What's so special about China's producer services? an input-output analysis

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What's So Special about China's Producer Services? An Input–output Analysis

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Abstract

In the present study, five stylized facts about China's producer services are established through international, intersectoral and intertemporal comparisons based on input–output tables. First, the overall services input ratio is the lowest in all the sample economies. Second, most producer services are supplied by the traditional labor-intensive sectors. Third, manufacturing is the biggest user of producer services, and service industry is the second, while the opposite is true for most of the other sample economies. Fourth, unlike other economies, China's "R&D" is of more characters of consumer services than producer services. Fifth, China has fairly lower service input ratios in almost all the industries. The backward and forward linkages coefficients are both smaller for "real estate activities" and "finance and insurance." Policy reform should focus not only on specific producer services but also on reducing obstacles that are inhibiting the balanced development of diverse producer services that will help China to optimize its economic structure.

Key words: producer services, Chinese economy, input–output analysis
JEL codes: C42, E64, F719

I. Introduction

The service sectors flourishing in the modern economy has presented a great heterogeneity[1] Many researchers believe that it is particularly useful to make a distinction between consumer (or final) services and producer (or intermediate) services (Greenfield, 1966; Browning and Singelmann, 1975; Grubel and Walker, 1989; Stibora and de Vaal, 1995). In contrast to consumer services, producer services enter the production process of other manufacturing and services firms as an input.

An important driver of the development of, and demand for, producer services is the general

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[1]Schettkat and Salverda (2004) and Eichengreen and Gupta (2009) provide good summaries of the literature on the development of service sectors. There have been many attempts to define "services" and the task appears to be difficult and elusive as a result of industrial and technological changes (Fuchs, 1968; Daniels, 1993).

trend away from internalization (or non-marketization) to externalization (or marketization). In the early stages of economic development, producer services are usually supplied in-house by user firms, and as economic development proceeds, various specialized service entities or firms (e.g. accounting, marketing and consulting firms) emerge separately in the market. This has the effect of increasing the choice of suppliers for firms that rely primarily on internal provision of producer services, although the dichotomy between those provided in-house and those obtained through market transactions is retained. The producer services provided in-house reflects the specialized division of labor inside the producers or firms, and, thus, the internal resource allocation and industrial linkages directed by firms' decisions. These types of producer services (i.e. *in-house producer services*) cannot be captured by input–output tables in the System of National Accounts (SNA), and will frequently be grouped according to firms' main business (e.g. manufacturing). The market driven group reflects the specialization and division of labor among different firms in the market, and hence the resource allocation and industrial linkages based on market competition. These types of producer services (i.e. *transacted-through-market producer services*) are reported in the SNA input–output tables. The outsourcing and marketization of producer services is a natural evolution of specialized division of labor and resource allocation from inside the firm to the market. It has the effect of optimizing the value chain and production chain inside the firm, and the firm's core competitiveness will be promoted. In the meantime, the resource allocation and utilization efficiencies of the firm and of the economy as a whole will be enhanced, the industrial division of labor and structure will become more rational, and the capabilities of the national economy as a whole for innovation and competition will be improved.

The evolution of producer services, especially transacted-through-market producer services, reflects not only the extensive margin (measuring service varieties) and intensive margin (measuring specialization level in services) of the specialized division of labor in producer services themselves, but also that between producer services and other industries. Agriculture, manufacturing and services are all users of producer services. It is generally recognized that the ongoing new industrial division of labor is characterized by the "smiling curve" rather than traditional horizontal or vertical division of labor. The two ends of the smiling curve are producer services, such as R&D, sales and after-sales services, for which the value-added is higher. The lowest part of the "smiling curve" comprises manufacturing, processing and assembling activities. By incorporating them, manufacturing is gradually being tertiarized, while some services become mechanized and automated; thus, the two kinds of industries become more integrated and interactive.[2] In the process of upgrading the product value-added of manufacturing, tertiarization develops and accordingly increases and diversifies the demand for services; while in the course of improving the quality of services, more and more hard technologies are introduced to catalyze technical innovation in manufacturing. This fits with the idea of a constantly evolving modern economy in which producer services perform a complementary role that does not involve the

[2]See also Bryson and Daniels (2010) on the "manuservice" economy.

replacement of manufacturing or damage to economic growth (Grubel and Walker, 1989).

