on East Asian firms. Their findings suggest that outsourcing services increase productivity. For Irish manufacturing firms, an increase of 10 percentage points in international services outsourcing contributes to an increase in productivity of approximately 0.9% (Görg, Hanley, and Strobl, 2008). The productivity effect is greater in US manufacturing, where 10% of productivity growth is attributable to the offshoring of services (Amiti and Wei, 2009). Several studies examined the impact of service inputs on the productivity of manufacturing firms. Arnold, Javorcik, and Mattoo (2006) studied Czech businesses and found that service inputs not only help firms increase productivity, but also serve as the impetus for service policy reform that has a positive effect on manufacturing productivity.

It is essential to note, however, that empirical evidence regarding the effects of servicification on productivity is far from consensus. Servicification appears to have negative and statistically significant negative correlations with the productivity of Türkiye's manufacturing firms, according to findings in Haven and Van Der Marel (2018). Specifically, firms that produce service outputs have nearly 18% lower productivity than firms that do not produce services. Moreover, empirical studies on servicification and productivity to date have focused on outsourcing and offshoring of services, whilst remaining silent on the productivity

effect of services revenue. This represents a significant research gap, particularly in light of the fact that manufacturing firms are increasingly offering services as an additional business portfolio.

This paper aims to address this deficiency by evaluating the effects of servicification on productivity from the perspectives of service inputs (demand-side) and service outputs (supply-side). Our empirical analysis employs firm-level data from the 2014 Inter-censal Economic Survey of Cambodia. The data are unique in that they contain a vast array of annual corporate information and, most importantly, allow us to differentiate between the share of service input to total inputs (our first proxy of servicification) and the share of service revenues to total output (another proxy of servicification). Regarding empirical strategy, we regress productivity with servicification variables controlling firm heterogeneity, such as year of operation, foreign ownership, registration, female manager, and skill intensity.

2. Literature Review

Servicification refers to the growing significance of the services sector in the manufacturing (Kommerskollegium, 2010; Baldwin, Forslid, and Ito, 2015; Lanz and Maurer, 2015, Miroudot and Cadestin, 2017). It pertains to three dimensions of service-manufacturing linkages: (i) an increase in the use of service inputs in the production process; (ii) the shift towards service activities or professions in manufacturing; and (iii) the bundle of services with products to add value and sharpen customer relationship. Recent studies have shown that the share of services inputs in manufacturing has risen across OECD countries (Nordås, 2010; Miroudot and Cadestin, 2017), in Europe (Kommerskollegium, 2016), in Asia (Baldwin, Forslid, and Ito, 2015; Mercer-Blackman and Ablaza, 2018), and in other economies. According to Miroudot and Cadestin (2017), the ratio varies between 25% and 60% across OECD economies, reflecting the transition of manufacturing activities to service-intensive tasks. The rapid expansion of GVCs is driving the growing servicification of manufacturing. Several seminal works, such as Baldwin and Yan (2014), Low (2013), Miroudot and Cadestin (2017), and Heuser and Mattoo (2017) have described services as the 'glue' that holds together fragmented production components across entire value chains; whereas Kommerskollegium (2016) argued that firms are increasingly utilising services to participate in GVCs. Increasing efficiency and productivity, a shift in corporate market strategy to add value and sharpen customer relationships,

reclassification of services, and an increase in the price of service tasks relative to manufacturing tasks are additional drivers of servicification (Nordås and Kim, 2013; Baldwin and Yan, 2014; Lodefalk, 2014; Kommerskollegium, 2016).

Conceptual and empirical studies on servicification vary in their thematic analysis, methodologies, and geographical scope. The first body of research focuses on quantifying servicification. Some studies calculated the value added proportion of service inputs in manufacturing exports using inter-country input–output tables. For instance, Lanz and Maurer (2015) used the OECD–World Trade Organization (WTO) Trade in Value Added (TiVA) database to demonstrate servicification and show that a sizeable portion (roughly one-third) of the value added in gross exports is derived from services. Studies by Baldwin and Yan (2014), Mercer-Blackman and Ablaza (2018), Baldwin, Ito, and Sat, (2014), Mercer-Blackman and Ablaza (2018), Miroudot and Cadestin (2017) for OECD countries, Kommerskollegium (2016) for the European Union, and Thangavelu, Wenxiao, and Oum (2017) for Asia are other examples of studies that use macro data to analyse the role of services in manufacturing. The evidence provided by these macro studies is consistent across regions and economies, demonstrating that the services sector accounts for a substantial share of exports and outputs from the manufacturing sector. In OECD economies, the services sector accounts for approximately half of the manufacturing value added (Miroudot and Cadestin, 2017); whilst in Asia, the share of services value added in 2017 accounted for 34% of total exports, a significant increase from 27.7% in 2000 (Mercer-Blackman and Ablaza, 2018). Another category of studies used data from individual firms to create indicators such as the proportion of inputs from services to total sales, the employment ratio of occupations in the services sector, and the revenue from services as a proxy for the servicification of manufacturing firms. Despite regional variations, evidence indicates that manufacturing companies use more service inputs, increasingly shift to service tasks, and offer services along with their products (Kelle and Kleinrt, 2010; Lodefalk, 2014; Crozet and Milet, 2017; Cadestin and Miroudot, 2020; Aquilante and Vendrell-Herrero, 2021).

