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Does Premature Deindustrialization Matter?

The Role of Manufacturing versus Services in Development

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Abstract

The shares of manufacturing in value added and employment across a range of developing economies peaked at lower levels of per capita income compared with their high-income, early-industrializer precursors. Based on the statistical analysis of input-output tables and firm-level data, the paper contributes to the discussion on whether this "premature deindustrialization" matters by showing that: a) the premature declining share of the manufacturing sector is largely not driven by a statistical artifice whereby what was earlier subsumed in manufacturing value added is now accounted for as service sector contributions; b) Some features of manufacturing that were thought of as uniquely special for development, such as scale economies, exports, and innovation, are increasingly shared by services sector firms. Yet, a given service subsector is unlikely to provide opportunities for productivity growth and job creation for unskilled labor simultaneously; c) Some high-productivity services serve final demand or derive demand from several sectors, while others are more closely linked to a manufacturing base.

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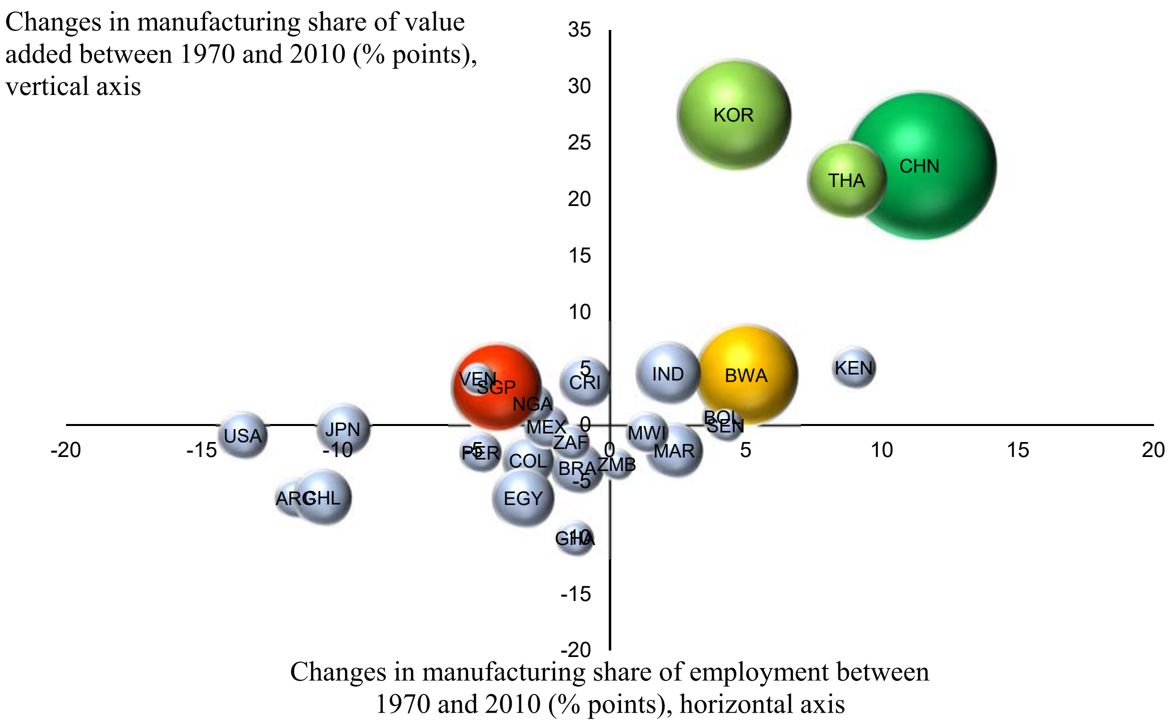
1. Introduction

Empirical evidence documents a robust association between the growth of manufacturing activity and overall economic growth. In a set of stylized facts, based on data from now advanced economies, Kaldor (1966) revealed a positive association between the (a) growth of manufacturing output and average GDP growth, (b) growth of manufacturing output and manufacturing productivity, and (c) growth of manufacturing output and overall productivity of the economy. More recent evidence based on data from developing countries also reveals a positive relationship between the growth of manufacturing output and overall GDP growth (Fagerberg and Verspagen 1999[1]; Szirmai and Verspagen 2015[2]). Among developing countries, China, the Republic of Korea and Thailand had a significant increase in the share of manufacturing in employment and value-added, combined with the highest per capita economic growth (Figure 1). However, these relationships in the data represent correlations, not causality which is hard to establish.[3]

Figure 1. Countries with large increase in manufacturing as a share of employment and value added achieve high income growth



Source: GGDC 10-Sectors
Note: The size of the circle corresponds to differences in per capita income growth rates across countries.

[1] The authors regress real GDP growth rates on growth rates of manufacturing. If the coefficient of manufacturing growth is higher than the share of manufacturing in GDP, this is interpreted as supporting the engine of growth hypothesis.
[2] The authors regressed average five-year growth rates on the share of manufacturing at the beginning of a given 5-year period and a set of control variables for a sample of 90 countries between 1950 and 2005.
[3] This relationship may suffer from an omitted variable bias and/or reverse causality.

Industrialization typically presented an opportunity for productivity-enhancing structural change because the manufacturing sector absorbed unskilled labor from agriculture at a substantial productivity premium (Restuccia et al. 2008, Herrendorf, Rogerson and Valentinyi 2013). This contribution of manufacturing through an inter-sectoral reallocation of resources is best reflected in the difference between productivity performance in Asia, compared to most countries in Sub-Saharan Africa and Latin America (McMillan, Rodrik and Verduzco-Gallo 2014).[4] Furthermore, the productivity of this labor in the manufacturing sector tends to converge to the frontier. Unlike cross-country evidence on aggregate labor productivity, Rodrik (2011) shows that labor productivity in (formal) manufacturing displays a clear tendency towards unconditional convergence. That is, manufacturing industries that start further away from the frontier experience faster productivity growth, regardless of policy, institutional, and geographic determinants. Duarte and Restuccia (2010) also find that high productivity growth in the manufacturing sector relative to the United States explains about 50% of the catch-up in relative aggregate productivity across countries.

Recent trends, however, show that the peak shares of manufacturing in value added and employment across a range of developing economies occurred at lower levels of per capita income compared to their high-income, early-industrializer precursors. Controlling for population size and per capita GDP in a sample of 42 economies between 1950 and 2012, Rodrik (2016) finds a lower share of manufacturing in employment and value added over time, as reflected in the coefficients of decadal time dummy variable magnitudes, which are negative and larger over time. Therefore, if industrialization is defined as an increase in the share of manufacturing in employment and value added, these results are indicative of “premature deindustrialization” (Dasgupta and Singh 2007). This suggests that countries are running out of industrialization opportunities sooner than did the early industrializers.

Considering these facts, the objective of the paper is two-fold. First, to what extent does it reflect a statistical artifice whereby what was earlier subsumed in manufacturing value added is now accounted for as service sector contributions to GDP? Second, to the extent that the premature declining share of the manufacturing sector and the increasing share of the services sector is not notional but real, does this matter for development opportunities? The latter has two dimensions. For one, is manufacturing special given the increasing contribution of the services sector to productivity growth? Furthermore, can the services sector can provide growth opportunities in the absence of a manufacturing core?