China's recent rise as a major player in the world economy is remarkable. This is not just because China failed to keep pace with the Industrial Revolution, which began in Europe in the middle of the 18th century, but because it has also been disengaged from the 20th century service revolution that was presaged by Fuchs (1968) and, subsequently, documented by Bell (1973), among others. Following the opening up of China in 1978, a program of reforms has included significant modifications to economic development doctrines and strategies. This process has included an increased, if quite gradual, commitment to a role for service industries in development. Reconfiguration of China's industrial structure toward a larger share of services is an essential component of its new economic development strategy. Yet, even though the expansion of the service industry since 1978 has been impressive, China is not yet a service economy as defined by Fuchs (1968) as an economy with more than half of its aggregate employment and output in the service sector. Admittedly, compared with most other countries that are already service economies, the timescale of the shift to services in China has been very short and the industry started from a low base. The technological environment is very different from that which accompanied earlier transitions to service economies in Europe or North America. Today's technology, such as information and communications technology (ICT), has also helped to diversify and enhance the portfolio of information and knowledge-intensive services, thereby enhancing the quality and competitiveness of goods-producing and service-providing industries. This is especially the case with respect to the increasingly important role of producer services (Stibora and de Vaal, 1995).

However, it is difficult to distinguish between producer services and consumer services; activities such as banking or transport services not only fulfill intermediate demand but also meet the needs of final consumers, even though they may emphasize the provision of services to one group or the other (Grubel and Walker, 1989). This means that if research is conducted using an arbitrary classification of producer services, it cannot accurately reflect their status, their role and contribution to a national economy. This continues to be an obstacle to reliable analysis of these activities. In an attempt to circumvent such problems, some researchers have turned to the input–output method.[3] Khayum (1995) uses input–output tables to examine the impact of service sector growth on intersectoral linkages in the US economy since the 1940s. Antonelli (1998) employs input–output statistics for the European economy in the second half of 1980s to demonstrate the co-evolution of new ICT and knowledge-intensive business services. A comparative analysis of the impact of knowledge-intensive services in Germany, the UK, the Netherlands and Japan is undertaken by Windrum and Tomlinson (1999). The differences in labor productivity performance and their association with ICT among 52 industries in 16 OECD countries are explored by van Ark *et al.* (2002), while Inklaar *et al.* (2008) use the new EU KLEMS database to analyze the differences in labor productivity growth dynamics among the US

[3]That is not to say that input–output analysis is not without its problems, but the input–output tables are the only real coherent source of information for the analysis of flows and interconnections between economic sectors (Miller and Blair, 2009).

and 11 European economies. Arnold *et al.* (2007) and Fernandes and Paunov (2012) examine the impact of services liberalization on manufacturing. Li and Hua (2002) are among the first to use input–output analysis to examine the development of China' producer services as a whole.

The present paper makes several contributions to the existing published literature. First, unlike the previous papers on producer services which usually employ a one-dimensional measure, we construct several quantitative measures that capture the structure and impact of different producer service sectors. Second, the present paper utilizes a comprehensive dataset that covers a large sample in terms of the number of economies and sectors as well as the number of years for each observed economy and sector. Whereas a majority of studies have employed cross-sectional data on a limited number of economies, the present paper is one of the first comprehensive studies spanning multiple periods and including both developing and developed economies. More broadly, our paper enriches the recent literature by making international, intersectoral and intertemporal comparisons to identify trends in the development of producer services and to determine their involvement in the Chinese economy.

The remainder of the paper is structured as follows. Sections II and III describe the methodology and data, respectively. Section IV presents evidence on producer services development in China and contrasts this to that in other sample economies. The final section concludes and derives some policy implications.

II. Method

A complete input–output table consists of four parts: intermediate usage, final usage, value-added and income reallocation. Insofar as a single sector or national economy as a whole is concerned, if total output (= intermediate plus final usage) is equal to total input (= intermediate input plus value-added) then the intermediate usage matrix (which is specified as X), the input coefficient (A), the Leontief inversion matrix (B), the complete consumption coefficient matrix (C), and their relationships are as follows:

$$X = (X_{ij})_{n\times n}$$

$$A = (a_{ij})_{n\times n},\ \ a_{ij} = \frac{X_{ij}}{\sum_{j} X_{ij}}$$

$$B = (b_{ij})_{n\times n} = (I - A)^{-1};\ \ C = (c_{ij})_{n\times n} = B - I,$$

where X_{ij} = intermediate inputs from sector i (in row i) used by sector j (in column j), a_{ij} = direct consumption coefficients, b_{ij} = Leontief complete consumption coefficients, c_{ij} = intermediate consumption coefficients and I is an identity matrix.