The second body of research is the empirical analysis of servicification. The relationship between servicification and export performance is one of the most studied topics in the context of services-manufacturing linkage. Using Swedish firm data, Lodefalk (2014) evaluated the impact of services on export intensity and discovered that firms with a greater proportion of in-house and outsourced services export more. Similar results are observed in German firms

(Aquilante and Vendrell-Herrero, 2021). Thangavelu, Wenxiao, and Oum (2017) is one of the few empirical studies that utilises macro data to evaluate the factors that impact the degree of servicification in Asian nations. It regressed the share of services value added in export against a number of variables, including participation, GVC position, infrastructure, human capital, technological, and institutional factors, and demonstrated that these variables are the driving force behind the growth of services activities in the region. The study revealed that productivity gain has often been cited in servicification literature as the motive behind firms becoming more servicified. Theoretically, enabling services such as transport and logistics, telecommunications and business services, as well as technology and research and development services, can help improve production coordination and efficiency (Amiti and Wei, 2009; Nordås and Kim, 2013; Lodefalk, 2014; Arnold, et al., 2016). Moreover, firms can achieve static gains from better reallocation of resources by outsourcing services activities and specialising in core manufacturing activities (Winkler, 2010).

Our literature review reveals two significant observations. First, empirical studies on servicification and productivity to date have tended to focus on the effect of service inputs as opposed to service outputs, resulting in a scant discussion of the productivity effects between firms selling services and those selling only goods. As more manufacturing firms offer services alongside their products and as a secondary revenue source, there is a significant knowledge gap in the international trade literature regarding the effect of service output on productivity. Second, there is no research that examines servicification of manufacturing in Cambodian businesses and its impact on firm productivity. This paper will investigate whether servicification, measured in terms of both service input and service output (income), helps firms increase their productivity.

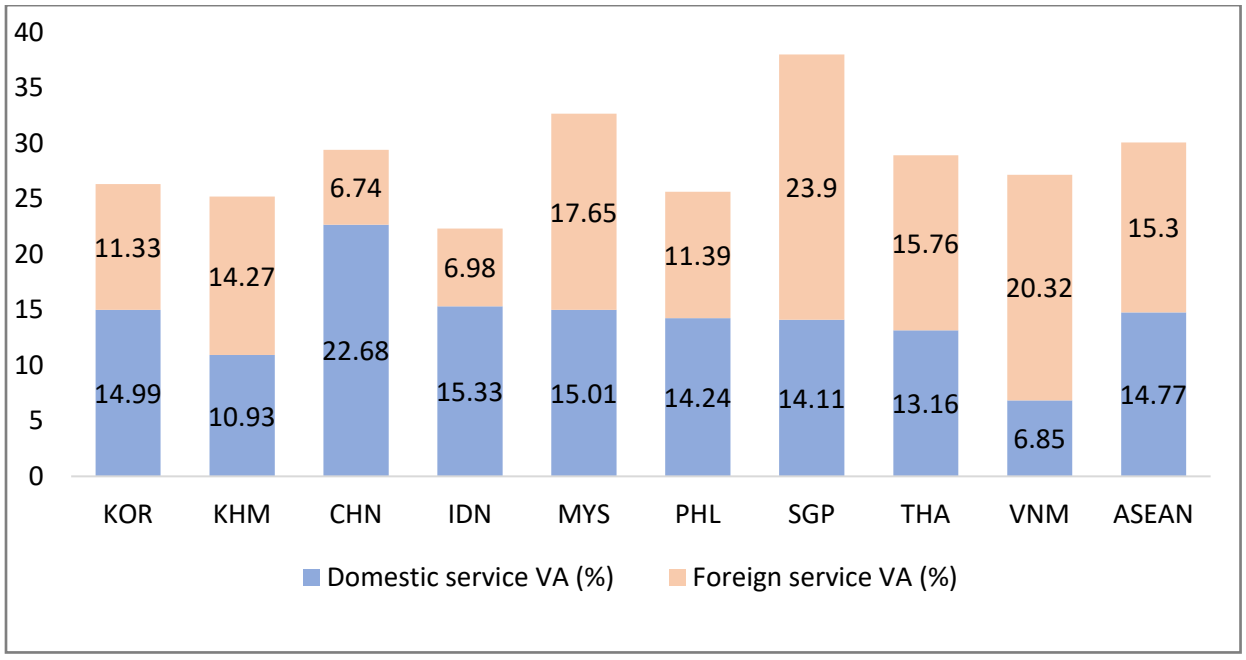
3. Servicification of the Cambodian Economy

To illustrate the extent of servicification in the Cambodian economy, we employ two distinct metrics: the share of service value added share to gross exports and the share of service input to the total expense. The first indicator, which is derived from the inter-country input–output tables, refers to the proportion of value added originating from all service industries to total gross exports by Cambodian manufacturing. Services value added is further disaggregated into domestic services value added (value added originating from domestic service industries) and foreign

services value added to trace the source of services contribution in manufacturing exports (value added originated from foreign service industries).