The paper uses different methodologies and databases to address these questions, which are described in greater detail across each section. First, a growth accounting exercise, based on input-output tables for China, India, Brazil, Mexico and the Russian Federation, decomposes services value added growth between 2000 and 2014 to analyze the importance of contracting out of manufacturing to services as an explanation for the latter’s growth. Second, manufacturing and services industries are disaggregated along a set of characteristics that are indicative of international trade, innovation, learning-by-doing and factor use – based on firm-level data for Brazil, China, the Arab Republic of Egypt, India, Nigeria, and Russia – to analyze the potential of the services sector as an alternative source of productivity gains and job creation. For each chosen

[4] After 2000, structural change contributed positively to Africa's overall productivity growth, accounting for about 40 percent of the total, on average, across the 19 countries in the sample.

characteristic, an industry is classified as “high,” “medium,” or “low”’ based on its position in the distribution, which is derived from the aggregation of firm-level data within and across countries. Third, the role of intermediate and final demand in explaining services value added growth is assessed through a growth decomposition exercise, based on input-output tables for China and India, to shed light on the extent to which services can develop without a manufacturing core.

Three main findings emerge from our analysis. First, the contribution of increased ‘contracting out’ from the manufacturing sector to the services sector to annual services value-added growth between 2000 and 2014 did not exceed 10 percent. Second, to the extent that premature deindustrialization is therefore not notional but real, it might matter less than before because firms in ICT services, for example, are not very different from those manufacturing electronics across a range of international trade, learning-by-doing and innovation characteristics. Yet, a given service subsector is unlikely to provide opportunities for productivity growth and job creation for unskilled people simultaneously. ICT and telecommunication services, on the one hand, and hotels and restaurants and construction, on the other hand, typify this dichotomy. Wholesale and retail trade is an exception – neither skill-intensive, nor less amenable to the potential productivity benefits associated with international trade, foreign technology, and on-the-job learning programs. Third, among these productivity-enhancing services, the growth of ICT and other professional, scientific and technical services can be driven by final demand or by intermediate demand which derives from sectors beyond manufacturing. In contrast, the growth of wholesale and retail trade, in contrast, might be more dependent on a manufacturing core.

The remainder of the paper is as follows. Section 2 analyzes the importance of contracting out of manufacturing to services as an explanation for the latter’s growth. Section 3 compares the manufacturing and services subsectors along a set of characteristics that matter for productivity growth and job creation. Section 4 analyzes the role of intermediate and final demand in explaining services value added growth. Section 5 concludes.

2. Is Premature Deindustrialization Notional or Real?

Premature deindustrialization may be attributable, at least in part, to the fact that activities that were earlier classified as “manufacturing” are now “services.” This refers to a statistical artifice whereby what was earlier subsumed in manufacturing value added is now accounted for as service sector contributions to GDP. Owing to a larger scale and the application of new technologies which has increased the complexity of production, firms in the manufacturing sector may find it more profitable to “contract out” service activities to specialist providers than to produce them in-house – a process that Bhagwati (1984) refers to as “splintering”. For instance, firms in the industrial sector may make greater use of specialist subcontractors to provide legal, accounting, and R&D services that the firms had previously provided themselves.

Methodology

The flow of intermediate inputs from the services sector to the manufacturing sector is the product of the input-output coefficient (the flow of intermediate transactions from the services sector required to produce one unit of manufacturing value added) and manufacturing value added. The change in this flow of intermediate inputs is therefore reflected in: (a) the change in the input-output coefficient from services to manufacturing given the initial level of manufacturing value added; (b) the change in manufacturing value added given the initial input-output coefficient from services to manufacturing; and (c) the product of the two changes.

These changes would have changed the demand for services (as a first round, partial equilibrium effect) by:

$$\Delta Y_s = \Delta IO_{StoM} Y_M + IO_{StoM} \Delta Y_M + \Delta IO_{StoM} \Delta Y_M \quad (1)$$

; where Y_S is services value added, Y_M is manufacturing value added, and IO_{StoM} is the input-output coefficient that reflects the use of services input to produce one unit of manufacturing value added.

In equation (1), the importance of 'contracting out' or splintering from the manufacturing sector to the services sector, which alters aggregate accounting, as an explanation for the growth of services value added is captured by $\Delta IO_{StoM} Y_M$ and $\Delta IO_{StoM} \Delta Y_M$.

Dividing equation (1) throughout by total value added, Y, we get:

$$\frac{\Delta Y_S}{Y} = \Delta IO_{StoM} \frac{Y_M}{Y} + IO_{StoM} \frac{\Delta Y_M}{Y} + \Delta IO_{StoM} \frac{\Delta Y_M}{Y} \quad (2)$$

$$\Rightarrow \frac{\Delta Y_S}{Y_S} * \frac{Y_S}{Y} = \Delta IO_{StoM} \frac{Y_M}{Y} + IO_{StoM} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} + \Delta IO_{StoM} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} \quad (3)$$

$$\Rightarrow \frac{\Delta Y_S}{Y_S} = \left(\Delta IO_{StoM} \frac{Y_M}{Y} + IO_{StoM} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} + \Delta IO_{StoM} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y}\right) * \frac{Y}{Y_S} \quad (4)$$

Equation (4), which is part of a broader growth decomposition exercise (as described in equations 5, 6, and 7), is estimated based on national "use" (input-output) tables between 2000 and 2014 for six large developing countries included in the World Input-Output Database (WIOD) – Brazil, China, India, Indonesia, Russia and Mexico.[5]

Results

The findings reveal that 'contracting out' from the manufacturing sector to the services sector explained, as measured by $\Delta IO_{StoM} Y_M$ and $\Delta IO_{StoM} \Delta Y_M$ in equation (1), 10 percent of annual average services value-added growth in China between 2000 and 2014. The corresponding number for Brazil, India and Russia was 9 percent over the same period. The splintering effect in explaining annual average services value-added growth during the same period was even lower, at 6 percent, in Mexico and negligible (in fact, negative) in Indonesia. Therefore, the contribution of splintering to annual services value-added growth over the last decade and a half does not exceed 10 percent in any of the developing countries in the sample (Table 1). While low, this contribution exceeds

[5] It contains data for 35 ISIC industries, including agriculture, mining, construction, utilities, 14 manufacturing industries, and 17 services industries.

earlier estimates, for example in the case of India (Gordon and Gupta 2004, Nayyar 2010). The time period under consideration is different. In addition, these studies estimate the importance of 'contracting out' to services growth in India by analyzing the increase in the input usage of services in the manufacturing sector but exclude its interaction with the change in manufacturing value added.

At the same time, the growth of services value added was closely linked to the growth of the manufacturing sector as reflected in $IO_{StoM}\Delta Y_M$ in equation (1), which accounted for nearly 30 percent of the average annual growth in China's services value added. The corresponding numbers for the change in manufacturing value added between 2000 and 2014 for a given use of services input in the manufacturing sector in 2000 in Brazil and India were somewhat lower, at 8 percent and 16 percent, respectively (Table 1).

Furthermore, it is possible that splintering may have had a greater contribution to the growth of services sub-sectors that predominantly serve intermediate demand. Equation (4) is therefore also estimated for three service subsectors: wholesale and retail trade, transportation and storage, and professional, scientific and technical services.

In China, the increased contracting out of services from manufacturing was particularly important in the annual average growth of professional, scientific and technical services' value added, with a contribution of more than 50 percent between 2000 and 2014. Its contribution to the growth of trade and transportation services, at 5 and 9 percent respectively, was below the average for the aggregate services sector. In contrast, splintering had a negligible contribution to the growth of professional, scientific and technical services in India. Yet, its contribution to the growth of trade and transportation services, at 19 and 17 percent respectively, was above the average for the aggregate services sector. In the two Latin American countries in the sample, the role of contracting out from the manufacturing sector seems to matter consistently more for the growth of the three subsectors under consideration compared to the service sector in the aggregate. For wholesale and retail trade, transportation and storage, and professional, scientific and technical services, its contribution between 2000 and 2014 was 23, 27 and 20 percent respectively for Brazil and 11, 9 and 17 percent respectively in Mexico (Table 1).