In order to use an input–output table to examine producer services, we need to make clear some relevant definitions and specify several indices:

1 We define the proportion of services inputs (i.e. producer services) in total intermediate

inputs ($\frac{SI}{II} = \frac{Services\ input}{Intermediate\ input}$) as the *services input ratio*, which depicts the tertiarization in every economic sector and the extent to which every sector demands service inputs. The proportion of producer services in national output is computed as $\frac{SI}{TO} = \frac{Producer\ services}{Total\ output} = \frac{Services\ input}{Total\ output}$.

2 The output of one specific service sector can be classified into two parts, which will be consumed by final users and used as an input by firms, respectively. The ratio of the former part in the output is the *consumer services ratio*, while the share of the latter part ($\frac{SI}{SO} = \frac{Services\ input}{Services\ output}$) is the *producer services* ratio, which identifies the extent to which a specific service sector is a producer service.

3 The *backward linkage coefficient* (BL_j), computed as $BL_j = \frac{\sum_{j=1}^{n} b_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}}$, measures the backward economic linkage of one specific sector *j* to the rest of the economy; that is, when the output of sector *j* increases by one unit, how much the increased demand from sector *j* (as a purchaser) will rely on the (upstream) sectors whose outputs are used as inputs to production in sector *j*. The greater this coefficient, the stronger the pulling power of sector *j* on the rest of the economy. The *forward linkage coefficient* (FL_i) is computed as $FL_i = \frac{\sum_{i=1}^{n} b_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}}$, which depicts the forward economic linkage of one specific sector *i* to other sectors; that is, when the output in every sector of the economy increases by one unit, how much the increased demands from these (downstream) sectors will depend on sector *i* (as a seller). The greater this coefficient, the higher the pressure of demand experienced by sector *i*.

III. Data

An input–output analysis has been undertaken using data for 44 economies: 26 developed economies and 18 developing/transitional economies (including the so-called BRICS economies: Brazil, Russia, India, China and South Africa).[4] The data are grouped into three sub-periods: mid-1990s, early-2000s and mid-2000s. There are 48 sectors included in the input–output tables, of which there are 17 ISIC (Rev. 3) 2-digit service industry subsectors: wholesale and retail trade

[4]The dichotomy between developing/transitional and developed economies is based on the IMF classification. If ranked in terms of increasing per capita GDP in US dollars at constant prices (2000) and constant exchange rates (2000) in the mid-2000s, the 18 developing economies are, in turn, Vietnam, India, Indonesia, China, Thailand, Romania, Russia, South Africa, Brazil, Turkey, Slovak, Hungary, Estonia, Chile, Poland, Mexico, Czech Republic and Argentina; the 26 developed economies are, in turn, Portugal, Slovenia, Greece, New Zealand, South Korea, Spain, Chinese Taipei, Italy, Israel, France, Germany, Australia, Belgium, Canada, Austria, Netherlands, Finland, UK, Ireland, Sweden, Denmark, the USA, Switzerland, Japan, Norway and Luxembourg.

and repairs (C50 to C52); hotels and restaurants (C55); transport and storage (C60 to C63), including land transport and transport via pipelines (C60), water transport (C61), air transport (C62), and supporting and auxiliary transport activities and activities of travel agencies (C63); post and telecommunications (C64); finance and insurance (C65 to C67); real estate activities (C70); renting of machinery and equipment (C71); computer and related activities (C72); R&D (C73); other business activities (C74); public administration and defense, and compulsory social security (C75); education (C80); health and social work (C85); other community, social and personal services (C90 to C93); and private households with employed persons and extra-territorial organizations and bodies (C95). Unfortunately, the sample of economies is not the same for each sub-period, nor is the number of sectors the same for all the sample economies.[5]