Figure 1 shows the proportion of services value added to Cambodia's manufacturing exports relative to selected East Asian countries. Specifically, services accounted for 25.2% of Cambodia's manufacturing export value in 2018. Cambodia's servicification rate is slightly higher than Indonesia's but lower than most East Asian economies, including the average ASEAN economy. Singapore's economy is highly servicified, as shown by the country's highest (38%) contribution of services value added to gross export. Malaysia, China, and Thailand have a relatively high proportion of services value added to gross exports as well. In terms of the origin of services, 10.9% of the service value added in Cambodia's manufacturing export is derived from the domestic services industry, whilst 14.3% is derived from foreign supply. In comparison to the majority of East Asian nations, Cambodia's domestic services supply to manufacturing is low, which partially reflects the limited capacity of the country's services sector to support the manufacturing industry's rapid expansion.

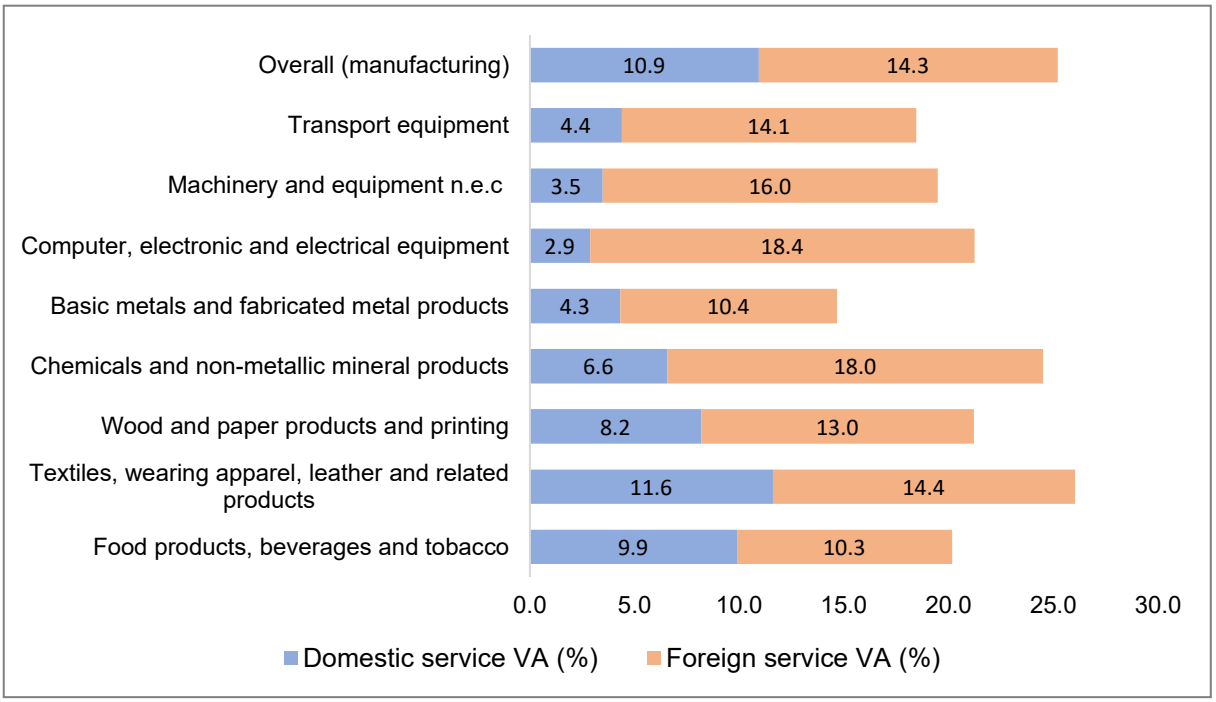
Figure 1: Services Value Added Share of Gross Exports in Countries in East Asia, 2018



KOR = Republic of Korea, KHM = Cambodia, CHN= China, IDN = Indonesia, MYS = Malaysia, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Viet Nam, VA = value added, ASEAN= Association of Southeast Asian Nations.
Source: OECD. Trade in Value-Added (TiVA) database. https://stats.oecd.org/index.aspx?queryid=106160 (accessed 7 March 2023).