Even as manufacturing firms are purchasing more services from specialist service providers, they are employing more workers in services occupations within the boundaries of the firm. Manufacturing companies increasingly no longer sell only physical goods, but instead sell bundles including design, development, marketing, warranties and after-sales care, etc. Xerox, for example, has restructured itself into a 'document solution' company with services accounting for around 50% of the firm's turnover (Benedettini et al. 2010). This increased service intensity of manufacturers, as it takes place within firm boundaries, is not reflected in input-output tables. Therefore, the estimates of "contracting out" or "splintering" presented above represent an upper bound; to the extent that manufacturing firms are providing more services in-house, activities earlier classified as services value added may now be subsumed in the manufacturing sector. There is one caveat though. Many services firms now produce goods such as Google in the market for tablets and Amazon with its Kindle (Lopez-Bassols and Millot 2013). This manufacturing activity would be therefore counted as services value added, thereby reinforcing the splintering of services from manufacturing argument.

3. Is Manufacturing Special?

The services sector has increasingly contributed to economic growth in the last three decades (Fagerberg and Verspagen 2002), especially during periods of growth acceleration (Timmer and de Vries 2009). The positive contribution of structural change to productivity growth, for instance in India after the 1990s and in Africa during the 2000s, was largely attributable to the movement from agriculture into services. Further, there is evidence of unconditional convergence in levels of labor productivity in the services sector across countries (Kinfemichael and Morshed 2016). Whether these productivity improvements and catch-up driven by services will be sustainable will depend on certain underlying characteristics.

That the manufacturing sector traditionally placed labor on a productivity path that rises up to the global frontier was attributable to the fact that it produces tradable goods, facilitating scale economies, greater competition, technology diffusion and other spillover effects. Global integration provides firms with the opportunity to access a larger market and expands the scope for "learning-by-doing". Even when they produce just for the home market, manufacturing firms compete with efficient suppliers from abroad, requiring that they become more productive to remain competitive. The diffusion of technology is particularly relevant given that about 90% of patents published in 2014 were related to manufacturing goods and almost 80% of total expenditure on R&D among them came from manufacturing firms. Direct backward and forward linkages are also typically regarded as stronger for manufacturing compared to other sectors (Su and Yao 2016).

The assertion that productivity improvements through capital accumulation, innovation or economies of scale are harder to achieve in services was traditionally explained by their labor-intensity (Baumol 1967). However, these features of manufacturing that were once thought of as uniquely special for productivity growth might be increasingly shared by the services sector. Owing to the ICT revolution, many services are now internationally tradable, thereby yielding the benefits of scale, greater competition and technology diffusion. In addition, manufacturing exports increasingly subsumes services value added too. The use of services as intermediate inputs into other sectors has important spillover effects, as evidenced by their role in boosting manufacturing productivity (Arnold, Javorcik and Mattoo 2011; Banga and Goldar 2004). There is increasingly innovation too. The share of total business R&D in services increased from 6.7 percent between 1990 and 1995 to nearly 17 percent between 2005 and 2010 (World Trade Organization 2013). And if innovation is defined more broadly than R&D, the share of innovating firms is relatively similar across manufacturing and services firms in most countries (Pires et al. 2008).

Choice of characteristics and subsectors

The manufacturing and services sectors are not monolithic, and the characteristics described above may differ significantly across subsectors. Therefore, the paper disaggregates constituent subsectors with reference to a set of characteristics relevant to the development process and can be divided into four broad categories.

First, we consider two characteristics indicative of participation in international trade: the direct exports-to-sales ratio and the indirect exports-to-sales ratio. Second, we consider three characteristics that proxy for different types of innovation: the share of firms that introduce new products, use new methods of production and contribute to R&D spending. Third, we use three characteristics indicative of "learning-by-doing": the share of large firms (indicating potential for scale economies), the share of firms using a licensed technology from a foreign-owned firm, and the share of firms with formal training programs (indicating on-the-job learning). Last, we analyze three characteristics indicative of the nature of factor use: capital expenditure per employee (measuring capital intensity), years of schooling (measuring skill intensity), and the (full-time) employment elasticity of output. They reveal the importance of physical and human capital, relative to labor, in the organization of production and thereby reflect the ease of securing employment for a predominantly unskilled labor force.

The choice of the level of industry disaggregation in the typology is guided by categories that facilitate meaningful economic analysis subject to data constraints. The statistical analysis is based on the latest available World Bank Enterprise Survey for Brazil, China, India, Russia, Egypt and Nigeria. This sample covers low- and middle-income countries from different regions of the world and provides representative firm-level information at the two-digit ISIC sector level. Seventeen sub-sectors/industries[6] are part of the stratification of each enterprise survey and therefore considered in the analysis to follow.

Methodology

As an illustrative example, consider the distinction between small, medium and large firms. The numbers presented in Table 5 indicate the average share of large firms across different industries, where 'large' firms are defined as those with more than 100 employees. This 'average' represents a simple average for the 6 countries in the sample where the number for each country, in turn, is a simple average of the sampled firms. For each country in the sample, data from the most recent enterprise survey are used. The corresponding Z-scores for the numbers in Table 5 indicate the number of standard deviations away from the mean a particular value is. Hence, a Z-score of −0.40 implies that for hotels and restaurants, the share of "large" firms is 0.40 standard deviations below the mean. In contrast, a Z-score of 1.10 implies that for electronics and communications equipment, the share of "large" firms is 1.10 standard deviations above the mean.

The data appear to be normally distributed, because 95% of the observations lie within two standard deviations of the mean. Given that the data are normally distributed, around 50 percent of all observations fall within 0.67 standard deviations above or below the mean. This establishes unique threshold points – observations that are more than 0.67 standard deviations above the mean are classified as 'high', while those that are more than 0.67 standard deviations below the mean are classified into the 'low' category. The remaining are classified into the 'medium' category. Using this formal statistical technique as a means of classification, following Nayyar (2013), we classify the different sectors into the following categories:

[6] Basic metals & metal products; fabricated metal products; non-metallic mineral products; food; wood products; plastics and rubber products; leather products; garments and textiles; chemicals and chemical products; electronics and communications equipment; machinery and equipment; motor vehicles; construction; hotels and restaurants; IT services; wholesale and retail; transport and communications.

(i) “High” scope for scale economies if $\frac{X-\mu}{\sigma} \geq 0.67$

(ii) “Medium” scope for scale economies if $-0.67 < \frac{X-\mu}{\sigma} < 0.67$

(iii) “Low” scope for scale economies if $\frac{X-\mu}{\sigma} \leq -0.67$

In this way, the aforementioned statistical technique divides each chosen attribute or characteristic in the taxonomy into three broad categories (Tables 3, 4, 5, and 6). Subsequently, for each attribute, each industry is classified as “high,” “medium,” or “low” based on the aggregation of firm-level data within and across countries (Table 2). The use of simple averages is attributable to the fact that a single number enables us to define unique threshold points for the variable in question. While the use of this formal statistical technique involves a subjective judgement in deciding the thresholds that classify a characteristic into categories of ‘high’, ‘medium’ and ‘low’, it introduces a degree of objectivity into the classification criteria.

There are two caveats to keep in mind. First, for certain subsectors, the data only allow us to compute the relevant threshold points at a level of aggregation that may not facilitate meaningful economic analysis. The grouping of transport, storage and communication services – where considerable internal diversity in the context of different attributes may result in a mischaracterization of the individual service activities by virtue of them being clubbed together – is a case in point. The classification of this subsector in the ‘medium’ range, at least in the context of certain attributes, may only be attributable to internal diversity. Second, this exercise subsumes existing distortions in the six developing countries on which it is based. For example, actual exports or capital intensity in a particular industry may reflect policy incentives rather than its true potential, i.e. the numbers reflect what is and not what could be in a counterfactual scenario.