IV. Empirical Analysis

1. An Overall Comparison

The average proportion of producer services (i.e. services input) in national output ($=\frac{SI}{TO}$) for the whole sample is 20–22.8 percent, for the developing/transitional economies 16.7–18.6 percent, and for the developed economies 21.8–25 percent (Table 1). Even though there has been a slight upward trend, China is in the range from 11.7 to 14.1 percent, which is near the bottom of the range for this index for all the three sub-periods (except for the mid-2000s when Thailand and India were the lowest). For China, services inputs account for less than 20 percent of the total intermediate inputs (see the ratio $\frac{SI}{II}$), with a services input ratio that is lower than any of the other economies. However, China's services inputs take up more than half of services output (see the ratio $\frac{SI}{SO}$), so that the producer services ratio is well above that for the sample economies except Ireland and Luxembourg. This phenomenon is understandable because even though producer services take up a larger share of services output (for reasons discussed below), a lower proportion of services in national output will make the services input ratio for China much smaller relative to other economies.

Table 1. Overall Comparison in Producer Services: Services as Inputs (%)

Sample			Mid-1990s			Early-2000s			Mid-2000s		
			$\frac{SI}{SO}$	$\frac{SI}{II}$	$\frac{SI}{TO}$	$\frac{SI}{SO}$	$\frac{SI}{II}$	$\frac{SI}{TO}$	$\frac{SI}{SO}$	$\frac{SI}{II}$	$\frac{SI}{TO}$
Developing/ Transitional economies	*China*		*54.24*	*19.02*	*11.74*	*53.86*	*18.93*	*12.16*	*51.99*	*19.96*	*14.12*
	All	Mean	39.98	31.60	16.72	41.48	31.97	17.35	42.71	32.18	18.60
		Maximum	54.24	40.13	21.34	53.86	46.24	24.63	53.75	43.97	25.08

[5]Detailed data are available upon request. We have to acknowledge that it may be better to use historical data to compare China with the developed economies when these economies were at a similar stage to China. However, there are no input–output tables for most of developed economies during the period from the 1950s and even earlier. There are tables, for example, for the USA in 1947 but they are structured very differently to more recent input–output tables. Therefore, economies such as India and Indonesia that are slightly behind China, and others such as Brazil and Russia that are at the same transitional stage as China, have been used for the international comparison.

		Minimum	31.14	19.02	11.74	30.21	18.93	12.16	35.12	19.96	12.69
		N	13	13	13	16	16	16	13	13	13
Developed economies	USA		34.56	42.89	20.83	39.23	48.96	26.21	38.88	49.74	26.67
	All	Mean	40.03	41.32	21.83	43.04	44.86	24.31	42.63	46.21	25.04
		Maximum	58.38	60.96	31.94	66.82	78.84	49.69	64.01	80.60	51.96
		Minimum	28.07	28.13	15.92	27.42	27.08	16.74	28.00	26.24	16.59
		N	24	24	24	25	25	25	24	24	24
The whole sample		Mean	40.01	37.90	20.03	42.43	39.83	21.59	42.66	41.28	22.78

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: $\frac{SI}{SO} = \frac{Services\ input}{Services\ output}$, which is defined as the producer services ratio. $\frac{SI}{II} = \frac{Services\ input}{Intermediate\ input}$, which is the services input ratio. $\frac{SI}{TO} = \frac{Producer\ services}{Total\ output} = \frac{Services\ input}{Total\ output}$, which is the proportion of producer services in national output. Due to space limitations, we do not list all the sample economies. Each economy's data are available upon request.

2. Which Sectors Are Providing Producer Services?

The averages for all the economies in Table 2 show that more than 60 percent of producer services come from just four subsectors: wholesale and retail trade and repairs (C50 to C52), land transport and transport via pipelines (C60), finance and insurance (C65 to C67), and other business activities (C74). Also important are post and telecommunications (C64) and real estate activities (C70), which provide more than 10 percent of the producer services. For the developed economies as a whole, Sector C74 (i.e. other business activities including accounting and consulting) has gained a larger share than the more traditional activities such as wholesale and retail trade and repairs. Other business activities have become the biggest sector supplying producer services. However, in the case of the developing/transitional economies, wholesale and retail trade and repairs is still the largest supplier of producer services. As an advanced service economy, the USA exhibits a distinctive profile, especially since the early-2000s when finance and insurance has been the biggest sector providing 16.5 percent of producer services, followed by R&D (14 percent). Both of these sectors are human capital and high-technology intensive and perform a crucial role in innovation. By contrast, more than 50 percent of producer services in China are provided by three more traditional and labor-intensive subsectors: wholesale and retail trade and repairs, hotels and restaurants (C55), and land transport and transport via pipelines. As of the mid-2000s, research and development comprises less than 0.6 percent of China's producer services. Counterintuitively, it also seems that the share of other business activities and finance and insurance in Chinese producer services has actually been decreasing over time, while the share of post and telecommunications has been increasing (probably linked to the widespread adoption of information technology by Chinese firms).