The contribution of services in Cambodia's manufacturing export varies notably across sectors. According to Figure 2, textiles and garments rely on service inputs the most, with a 26% share, followed by chemicals and non-metallic mineral products (24.5%) and electronic and electrical equipment (21.2%). The export of basic metals and metal products requires the least amount of service inputs. Despite their differences, all manufacturing sectors share the characteristic that foreign services value added in their gross exports is significantly greater than the domestic services value added.

Figure 2: Services Value Added Share of Gross Exports in Cambodia by Sector, 2018

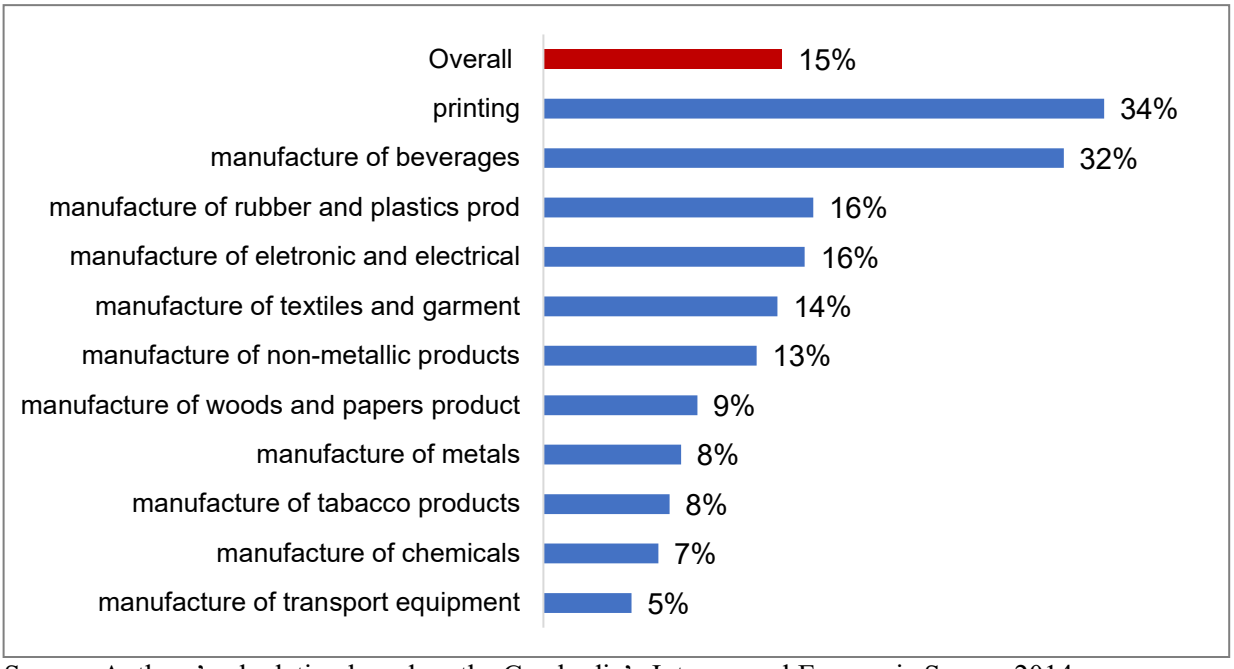


VA = value added.
Source: OECD. TiVA database. https://stats.oecd.org/index.aspx?queryid=106160 (accessed 7 March 2023).

The share of services value added discussed above offers helpful information regarding the economic ties between manufacturing and services. However, it is unable to capture firm dynamics regarding the acquisition of inputs for services by manufacturing enterprises. To capture servicification in terms of service demand, we generate a firm-level indicator called service input intensity using the 2014 Cambodia Inter-censal Economic Survey. To capture the servicification in terms of service demand, we construct a firm-level indicator called service input

intensity, which is calculated by dividing the cost of service inputs, such as electricity expenses, transportation and travel expenses, rental, repair, and maintenance expense, management and consulting services, advertising expense, and expenses on other services by total expenditures. As shown in Figure 3, Cambodian manufacturers allocated on average about 15% of their total expenditures to service. The service input intensity varies considerably between firms of various sizes and industries. Larger companies typically use more service inputs in production than small and medium-sized enterprises (SMEs), as evidenced by the service input share of 18.8% versus 14.2%. The printing industry uses the highest proportion of service inputs at 34%, followed by the beverage industry at 32%. The manufacturing of rubber and plastics products (16%), electronic and electrical equipment (16%), textiles and garments (14%) and non-metallic products (13%), all have a modest proportion of service inputs. In contrast, the manufacturing of transportation equipment utilises the smallest proportion of services at 5%, followed by the manufacturing of chemicals (7%), and tobacco products (8%).