Results

There are five main stylized facts that emerge. First and foremost, there is no clear pattern which separates the manufacturing from service sectors with respect to the productivity-enhancing characteristics under consideration. In the manufacturing sector, electronics and communication equipment, machinery and equipment, and motor vehicles are categorized as “medium” or “high” along the dimensions of scale, on-the-job learning, and use of foreign technologies and innovation – new products, new processes and R&D spending. At the same time, light manufactures such as garments and leather products and a range of commodity-based manufactures are categorized as “low” or “medium” along the same attributes that are indicative of productivity gains. This heterogeneity of technology diffusion within the manufacturing sector reinforces Rodrik’s (2016) finding of unconditional convergence, where catch-up appears to be least rapid in textiles and clothing and most rapid in machinery and equipment. Within services industries, IT services are similarly classified as “high” or “medium” across a range of learning-by-doing characteristics such as scale economies and formal worker training programs as well as on all three innovation characteristics. On the flipside, construction services and hotels and restaurants are categorized as “low” or “medium” along the same attributes.

Second, trade in manufactured goods is relatively high despite a surge in services trade in recent times. For example, no service industry is classified in the 'high' category with regard to direct exports. When looking at indirect exports, however, sectors such as IT services and transport and communication services are classified in the 'high' category. This highlights the fact that many services are increasingly embodied in the export of manufactured goods.

Third, industries with greater potential for productivity increases are less likely to create jobs for unskilled labor, and vice versa, across the manufacturing and services sectors. Electronics and communication equipment, machinery and equipment, and IT services are classified as "medium" or "high" across the attributes indicative of learning-by-doing and innovation, but also on skill and capital intensity.[7] Therefore, without sufficient human capital, there are limits to how much labor can be absorbed in these productivity-enhancing service sectors. At the same time, commodity-based industries such as fabricated metal products, nonmetallic products, and wood products as well as service sectors such as construction and hotels and restaurants are classified as "low" or "medium" with respect to these innovation and learning-by-doing measures, as also on capital and skill intensity. The potential of these sectors to create permanent full-time jobs, as measured by the employment elasticity of output, is also relatively limited.

Fourth, international trade is one productivity-related attribute which distinguishes unskilled labor-intensive industries in the manufacturing sector from those in the services sector. For example, garments and leather products are categorized as "high" in terms the export-to-sales ratio of firms, while a wide range of commodity-based manufactures are classified as "medium". However, construction services and hotels and restaurants are classified as "low" with respect to international tradedness, including indirect exports.

Fifth, wholesale and retail trade is the only service subsector that is not skill-intensive, but also classified as "medium" with respect to the rage of learning-by-doing, international tradedness, and innovation characteristics.

The heterogeneity across industries suggests that considering manufacturing and services as composite categories may conceal more than it reveals. Yet, there is the related question of whether the variation in these growth-promoting attributes across disaggregated industries also conceals more than it reveals. This relates to the literature which documents large heterogeneity in productivity across firms in the same industry (Bloom et al. 2010). Hsieh and Klenow (2009), for example, find that between a third and half of the differences in manufacturing total factor productivity between China and India and the United States can be explained by the large number of inefficient firms. Similarly, Dias et al. (2016) show that reducing the misallocation of resources across services firms in Portugal would boost aggregate gross output by around 12 percent and aggregate value added by around 31 percent.

A comparison across the attributes included in the typology indeed shows that the share of firms that exhibit the learning-by-doing characteristics, participate in international trade, and undertake innovation is consistently higher among large firms relative to small and medium-size firms. Therefore, some industries might be characterized as "high" across these productivity-related

[7] While IT services are classified as 'high' with respect to skill intensity, they are also placed in the 'high' category in terms of its (full-time) employment elasticity of output.

attributes, at least in part, because they have a higher share of large firms. However, when repeating the exercise to classify industries as "low", "medium", or "high" based only on the sample of large firms, the data continue to be normally distributed, i.e., around 50 percent of all observations fall within 0.67 standard deviations above or below the mean (Tables 3, 4, 5, and 6). Therefore, industries are not closely clustered together in terms of the z-values such that it remains possible to establish two unique threshold points to divide industries into three categories. And the resulting categorization of industries across the attributes under consideration remains robust to this change.

4. Does the Growth of Services Depend on a Manufacturing Base?

The analysis based on firm-level data from six developing countries in the previous subsection highlighted information technology and transportation and communications as two service subsectors that are characterized as "high" across a range of characteristics indicative of learning-by-doing, international trade, and innovation. Further, wholesale and retail trade was classified as "medium" with respect to the same characteristics, while also not being skill and/or capital-intensive. That the services sector is increasingly characterized by productivity-enhancing characteristics notwithstanding, there is question of whether it can develop in the absence of a manufacturing base. This concern derives from the conventional pattern of structural change from agriculture to industry, and later from industry to services (Kuznets, 1971).

Unlike some service industries – such as health, education, tourism, and community services – that are largely stand-alone, transportation and communications, wholesale and retail trade, and professional, scientific, and technical services serve consumers directly but are also linked to manufacturing activity. To the extent that final demand contributes substantially to the growth of these services subsectors, opportunities can be created independent of a country's manufacturing base. Such opportunities might be reinforced if intermediate demand for a given services subsector derives largely from sectors other than manufacturing, i.e. agriculture, utilities, construction and other services.

<u>Methodology</u>

Growth in services value added is decomposed into changes attributable to intermediate and final demand. Final demand consists of consumption, investment, and net exports. The first part of intermediate demand refers to a given service subsector's input into other sectors in the economy and enters as a positive contribution in the growth accounting exercise. It has 12 components: (1) the change in the input usage of services in agriculture; (2) the change in agriculture value added given the initial input usage of services in agriculture; (3) the product of these two changes; (4) the change in the input usage of services in manufacturing; (5) the change in manufacturing value added given the initial input usage of services in manufacturing; (6) the product of these two changes; (7) the change in the input usage of services in other industry (mining, construction, and utilities); (8) the change in other industry value added given the initial input usage of services in other industry; and (9) the product of these changes; (10) the change in the input usage of services in other services; (11) the change in other services value added given the initial input usage of services in other services; and (12) the product of these two changes. The second part of intermediate demand refers to input from other sectors into the given service subsector services and has the analogous 12 components, thereby accounting for negative contributions in the growth accounting exercise. Therefore, the accounting exercise decomposes the growth in services value added into 27 component parts as shown in Equation (5).

$$\Delta Y_s = \Delta C + \Delta I + \Delta NX + \Delta IO_{StoA} Y_A + IO_{StoA} \Delta Y_A + \Delta IO_{StoA} \Delta Y_A + \Delta IO_{StoM} Y_M + IO_{StoM} \Delta Y_M + \Delta IO_{StoM} \Delta Y_M + \Delta IO_{StoMUC} Y_{MUC} + IO_{StoMUC} \Delta Y_{MUC} + \Delta IO_{StoMUC} \Delta Y_{MUC} + \Delta IO_{StoOTHERS} Y_{OTHERS} + IO_{StoOTHERS} \Delta Y_{OTHERS} + \Delta IO_{StoOTHERS} \Delta Y_{OTHERS} - \Delta IO_{AtoS} Y_A - IO_{AtoS} \Delta Y_A - \Delta IO_{AtoS} \Delta Y_A - \Delta IO_{MtoS} Y_M - IO_{MtoS} \Delta Y_M - \Delta IO_{MtoS} \Delta Y_M - \Delta IO_{MUCtoS} Y_{MUC} - IO_{MUCtoS} \Delta Y_{MUC} - \Delta IO_{MUCtoS} \Delta Y_{MUC} - \Delta IO_{OTHERStoS} Y_{OTHERS} - IO_{OTHERStoS} \Delta Y_{OTHERS} - \Delta IO_{OTHERStoS} \Delta Y_{OTHERS} \quad (5)$$