Table 2. Major Sectors as Producer Service Providers in the Mid-2000s (%)

			C50–52	C55	C60	C64	C65–67	C70	C73	C74	C80	C85	C90–93
Developing /transitional economies	China		17.37	10.94	24.81	10.24	9.92	2.63	0.56	13.99	1.15	1.64	6.75
	All	Mean	24.71	3.01	13.49	8.00	12.66	5.75	0.62	14.38	0.75	0.64	5.36
		Maximum	37.65	10.94	24.81	16.35	22.26	9.94	1.11	24.04	2.03	1.64	11.01

		Minimum	16.49	0.90	6.99	4.25	6.82	0.10	0.01	2.13	0.12	0.01	2.28
		N	13	13	13	13	13	13	9	13	11	13	13
Developed economies	USA		11.41	2.17	5.67	7.43	15.62	10.69	13.84	7.89	0.54	0.47	13.78
	All	Mean	15.78	2.79	5.65	6.04	15.81	7.28	3.50	21.08	0.86	1.64	5.28
		Maximum	30.18	5.56	9.69	9.07	65.97	13.64	23.09	35.07	2.93	8.36	13.78
		Minimum	2.73	0.53	0.52	1.86	5.38	2.84	0.13	7.89	0.17	0.08	1.86
		N	24	23	24	24	24	24	21	22	24	24	24
The whole sample		Mean	18.92	2.87	8.41	6.73	14.70	6.74	2.63	18.59	0.83	1.29	5.31

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: For a specific economy, the aggregate of the sectors as producer service providers should be 100 percent but may be less than 100 percent due to the omission of some minor sectors. C50–52 are for "wholesale and retail trade and repairs," C55 for "hotels and restaurants," C60 for "land transport and transport via pipelines," C64 for "post and telecommunications," C65–67 for "finance and insurance," C70 for "real estate activities," C73 for "R&D," C74 for "other business activities," C80 for "education," C85 for "health and social work" and C90–93 for "other community, social and personal services." Data for other periods are available upon request.

3. Which Sectors Use Producer Services as Inputs?

Taking producer services as a whole (Table 3), in most of the sample economies (especially in developed economies such as the UK and the USA) between 50 and 70 percent of producer services are used by service industries (C50 to C95) and approximately 25 percent by manufacturing (C15 to C37), with the balance going to construction (C54), agriculture, hunting, forestry and fishing (C01 to C05), and electricity, gas and water supply (C40 to C41). Over the same period, China is similar to India and deviates from the international picture with manufacturing the biggest user of producer services, consuming over 40 percent of the total. Services are not only lagging behind but their share has been increasing slowly, from 36.6 percent in the mid-1990s to almost 40 percent in the mid-2000s.

Table 3. Major Sectors as Producer Service Users (%): Producer Services as a Whole