Figure 3: Share of Service Inputs to Total Expenses Amongst Cambodian Manufacturing Firms



Source: Authors' calculation based on the Cambodia's Inter-censal Economic Survey 2014.

4. Econometric Specification and Data Source

4.1. Empirical Strategy

We estimate the effect of servicification on productivity based on the following econometric specification:

$$ln\_prod_{is} = \alpha_0 + \beta_1 serv_{is} + \beta_2 X_{is} + d_l + d_s + \varepsilon_{is} \quad (1)$$

Where subscript i denotes firm and s is sector. Variable ln_prod_{is} is log form of productivity, which is measured by annual sales over total employees. Variable $serv_{is}$ refers to servicification, which is proxied by two measures. First, we define servicification as the proportion of expenditure on services to total expenses ($serv\_inp_{is}$), subsequently refers to as service input intensity. Second, service output (also known as output servicification) is a dummy variable taking value 1 for firms generating extra revenue from service supply and 0 otherwise ($serv\_outp_{is}$). Other firm characteristics that may affect productivity are represented by X_{is}.

As with the majority of studies on productivity, we control for a number of firm characteristics, including ownership structure, age, business registration, and skill intensity. Foreign ownership *(for_own_{isr})* variable takes value 1 if the establishment is foreign-owned and 0 otherwise. Registration ($register_{is}$) is also binary with value 1 if a firm has registered their business at designated public institution and 0 otherwise. The firm age *(age_{is})* in our model refers to the number of years in operation. We follow Thangavelu (2013) to measure skill intensity *($skill_{is}$)* based on wages and salaries. Precisely, skill intensity is defined as the ratio of wages and salaries to total employees, which can be called the average wage of a firm. This proxy was used in Thangavelu (2013) to measure the quality of human capital under the assumption that firms with higher average labour costs per worker employ higher skilled labour. To control unobserved shocks that may affect productivity across different sectors and locations, our econometric specification also includes location-fixed effect d_l and sector-fixed effect d_s.

The final estimation equation is given as:

$$ln\_prod_{is} = \alpha_0 + \beta_1 serv\_inp_{is} + \beta_2 serv\_outp_{is} + \beta_3 for\_own_{is} + \beta_4 age_{is} + \beta_5 register_{is} + \beta_6 sex\_owner_{is} + \beta_7 skill_{is} + d_l + d_s + \varepsilon_{is} \quad (2)$$

We estimated equation (2) using ordinary least squares (OLS) as the baseline estimation. To account for variances across various industries and locations, we control sector and location-fixed effects.

4.2. Data Source

Data used in the empirical analysis are derived from Cambodia's Inter-Censal Economic Survey 2014. It is a sample survey of 10,000 establishments across the country to collect basic statistics including registration, ownership, year of operation, revenues and expenses, wages, and the number of employees. We include only manufacturing enterprises and exclude observations with missing data for any variable. Such a data-cleaning procedure leaves us with only 414 observations for estimation. Summary statistics are presented in Table 1.

Table 1: Summary Statistics

Variable	Observation	Mean	Standard Deviation
Labour productivity (in log)	422	8.418675	1.295413
Age	422	6.438389	5.333954
Foreign ownership (%)	422	0.4526066	0.4983396
Register (%)	422	0.6279621	0.4839221
Female owner (%)	422	0.1635071	0.3702667
Skill intensity (in log)	422	6.978251	1.005205
Share of service inputs to total expense	422	.1234876	.153779
Share of firms selling services as secondary incomes	422	0.035545	0.1853726

Source: Authors' calculation based on Cambodia's Inter-censal Economic Survey 2014.

5. Empirical Results

5.1. Servicification in Terms of Inputs and Productivity

The estimation that accounts for any unobserved location-varying and sector-varying shocks affecting the productivity level of firms is given in Table 2. The age coefficients are positive and statistically significant across all specifications. The result demonstrates the significance of physical presence and experience in enhancing productivity. In other words, firms with a longer history of operation are more productive than their younger counterparts. The foreign ownership coefficient is negative but insignificant, which implies that the productivity level of foreign-owned firms is not different from the one of Cambodian-owned firms. The result slightly contradicts existing literature, i.e. Görg, Hanley, and Strobl (2008) and supports the claim

that foreign-owned firms have several advantages including human and capital resources, technological and production capabilities and access to foreign networks, which are factors that contribute to higher productivity. The estimated coefficient for registration is positive but not statistically significant, indicating that firms with formal status through registration tend to have comparable levels of productivity to unregistered firms. The coefficient of female ownership is negative but insignificant, indicating that there is no significant difference in productivity between firms owned by women and those owned by men. The estimated coefficient for skill intensity is strongly positive, suggesting that firms with higher levels of skill are more productive. The importance of skill intensity in raising a firm's productivity is not uncommon in the empirical literature. For example, Crépon, Duguet, and Mairessec (1998), Pham (2015), and Pattnayak and Thangavelu (2014) revealed that having a higher-skilled workforce increased the productivity of firms; whilst Jamal (2018) found that productivity improvement is strongly associated with the educational level of production workers.