where C is final consumption, I is final investment, NX is net exports, Y_S is value added in a given services subsector, Y_M is manufacturing value added, Y_A is agricultural value added, Y_{MUC} is value added in mining, utilities and construction, Y_{OTHERS} is value added in other services subsectors, IO_{StoM} is the input-output coefficient that reflects the use of services input to produce one unit of manufacturing value added, IO_{StoA} is the input-output coefficient that reflects the use of services input to produce one unit of agricultural value added, IO_{StoMUC} is the input-output coefficient that reflects the use of services input to produce one unit of value added in mining, utilities and construction, $IO_{StoOTHERS}$ is the input-output coefficient that reflects the use of services input to produce one unit of value added in other services subsectors, IO_{AtoS} is the input-output coefficient that reflects the use of agricultural input to produce one unit of services value added, IO_{MtoS} is the input-output coefficient that reflects the use of manufacturing input to produce one unit of services value added, IO_{MUCtoS} is the input-output coefficient that reflects the use of mining utilities and construction input to produce one unit of services value added, and $IO_{OTHERStoS}$ is the input-output coefficient that reflects the use of other services input to produce one unit of services value added.

Dividing equation (5) throughout by total value added, Y, we get:

$$\Delta Y_s = \frac{\Delta C}{Y} + \frac{\Delta I}{Y} + \frac{\Delta NX}{Y} + \Delta IO_{StoA} \frac{Y_A}{Y} + IO_{StoA} \frac{\Delta Y_A}{Y} + \Delta IO_{StoA} \frac{\Delta Y_A}{Y} + \Delta IO_{StoM} \frac{Y_M}{Y} + IO_{StoM} \frac{\Delta Y_M}{Y} + \Delta IO_{StoM} \frac{\Delta Y_M}{Y} + \Delta IO_{StoMUC} \frac{Y_{MUC}}{Y} + IO_{StoMUC} \frac{\Delta Y_{MUC}}{Y} + \Delta IO_{StoMUC} \frac{\Delta Y_{MUC}}{Y} + \Delta IO_{StoOTHERS} \frac{Y_{OTHERS}}{Y} + IO_{StoOTHERS} \frac{\Delta Y_{OTHERS}}{Y} + \Delta IO_{StoOTHERS} \frac{\Delta Y_{OTHERS}}{Y} - \Delta IO_{AtoS} \frac{Y_A}{Y} - IO_{AtoS} \frac{\Delta Y_A}{Y} - \Delta IO_{AtoS} \frac{\Delta Y_A}{Y} - \Delta IO_{MtoS} \frac{Y_M}{Y} - IO_{MtoS} \frac{\Delta Y_M}{Y} - \Delta IO_{MtoS} \frac{\Delta Y_M}{Y} - \Delta IO_{MUCtoS} \frac{Y_{MUC}}{Y} - IO_{MUCtoS} \frac{\Delta Y_{MUC}}{Y} - \Delta IO_{MUCtoS} \frac{\Delta Y_{MUC}}{Y} - \Delta IO_{OTHERStoS} \frac{Y_{OTHERS}}{Y} - IO_{OTHERStoS} \frac{\Delta Y_{OTHERS}}{Y} - \Delta IO_{OTHERStoS} \frac{\Delta Y_{OTHERS}}{Y} \quad (6)$$

$$\Rightarrow \frac{\Delta Y_S}{Y_S} = \Big(\frac{\Delta C}{C} * \frac{C}{Y} + \frac{\Delta I}{I} * \frac{I}{Y} + \frac{\Delta NX}{NX} * \frac{NX}{Y} + \Delta IO_{StoA} \frac{Y_A}{Y} + IO_{StoA} \frac{\Delta Y_A}{Y_A} * \frac{Y_A}{Y} + \Delta IO_{StoA} \frac{\Delta Y_A}{Y_A} * \frac{Y_A}{Y} + \Delta IO_{StoM} \frac{Y_M}{Y} + IO_{StoM} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} + \Delta IO_{StoM} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} + \Delta IO_{StoMUC} \frac{Y_{MUC}}{Y} + IO_{StoMUC} \frac{\Delta Y_{MUC}}{Y_{MUC}} * \frac{Y_{MUC}}{Y} + \Delta IO_{StoMUC} \frac{\Delta Y_{MUC}}{Y_{MUC}} * \frac{Y_{MUC}}{Y} + \Delta IO_{StoOTHERS} \frac{Y_{OTHERS}}{Y} + IO_{StoOTHERS} \frac{\Delta Y_{OTHERS}}{Y_{OTHERS}} * \frac{Y_{OTHERS}}{Y} + \Delta IO_{StoOTHERS} \frac{\Delta Y_{OTHERS}}{Y_{OTHERS}} * \frac{Y_{OTHERS}}{Y} - \Delta IO_{AtoS} \frac{Y_A}{Y} - IO_{AtoS} \frac{\Delta Y_A}{Y_A} * \frac{Y_A}{Y} - \Delta IO_{AtoS} \frac{\Delta Y_A}{Y_A} * \frac{Y_A}{Y} - \Delta IO_{MtoS} \frac{Y_M}{Y} - IO_{MtoS} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} - \Delta IO_{MtoS} \frac{\Delta Y_M}{Y_M} * \frac{Y_M}{Y} - \Delta IO_{MUCtoS} \frac{Y_{MUC}}{Y} - IO_{MUCtoS} \frac{\Delta Y_{MUC}}{Y_{MUC}} *$$

$$\frac{Y_{MUC}}{Y} - \Delta IO_{MUCtoS}\frac{\Delta Y_{MUC}}{Y_{MUC}} * \frac{Y_{MUC}}{Y} - \Delta IO_{OTHERStoS}\frac{Y_{OTHERS}}{Y} - IO_{OTHERStoS}\frac{\Delta Y_{OTHERS}}{Y_{OTHERS}} * \frac{Y_{OTHERS}}{Y} - \Delta IO_{OTHERStoS}\frac{\Delta Y_{OTHERS}}{Y_{OTHERS}} * \frac{Y_{OTHERS}}{Y}\Big) * \frac{Y}{Y_S} \qquad (7)$$

Equation (7) is estimated based on national "use" (input-output) tables between 2000 and 2014 for China and India – countries which experienced high rates of growth in services value added between 2000 and 2014.

Results

The contribution of final demand to the growth of professional, scientific and technical services between 2000 and 2014 in India – at almost 90 percent – indicates that the expansion of the sector was largely "stand-alone, i.e. direct transactions between service providers and final consumers. In fact, among the different components of final demand, net exports accounted for 66 percent of the subsector's growth compared to 20 percent for consumption and 3 percent for investment (Table 9). This is indicative of India's success in the export of offshore professional services, starting with BPO services such as contact and call centers, which laid the foundation for higher value-added services such as software, finance and accounting (Nayyar 2012).

In contrast, the contribution of final demand to the growth of professional, scientific and technical services in China between 2000 and 2014, was 24 percent and that of (net) exports was only 1 percent. The contribution of intermediate demand in the growth of these services was therefore paramount, but this was not driven by links with the manufacturing sector. In fact, what seemed to matter most was the input of professional scientific and technical services into mining, utilities and construction as well as other services (Table 9).

Final demand mattered less for the growth of other high-productivity services. For example, it accounted for 50 percent of the growth in wholesale and retail trade in China and India between 2000 and 2014 (Table 7). In the case of transportation and storage services, final demand mattered less, accounting for approximately 31 percent of the sector's growth in China (Table 8). Furthermore, the large contribution inputs into manufacturing value added within the intermediate demand component indicates that the growth of these services subsectors might depend more on a manufacturing core. Services input into manufacturing value added accounted for, respectively, 62 percent and 38 percent of annual average wholesale and retail trade services value added growth between 2000 and 2014 in China and India. The input of these wholesale and retail trade services into other sectors made a substantially smaller contribution to its growth (Table 7). The growth of transportation services presents a similar picture.

That these services may "need" a manufacturing core to develop does not take away from the fact that transportation and distribution services are vital inputs into the production of manufactured goods. Hence, to the extent that services are embodied in manufacturing, there will likely be a symbiotic relationship between the two sectors. For example, input into manufacturing accounted for 59 percent of the annual average value-added growth in transportation and communication services between 2000 and 2014 in India, while manufacturing input into these services accounted for (negative) 60 percent (Table 8). Increasingly, therefore, the growth of the manufacturing sector too will depend on a vibrant and robust services sector.

5. Conclusion

The share of manufacturing in employment and value added appears to be peaking at earlier levels of per capita GDP than in the past. The notional aspect of this premature deindustrialization, as measured by the increased ‘contracting out’ from the manufacturing sector to the services sector, contributed to less than 10 percent of annual services value-added growth between 2000 and 2014 across developing countries. This contribution typically matters more for subsectors that serve both final and intermediate demand, such as wholesale and retail trade, transportation and storage, and professional, scientific and technical services.

To the extent that premature deindustrialization is not notional but real, it matters less than before because the features of manufacturing that were considered uniquely special for development are increasingly shared by the services sector in developing countries. ICT services, for instance, are not very different from the manufacture of electronics in that both are classified as “high” or “medium” across a range of learning-by-doing, international trade and innovation characteristics. Yet, a given service subsector is unlikely to provide opportunities for productivity growth and job creation for unskilled people simultaneously. For example, ICT, transportation and communication services are classified as “high” or “medium” across a range of learning-by-doing characteristics, exports and innovation, but also belong to the group that is “high” in skill intensity. At the same time, construction and hotels and restaurants are characterized by “low” skill intensity but also by “low” or “medium” productivity-enhancing traits. Wholesale and retail trade is perhaps an exception, combining “low” skill intensity with “medium” productivity-enhancing traits.

There are some caveats in order though. First, even manufacturing industries with greater potential for productivity increases are less likely to create jobs for unskilled labor, and vice versa. Second, there is heterogeneity across firms within industries. For instance, large firms score much higher than small and medium-sized enterprises across the different characteristics which are indicative of productivity gains. Third, the analysis in this paper is based on developing countries, but the trade-off between productivity growth and job creation in advanced economies might be more muted given a larger supply of highly skilled labor and, for the most part, a lower share of young workers entering the labor market.

Furthermore, there is the question of the extent to which productivity-enhancing service sectors can develop without a robust manufacturing base in developing countries. Professional, scientific and technical services provide greater opportunities because final demand matters more and because intermediate demand derives from sectors other than manufacturing too. The growth of wholesale and retail trade and transportation services, in contrast, depends in larger part on a manufacturing core. This is attributable to a larger contribution of intermediate demand and because much of the intermediate demand for these services derives from the manufacturing sector.

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Table 1: Percentage Contribution of Contracting Out from Manufacturing to Services, 2000 to 2014

All services (ISIC G-P)	Average Value-Added Growth Rate	Percentage contribution of $\Delta IO_{StoM} Y_M + \Delta IO_{StoM} \Delta Y_M$	Percentage contribution of $IO_{StoM} \Delta Y_M$
BRA	0.07	8.5%	7.9%
CHN	0.32	10.2%	28.1%
IND	0.12	8.8%	16.0%
RUS	0.09	8.8%	4.7%
MEX	0.04	5.9%	6.7%

Wholesale and retail trade	Average Value-Added Growth Rate	Percentage contribution of $\Delta IO_{StoM} Y_M + \Delta IO_{StoM} \Delta Y_M$	Percentage contribution of $IO_{StoM} \Delta Y_M$
BRA	0.09	23.5%	15.8%
CHN	0.32	4.8%	57.7%
IND	0.16	18.5%	19.7%
RUS	0.05	20.7%	15.8%
MEX	0.04	11.7%	11.2%

Transportation and storage	Average Value-Added Growth Rate	Percentage contribution of $\Delta IO_{StoM} Y_M + \Delta IO_{StoM} \Delta Y_M$	Percentage contribution of $IO_{StoM} \Delta Y_M$
BRA	0.06	27.8%	25.9%
CHN	0.18	9.3%	79.5%
IND	0.10	16.6%	42.0%
RUS	0.05	12.5%	8.1%
MEX	0.03	8.4%	12.3%

Professional, scientific and technical services	Average Value-Added Growth Rate	Percentage contribution of $\Delta IO_{StoM} Y_M + \Delta IO_{StoM} \Delta Y_M$	Percentage contribution of $IO_{StoM} \Delta Y_M$
BRA	0.07	20.1%	25.5%
CHN	0.52	59.1%	23.5%
IND	0.31	-1.3%	18.0%
RUS	-	-	-
MEX	0.03	17.0%	17.0%

Source: Authors' calculation based on World Input-Output Database
Note: There is missing information on value added in Russia's professional, scientific and technical services

Table 2: Categorizing Manufacturing and Services Subsectors based on Selected Economic Characteristics

CATEGORY	Learning-by-doing			Trade		Innovation			Factor-use		
Total sector	**share of large firms (more than 100 employees)**	**share of firms with formal training programs**	**share of firms that used a licensed technology from a foreign-owned firm**	**exports-to-sales ratio**	**indirect exports-to-sales ratio**	**share of firms that introduced new products**	**share of firms that introduced new methods**	**share of firms that incurred R&D spending**	**capital expenditure per employee**	**years of schooling**	**(full-time) employment elasticity of output**
Electronics & Communications Equip	Medium	Medium	High	High	High	High	High	High	Medium	High	Medium
Machinery & Equipment	Medium	Medium	Low	Low	High	Medium	Medium	High	Medium	High	Medium
Motor Vehicles	Medium	High	Low	Low		High	High	High	Medium	Low	Medium
IT & IT Services	High	High	Medium	Medium	High	High	High	Low	Medium	High	Medium
Transport, Storage, & Communications	High	Medium	Low	Medium	Medium	Low	Medium	Medium	Medium	Medium	Low
Leather Products	Low	Medium	Medium	Medium	High	Low	Low	Low	High	Medium	Medium
Garments and textiles	High	High	Medium	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
Furniture	Medium	High	Medium	High	Medium	Medium	Medium	Low	Medium	Medium	Low
Basic Metals & Metal Products	Medium	Low	High	High	Medium	High	High	Medium	Medium	Medium	High
Plastics & Rubber	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Chemical Products	Medium	High	Medium	Medium	High	Medium	Medium	Medium	Medium	Medium	Medium
Fabricated Metal Products	Medium	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Non-Metallic Mineral Products	Medium	Medium	Medium	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
Wood Products	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Medium	Medium	High
Food	Medium	Medium	Medium	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium
Construction	Low	Low	High	Medium	Medium	High	Medium	Medium	Medium	Medium	Medium
Hotels & Restaurants	Low	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Low
Wholesale and retail	Medium	Low	Medium	Medium	Low	Low	Medium	High	Medium	High	Medium

Source: Author's Calculation based on the latest available World Bank Enterprise Survey of 6 Countries (Brazil China Egypt India Russia and Nigeria). All indicators are weighted by the survey weight.