Table 2: Estimation Results of Servicification (in terms of inputs) Effect on Productivity

	(1)	**(2)**	**(3)**	**(4)**
	All Manufacturing	**All Manufacturing**	**Textiles and Garments**	**Other Manufacturing**
Age	0.225***	0.223***	0.360***	0.0725*
	(0.0632)	(0.0630)	(0.0882)	(0.0923)
Foreign owned	–0.162	–0.133	–0.0433	0.125
	(0.151)	(0.151)	(0.205)	(0.256)
Register	0.0313	0.0327	–0.0110	0.176
	(0.169)	(0.168)	(0.281)	(0.220)
Female owner	–0.0836	–0.0814	0.0601	–0.0403
	(0.146)	(0.146)	(0.189)	(0.252)
Skill intensity	0.760***	0.702***	0.650***	0.895***
	(0.0564)	(0.0659)	(0.0717)	(0.0895)
Service input intensity	1.061*	–2.199	0.506*	1.092*
	(0.544)	(1.983)	(0.643)	(0.921)
Skill # service input intensity		0.484*		
		(0.283)		
Observations	413	413	216	197
R-squared	0.412	0.416	0.424	0.534

	(1)	(2)	(3)	(4)
	All Manufacturing	**All Manufacturing**	**Textiles and Garments**	**Other Manufacturing**
Sector-FE	Yes	Yes	No	No
Location-FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

FE = fixed effect.

Source: Authors' calculation based on Cambodia's Inter-Censal Economic Survey 2014.

The estimations for servicification variables are robust and in accordance with the theoretical prediction. The coefficient for the proportion of service inputs to total expenses is positive and significant, indicating the significant contribution of servicification to productivity enhancement. The results in Column (1) indicate that an average 10% increase in service input intensity would lead to about 10% rise in productivity level. The evidence is in conformity with theoretical prediction asserting that enabling services sourcing from external suppliers could divert internal resources to focus on core manufacturing activities and thus fuel greater efficiency and productivity (Nordås and Kim, 2013; Kommerskollegium, 2016; Lodefalk, 2017). The finding is also consistent with evidence from manufacturing firms in the US (Amiti and Wei, 2009), in Germany (Winkler, 2010); in the UK (Girma and Görg, 2004), and broadly in East Asian and European countries (Kang, et al., 2010, Schwörer, 2011).

To examine whether productivity gains from servicification vary across firms with different skill intensity, we augment our econometric specification by introducing interactive terms between skill intensity and service inputs intensity. The estimation results are shown in Table 2, Column 2. The positive and statistically significant coefficient of interactive terms suggests that firms that use more service inputs and have a greater proportion of skilled workers realise greater productivity gains. In addition, we investigate the effect of servicification on productivity in various industries. We estimate equation (2) separately for the textiles and apparel and other manufacturing sectors. The estimation results are presented in Table 2, Column 3 for textiles and garments and Column 4 for other manufacturing. Textiles and apparel have a lower coefficient of service input intensity than other manufacturing sectors. This indicates that the productivity gains from servicification in the textiles and apparel industry are smaller than in other manufacturing industries.

5.1. Servicification in Terms of Output and Productivity

We estimate equation (2) with $serv\_outp_{is}$ variable to determine the effect of supply-side servicification on productivity. Similar to the previous specification, the estimation includes fixed effects for sector and location in addition to firm characteristics to account for any unobserved variations that may affect the productivity level of a firm. The estimated outcomes are presented in Table 3. The coefficient for selling service outputs is positive but not statistically significant, indicating that servicified firms have a similar level of productivity as non-servicified firms. In addition, we found no evidence of a significant impact of servicification in terms of output on productivity across industries.

Table 3: Estimation Results of Servicification (in terms of outputs) Effect on Productivity

Variables	(1) All manufacturing	(2) All manufacturing	(3) Textiles and garments	(4) Other manufacturing
Age	0.237***	0.235***	0.369***	0.0797*
	(0.0632)	(0.0633)	(0.0878)	(0.0922)
Foreign owned	–0.138	–0.192	–0.0420	0.154
	(0.151)	(0.164)	(0.206)	(0.255)
Register	0.0771	0.0223	0.0300	0.206
	(0.168)	(0.180)	(0.280)	(0.218)
Female owner	–0.105	–0.0942	0.0408	–0.0422
	(0.147)	(0.148)	(0.189)	(0.253)
Skill intensity	0.749***	0.749***	0.632***	0.894***
	(0.0565)	(0.0566)	(0.0714)	(0.0900)
Service revenues (dummy)	0.0641	0.0291	0.194	0.366
	(0.282)	(0.285)	(0.326)	(0.489)
Observations	413	413	216	197
R-squared	0.406	0.407	0.423	0.532
Sector-FE	Yes	Yes	Yes	Yes
Location-FE	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effect.
Source: Authors' calculation based on Cambodia's Inter-Censal Economic Survey 2014.