Table 3: International Trade (Direct and Indirect Exports-to-Sales Ratio)

	International Trade							
	Direct exports-to-sales ratio				Indirect exports-to-sales ratio			
sector	Raw score	Z-score	Raw score of large firms	Z-score of large firms	Raw score	Z-score	Raw score of large firms	Z-score of large firms
Electronics & Communications Equip	5.6	0.5	9.8	-0.1	2.6	0.0	3.4	-0.3
Machinery & Equipment	3.4	-0.5	9.1	-0.2	2.2	-0.3	1.9	-0.6
Motor Vehicles	6.0	0.7	8.5	-0.3	4.7	1.6	6.1	0.4
IT & IT Services	9.6	2.2	5.7	-0.7	3.7	0.8	14.2	2.5
Transport, Storage, & Communications	8.6	1.7	5.7	-0.7	3.2	0.5	12.6	2.1
Leather Products	1.3	-1.3	13.8	0.6	2.0	-0.4	1.6	-0.7
Garments and textiles	7.0	1.1	16.9	1.1	3.5	0.7	4.6	0.1
Furniture	4.3	-0.1	16.3	1.0	4.3	1.3	0.7	-0.9
Basic Metals & Metal Products	4.2	-0.1	9.5	-0.1	1.1	-1.1	3.2	-0.3
Fabricated Metal Products	4.6	0.1	6.2	-0.7	4.5	1.5	2.3	-0.5
Non-Metallic Mineral Products	3.9	-0.2	5.4	-0.8	1.8	-0.6	3.1	-0.3
Plastics & Rubber	6.2	0.7	11.9	0.3	2.0	-0.5	1.3	-0.8
Wood Products	4.4	0.0	25.4	2.5	1.8	-0.6		0.0
Food	4.2	-0.1	8.7	-0.3	3.4	0.6	4.9	0.1
Construction	0.1	-1.8	0.2	-1.6	0.1	-1.9	0.2	-1.1
Hotels & Restaurants	1.5	-1.2	2.0	-1.3	0.9	-1.3	1.1	-0.8
Wholesale and retail	3.4	-0.4	11.5	0.2	1.4	-0.9	9.1	1.2
Chemical Products	3.1	-0.5	7.8	-0.4	3.8	0.9	3.3	-0.3

Table 4: Innovation (New Products, New Processes, and R&D Spending)

	Innovation											
	Share of firms that introduced new products				Share of firms that introduced new methods				Share of firms that incurred R&D spending			
sector	Raw score	Z-score	Raw score of large firms	Z-score of large firms	Raw score	Z-score	Raw score of large firms	Z-score of large firms	Raw score	Z-score	Raw score of large firms	Z-score of large firms
Electronics & Communications Equip	49.7	1.6	83.1	2.2	50.3	1.9	71.4	1.8	41.0	2.1	57.2	1.6
Machinery & Equipment	23.3	-0.8	51.6	0.4	20.8	-1.0	53.2	0.3	33.3	1.3	60.6	1.9
Motor Vehicles	0.7	-2.9	13.7	-1.8	0.6	-3.0		0.0		0.0		0.0
IT & IT Services	25.0	-0.7	45.2	0.0	37.5	0.7	61.6	1.0	35.3	1.5	34.9	0.0
Transport, Storage, & Communications	24.0	-0.7	38.5	-0.4	27.6	-0.3	55.0	0.4	20.6	-0.1	47.3	0.9
Leather Products	37.7	0.5	52.2	0.4	31.3	0.0	51.7	0.1	29.2	0.9	32.5	-0.2
Garments and textiles	38.7	0.6	52.9	0.4	34.9	0.4	46.5	-0.3	14.7	-0.7	24.0	-0.8
Furniture	38.3	0.6	52.9	0.4	38.5	0.8	57.7	0.6	16.8	-0.5	52.3	1.3
Basic Metals & Metal Products	48.9	1.6	72.1	1.5	44.3	1.3	65.3	1.3	21.5	0.0	21.4	-1.0
Fabricated Metal Products	37.1	0.5	53.6	0.5	37.1	0.6	38.3	-1.0	20.5	-0.1	16.3	-1.4
Non-Metallic Mineral Products	26.5	-0.5	13.4	-1.8	29.1	-0.2	28.5	-1.8	9.3	-1.3	26.2	-0.7
Plastics & Rubber	31.3	-0.1	37.2	-0.4	30.8	0.0	35.9	-1.2	15.9	-0.6	30.9	-0.3
Wood Products	32.1	0.0	20.1	-1.4	32.5	0.2	55.1	0.4	9.0	-1.3	39.1	0.3
Food	35.3	0.3	41.4	-0.2	29.2	-0.2	32.4	-1.5	13.3	-0.9	27.3	-0.6
Construction	41.4	0.9	33.7	-0.6	29.5	-0.1	51.8	0.2	26.8	0.6	39.1	0.3
Hotels & Restaurants	34.2	0.2	57.5	0.7	28.8	-0.2	63.0	1.1	18.0	-0.3	24.2	-0.8
Wholesale and retail	27.0	-0.5	34.8	-0.6	27.2	-0.4	44.8	-0.4	11.8	-1.0	17.4	-1.3
Chemical Products	30.6	-0.1	47.5	0.1	26.9	-0.4	48.6	-0.1	28.7	0.8	51.0	1.2

Table 5: Learning-by-Doing (Large Firms, Formal Training Programs, and Foreign Licensed Technology

	Learning-by-doing									
	Share of large firms (more than 100 employees)		**Share of firms with formal training programs**				**Share of firms that used a licensed technology from a foreign-owned firm**			
sector	**Raw**	**Z-score**	**Raw score**	**Z-score**	**Raw score of large firms**	**Z-score of large firms**	**Raw score**	**Z-score**	**Raw score of large firms**	**Z-score of large firms**
Electronics & Communications Equip	24.8	1.1	61.1	1.4	72.7	0.8	17.0	1.9	31.8	0.6
Machinery & Equipment	15.9	0.1	47.6	0.5	72.9	0.8	13.2	1.0	21.7	-0.1
Motor Vehicles	29.4	1.6	64.2	1.6	86.6	1.8	16.2	1.7	24.3	0.1
IT & IT Services	27.0	1.3	54.6	1.0	70.5	0.7	5.5	-0.8		0.0
Transport, Storage, & Communications	9.1	-0.7	40.9	0.1	56.2	-0.3	6.6	-0.5	33.2	0.6
Leather Products	2.1	-1.5	20.3	-1.2	54.6	-0.4	3.3	-1.3	14.0	-0.6
Garments and textiles	20.9	0.6	34.9	-0.3	51.5	-0.6	9.8	0.2	26.8	0.2
Furniture	15.4	0.0	33.3	-0.4	44.6	-1.1	5.2	-0.8	38.4	1.0
Basic Metals & Metal Products	21.6	0.7	54.0	0.9	70.3	0.7	7.5	-0.3	7.8	-1.0
Fabricated Metal Products	11.9	-0.4	37.6	-0.1	44.6	-1.1	9.7	0.2	23.6	0.0
Non-Metallic Mineral Products	13.3	-0.2	33.6	-0.3	51.0	-0.7	6.6	-0.5	21.2	-0.1
Plastics & Rubber	14.3	-0.1	41.4	0.1	59.8	-0.1	10.7	0.4	14.4	-0.6
Wood Products	0.6	-1.7	2.0	-2.3	91.7	2.1	3.8	-1.2	4.2	-1.3
Food	20.6	0.6	39.5	0.0	59.6	-0.1	8.1	-0.2	21.0	-0.2
Construction	24.9	1.1	45.4	0.4	63.1	0.2	6.0	-0.7	8.3	-1.0
Hotels & Restaurants	11.7	-0.4	48.1	0.6	60.6	0.0	3.3	-1.3	3.4	-1.3
Wholesale and retail	4.0	-1.3	33.3	-0.4	62.5	0.1	16.2	1.7	38.0	1.0
Chemical Products	19.1	0.4	42.2	0.2	51.0	-0.7	10.1	0.3	21.8	-0.1