6. Conclusion

This paper examines the impact of servicification on productivity in Cambodia's manufacturing industries using firm-level data. In this paper, the servicification is measured by two variables: (i) the proportion of service costs to total input, and (ii) a binary variable with a value of 1 if firms generate income from the sale of services and 0 if they do not. Our findings are robust across a range of econometric specifications, suggesting that servicification is positively associated with productivity. Specifically, Cambodian manufacturing firms that utilise a greater proportion of service inputs are more productive. Further, our results show that the positive effect of servicification on productivity is more pronounced in industries that are more service-intensive. This suggests that firms in industries that rely heavily on services are more likely to benefit from servicification than those in industries with lower service intensity. The findings are consistent with the vast majority of empirical research and highlight the significant contribution of services in terms of inputs in helping firms raise productivity. However, we find no evidence that servicification in terms of output increases productivity. This suggests that firms may need to focus on improving the quality and efficiency of their service inputs rather than simply increasing the quantity of services they offer. Additionally, our results suggest that policymakers should prioritise policies that support the development of high-quality service inputs in order to promote productivity growth.

We also find evidence that demonstrates the importance of firm heterogeneity in boosting productivity. In particular, firms that had been in operation for a longer period of time were also found to be more productive than newer firms. This suggests that experience and knowledge gained over time can lead to more efficient production processes and better management practices. Additionally, we found that skill intensity is positively correlated with productivity, with the impact of skill intensity on productivity consistent across different industries. Our findings highlight the importance of investing in skill and human capital development as a means to enhance productivity and competitiveness in the manufacturing sector.

However, we observe no significant differences in productivity levels between foreign-owned and domestically-owned firms, as well as between registered and unregistered firms, despite the presence of positive estimated coefficient signs. It is important to note that our study only considers the manufacturing sector, and the results may not necessarily apply to other industries. Furthermore, even though we have identified a few factors that boost productivity

levels, it is still unclear how businesses can use these factors to their fullest potential. Future research could explore the mechanisms through which servicification and human capital within the firms affect productivity and identify best practices for firms to adopt. Overall, our study sheds light on the complex nature of productivity in the manufacturing sector and highlights the need for continued investigation and investment in this area.

References

Amiti, M. and S.J. Wei (2009), 'Service Offshoring and Productivity: Evidence from the US', *World Economy*, 32(2), pp.203–20.

Aquilante, T. and F. Vendrell-Herrero (2021), 'Bundling and Exporting: Evidence from German SMEs', *Journal of Business Research,* 132, pp.32–44.

Arnold, J., B. Javorcik, and A. Mattoo (2006), 'The Productivity Effects of Services Liberalization: Evidence from the Czech Republic', *Journal of International Economics,* 85(1), pp.136–46.

Arnold, J.M., B. Javorcik, M. Lipscomb, and A. Mattoo (2016), 'Services Reform and Manufacturing Performance: Evidence from India', *The Economic Journal,* 126(590), pp.1–39.

Baldwin, J.R. and B. Yan (2014), 'Global Value Chains and the Productivity of Canadian Manufacturing Firms', *Economic Analysis Research Paper Series No. 090.* Statistics Canada.

Baldwin, R., R. Forslid, and T. Ito (2015), 'Unveiling the Evolving Source of Value Added in Exports', *Joint Research Program Series No.161.* Tokyo: Institute of Developing Economies.

Baldwin, R., T. Ito, and H. Sato (2014), 'Portrait of Factory Asia: Production Network in Asia and its Implication for Growth - the "Smile Curve"', *Joint Research Program Series No.159*. Tokyo: Institute of Developing Economies.

Baldwin, R.E., R. Forslid, and T. Ito (2015). 'Unveiling the Evolving Source of Value Added in Exports', *Joint Research Program Series No. 1621.* Tokyo: Institute of Developing Economies.

Cadestin, C. and S. Miroudot (2020), 'Services Exported Together with Goods', *OECD Trade Policy Papers No. 236.* Paris: OECD Publishing.

Crépon, B., E. Duguet, and J. Mairessec (1998), 'Research, Innovation and Productivity: An Econometric Analysis at the Firm Level', *Economics of Innovation and New Technology,* 7(2), pp.115–58.

Crozet, M. and E. Milet (2017), 'Should Everybody be in Services? The Effect of Servitization on Manufacturing Firm Performance', *Journal of Economics & Management Strategy,* 26(4), pp.820–41.

Gereffi, G. and K. Fernandez-Stark (2010), 'The Offshore Services Global Value Chain', Durham, UK: Center on Globalization, Governance & Competitiveness.