Table 6: Factor Use (Capital Intensity, Skill Intensity and Employment Elasticity of Output)

	Factor-use											
	Capital expenditure per employee				Years of schooling				(Full-time) employment elasticity of output			
sector	Raw score	Z-score	Raw score of large firms	Z-score of large firms	Raw score	Z-score	Raw score of large firms	Z-score of large firms	Raw score	Z-score	Raw score of large firms	Z-score of large firms
Electronics & Communications Equip	5385.9	-0.4	2088.6	-0.9	11.1	1.2	10.8	0.5	0.7	-0.2	0.7	-0.3
Machinery & Equipment	4298.9	-0.5	3625.4	-0.5	10.9	1.1	11.1	0.7	0.7	-0.2	0.8	-0.2
Motor Vehicles	11079.0	0.1	10091.7	1.5	6.7	-3.2	6.5	-2.4	0.7	-0.2	0.7	-0.3
IT & IT Services	5176.9	-0.5	5450.1	0.1	11.1	1.2	12.0	1.3	0.9	0.3	1.4	0.9
Transport, Storage, & Communications	13159.5	0.3	2845.8	-0.7	10.3	0.4	11.5	1.0	0.5	-0.7	0.4	-0.9
Leather Products	48714.7	3.9	3044.2	-0.6	9.3	-0.6	8.8	-0.8	0.6	-0.3	1.1	0.5
Garments and textiles	4122.5	-0.6	2622.3	-0.8	9.3	-0.6	9.2	-0.6	0.8	0.0	0.7	-0.5
Furniture	8921.8	-0.1	1720.1	-1.0	10.2	0.3	10.8	0.5	0.4	-0.8	0.6	-0.6
Basic Metals & Metal Products	6414.1	-0.3	10296.4	1.6	9.6	-0.3	9.8	-0.2	1.3	1.3	1.7	1.5
Fabricated Metal Products	5501.5	-0.4	3733.9	-0.4	9.5	-0.4	10.5	0.3	0.7	-0.1	0.7	-0.4
Non-Metallic Mineral Products	7520.4	-0.2	6222.4	0.3	10.2	0.3	10.4	0.2	0.6	-0.4	1.1	0.4
Plastics & Rubber	7043.6	-0.3	8333.9	1.0	9.9	0.0	10.6	0.4	0.8	0.0	1.1	0.4
Wood Products	9849.3	0.0	1921.1	-1.0	9.9	0.0	10.4	0.2	2.1	3.3	0.4	-1.0
Food	4669.0	-0.5	5044.3	0.0	9.4	-0.5	10.3	0.1	1.0	0.6	2.4	2.9
Construction	13173.0	0.3	7041.7	0.6	10.6	0.7	6.5	-2.4	0.8	0.1	0.4	-0.9
Hotels & Restaurants	3499.2	-0.6	1846.6	-1.0	9.1	-0.8		0.0	0.3	-1.2	0.4	-1.0
Wholesale and retail	7081.5	-0.3	4582.8	-0.2	10.7	0.8	11.2	0.8	0.6	-0.3	1.2	0.5
Chemical Products	13879.1	0.4	12831.3	2.4	10.3	0.4	10.5	0.3	0.8	0.1	0.9	0.1

Source: Author's Calculation based on the latest available World Bank Enterprise Survey of 6 Countries (Brazil China Egypt India Russia and Nigeria). All indicators are weighted by the survey weight.

Table 7: Decomposition of Value-Added Growth in Wholesale and retail trade

	Percentage contribution from all demands			
country	**Intermediate Inputs**	**Consumption**	**Investment**	**Net Export**
China	49%	22%	10%	19%
India	48%	47%	4%	1%

	Intermediate Inputs Breakdown							
country	Agriculture		Manufacturing		Mining, Utilities and Construction		Other services	
China	**2%**		**63%**		**9%**		**-25%**	
	StoA	*AtoS*	*StoM*	*MtoS*	*StoMUC*	*MUCtoS*	*StoOTHERS*	*OTHERStoS*
	2%	1%	63%	0%	10%	-2%	22%	-47%
India	**5%**		**35%**		**10%**		**-1%**	
	StoA	*AtoS*	*StoM*	*MtoS*	*StoMUC*	*MUCtoS*	*StoOTHERS*	*OTHERStoS*
	5%	0%	38%	-3%	11%	-1%	10%	-11%

Source: Authors' calculation based on World Input-Output Database
Note: StoA represents inputs from wholesale and retail trade to agriculture, StoM represents inputs from wholesale and retail trade to manufacturing, StoMUC represents inputs from wholesale and retail trade to mining, utilities and construction, StoOTHERS represents inputs from wholesale and retail trade to other services and AtoS, MtoS, MUCtoS, and OTHERStoS, respectively, represent the converse.

Table 8: Decomposition of Value-Added Growth in Transportation and Storage Services

country	Intermediate Inputs	Consumption	Investment	Net Export
	Percentage contribution from all demands			
China	70%	19%	8%	3%
India	-16%	113%	8%	9%

Intermediate Inputs Breakdown

country	Agriculture		Manufacturing		Mining, Utilities and Construction		Other services	
China	**0%**		**29%**		**26%**		**15%**	
	StoA	*AtoS*	*StoM*	*MtoS*	*StoMUC*	*MUCtoS*	*StoOTHERS*	*OTHERStoS*
	2%	-3%	89%	-60%	30%	-4%	49%	-34%
India	**1%**		**-1%**		**10%**		**-25%**	
	StoA	*AtoS*	*StoM*	*MtoS*	*StoMUC*	*MUCtoS*	*StoOTHERS*	*OTHERStoS*
	3%	-3%	59%	-60%	16%	-6%	24%	-50%

Source: Authors' calculation based on World Input-Output Database
Note: StoA represents inputs from transport and storage to agriculture, StoM represents inputs from transport and storage to manufacturing, StoMUC represents inputs from transport and storage to mining, utilities and construction, StoOTHERS represents inputs from transport and storage to other services and AtoS, MtoS, MUCtoS, and OTHERStoS, respectively, represent the converse.

Table 9: Decomposition of Value-Added Growth in Professional, Scientific and Technical Services

Percentage contribution from all demands

country	Intermediate Inputs	Consumption	Investment	Net Export
China	76%	19%	4%	1%
India	14%	20%	3%	66%

Intermediate Inputs Breakdown

country	Agriculture	Manufacturing	Mining, Utilities and Construction	Other services
China	**0%**	**-6%**	**45%**	**36%**

StoA	*AtoS*	*StoM*	*MtoS*	*StoMUC*	*MUCtoS*	*StoOTHERS*	*OTHERStoS*
2%	-2%	83%	-88%	47%	-2%	92%	-56%

country	Agriculture	Manufacturing	Mining, Utilities and Construction	Other services
India	**0%**	**5%**	**3%**	**6%**

StoA	*AtoS*	*StoM*	*MtoS*	*StoMUC*	*MUCtoS*	*StoOTHERS*	*OTHERStoS*
0%	0%	17%	-12%	8%	-5%	25%	-19%

Source: Authors' calculation based on World Input-Output Database

Note: StoA represents inputs from professional, scientific and technical services to agriculture, StoM represents inputs from professional, scientific and technical services to manufacturing, StoMUC represents inputs from professional, scientific and technical services to mining, utilities and construction, StoOTHERS represents inputs from professional, scientific and technical services to other services and AtoS, MtoS, MUCtoS, and OTHERStoS, respectively, represent the converse.