Girma, S., and H. Görg (2004), 'Outsourcing, Foreign Ownership, and Productivity: Evidence from UK Establishment-level Data', *Review of International Economics,* 12(5), pp.817–32.

Görg, H., A. Hanley, and E. Strobl (2008), 'Productivity Effects of International Outsourcing: Evidence from Plant-level Data', *Canadian Journal of Economics/Revue canadienne d'économique,* 41(2), pp.670–88.

Haven, T. and E. van der Marel (2018), 'Servicification of Manufacturing and Boosting Productivity through Services Sector Reform in Turkey', *Policy Research Working Paper No. 8643.* Washington, DC: World Bank.

Heuser, C. and A. Mattoo (2017), 'Services Trade and Global Value Chains', *Policy Research Working Paper No. 8126.* Washington, DC: World Bank.

Jamal, H. (2018), 'Exploring Determinants of Productivity in Pakistani Manufacturing Firms', *MPRA Paper No. 87948.*

Kang, M., H.H. Kim, H. Lee, and J. Lee (2010), Regional Production Networks, Service Offshoring, and Productivity in East Asia', *Japan and the World Economy,* 22(3),pp.206–16.

Kelle, M. and J. Kleinert (2010), 'German Firms in Service Trade', *Applied Economics Quarterly,* 56(1), pp.51–71.

Kommerskollegium (2010), 'Servicification of Swedish Manufacturing'. Stockholm: National Board of Trade Sweden.

Kommerskollegium (2016), 'The Servicification of EU Manufacturing: Building Competitiveness in the Internal Market'. Stockholm: National Board of Trade Sweden.

Lanz, R. and A. Maurer (2015): 'Services and Global Value Chains: Some Evidence on Servicification of Manufacturing and Services Networks', *WTO Staff Working Paper No. ERSD-2015-03.* Geneva: World Trade Organization.

Lodefalk, M. (2014), 'The Role of Services for Manufacturing Firm Exports', *Review of World Economics,* 150, pp.59–82.

Lodefalk, M. (2017), 'Servicification of Firms and Trade Policy Implications', *World Trade Review,* 16(1), pp.59–83.

Low, P. (2013), 'The Role of Services in Global Value Chains', in D. Elms and P. Low, eds. *Global Value Chains in a Changing World.* Geneva: World Trade Organization**,** pp.61–81.

Mercer-Blackman, V. and C. Ablaza (2018), 'The Servicification of Manufacturing in Asia: Redefining the Sources of Labor Productivity', *ADBI Working Paper No. 902.* Tokyo: Asian Development Bank Institute.

Miroudot, S. and C. Cadestin (2017), 'Services in Global Value Chains: From Inputs to Value-Creating Activities', *OECD Trade Policy Papers No. 197.* Paris: OECD Publishing.

Nordås, H.K. (2010), 'Trade in Goods and Services: Two Sides of the Same Coin?', *Economic Modelling,* 27(2), pp.496–506.

Nordås, H.K. and Y. Kim (2013), The Role of Services for Competitiveness in Manufacturing', *OECD Trade Policy Papers No. 148*. Paris: OECD Publishing.

Pattnayak, S.S. and S.M. Thangavelu (2014). 'Productivity and Learning-by-exporting: A Firm-level Analysis of Indian Manufacturing', *The World Economy,* 37(7), pp.1016–26.

Pham, T.T.T. (2015), 'Does Exporting Spur Firm Productivity? Evidence from Vietnam', *Journal of Southeast Asian Economies,* 32(1), pp.84–105.

Schwörer, T. (2011), 'Offshoring and Productivity: Evidence for the Western European Manufacturing Sector', *Working Paper No. 1786.* Kiel: Kiel Institute for the World Economy.

Schwörer, T. (2013), 'Offshoring, Domestic Outsourcing and Productivity: Evidence for a Number of European Countries', *Review of World Economics,* 149(1), pp.131–49.

Thangavelu, S. (2013), 'Globalization and Performance of Small and Large Firms: Case of Vietnamese Firms', in C.H. Hahn and D. Narjoko (eds.), *Globalization and Performance of Small and Large Firms.* Jakarta: Economic Research Institute for ASEAN and East Asia**.**

Thangavelu, S., W. Wenxiao, and S. Oum (2017), 'Servicification in Global Value Chains: The Case of Asian Countries', *ERIA Discussion Paper Series No. 2017-12.* Jakarta: Economic Research Institute for ASEAN and East Asia.

Vandermerwe, S. and J. Rada (1988), 'Servitization of Business: Adding Value by Adding Services' *European Management Journal,* 6(4), pp.314–24.

Winkler, D. (2010), 'Services Offshoring and its Impact on Productivity and Employment: Evidence from Germany 1995–2006', *The World Economy,* 33(12), pp.1672–701.

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