				C01–05	C10–14	C15–37	C40–41	C45	C50–95
Mid-1990s	Developing /transitional economies	China		5.55	3.07	44.76	2.02	7.97	36.63
		All	Mean	4.98	2.17	30.19	2.75	7.06	52.84
			Maximum	9.62	6.72	44.76	9.11	13.79	70.23
			Minimum	2.40	0.36	16.09	0.80	3.38	30.53
			N	13	13	13	13	13	13
	Developed economies	USA		1.58	1.08	21.07	1.45	6.80	68.02
		All	Mean	2.08	0.88	24.79	1.33	6.15	64.76
			Maximum	6.67	5.10	47.77	2.33	10.56	87.18
			Minimum	0.34	0.04	7.45	0.15	3.07	43.27
			N	24	24	24	24	24	24
	The whole sample		Mean	3.10	1.34	26.69	1.83	6.47	60.57
Early-2000s	Developing /transitional economies	China		4.58	2.22	40.32	3.97	12.00	36.92
		All	Mean	4.19	2.52	29.43	2.44	7.02	54.40
			Maximum	9.72	8.06	43.41	6.33	12.00	71.83
			Minimum	1.78	0.33	16.56	0.52	2.71	34.62
			N	16	16	16	16	16	16
	Developed economies	USA		0.96	0.93	19.80	0.88	4.26	73.17
		All	Mean	1.60	0.79	23.91	1.10	5.67	66.93
			Maximum	6.45	5.61	47.61	1.97	11.45	91.73
			Minimum	0.12	0.03	4.06	0.09	2.67	45.73
			N	25	25	25	25	25	25
	The whole sample		Mean	2.61	1.46	26.07	1.63	6.20	62.04
Mid-2000s	Developing /transitional economies	China		3.55	3.50	41.85	3.36	8.30	39.45
		All	Mean	3.21	1.86	29.42	2.48	6.63	56.41
			Maximum	7.65	5.92	42.16	4.37	11.94	71.97

			Minimum	1.54	0.27	16.63	0.86	2.44	34.79
			N	13	13	13	13	13	13
	Developed economies	USA		0.84	1.21	17.83	0.71	4.48	74.94
		All	Mean	1.18	0.73	21.85	1.12	5.53	69.60
			Maximum	2.73	4.57	36.51	1.97	8.99	92.15
			Minimum	0.08	0.02	3.46	0.37	2.72	56.92
			N	24	24	24	24	24	24
	The whole sample		Mean	1.89	1.13	24.51	1.60	5.92	64.96

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: The major sectors as producer service users are C01–05 for "agriculture, hunting, forestry and fishing," C10–14 for "mining and quarrying," C15–37 for "manufacturing," C40–41 for "electricity, gas and water supply," C45 for "construction," and C50–95 for "services." The aggregate for a specific economy and a specific sector is 100 percent.

A closer look at which types of producer services are used as inputs provides a different picture (Table 4). In China, if wholesale and retail trade and repairs function as producer services, approximately 60 percent of them are used by manufacturing, which enables manufacturing to become the largest user of these kinds of service inputs. In the other sample economies, manufacturing and services use wholesale and retail trade and repairs with almost equal intensity (around 40 percent). In the case of hotels and restaurants, China mirrors other economies in that services are the biggest user of hotels and restaurants. Chinese manufacturing uses more land transport and transport via pipelines than services, but in the majority of the other economies services use more of this type of producer services than manufacturing. Although services are the largest user of post and telecommunications and other business activities in China, accounting for 40 percent in the mid-2000s (but down from a higher level in the mid-1990s), this share is far below those of most of other economies. The pattern is much the same for finance and insurance while the biggest user of real estate activities is services, which is similar across almost all sample economies, including China. R&D shows the most variation in utilization: in the case of economies such as the USA, the UK, Norway and Denmark, services are the largest user of R&D, but for Japan, Germany, France, Ireland and Finland, manufacturing is the largest user of R&D. Manufacturing and services in China use R&D in equal measure. Finally, while in China manufacturing and services are almost equal users of health and social work as producer services, for most economies, services are typically the largest users.

Table 4. Major Sectors as Producer Service Users in the Mid-2000s (%): Producer Services by Sector

		C50–52	C55	C60	C64	C65–67	C70	C73	C74	C80	C85	C90–93
China (users by sector)	C01–05	5.5	1.47	4.39	0.93	5.41	0.41	1.93	3.15	2.96	1.78	2.73
	C10–14	2.57	2.91	4.34	3.01	3.33	0.43	4.35	3.34	6.5	9.78	4.2
	C15–37	61.61	30.53	46.09	33.59	32.85	16.59	40.93	41.71	27.83	43.42	31.74
	C40–41	4.87	1.18	3.53	1.66	5.96	0.19	1.16	1.64	2.37	5.72	5.75
	C45	8.43	5.82	8.57	20.02	2.95	0.2	0.67	8.95	4.55	3.26	5.36
	C50–95	17.02	58.09	33.09	40.8	49.51	82.19	50.96	41.21	55.79	36.06	50.21
USA (users by sector)	C01–05	1.66	0.17	1.43	0.24	0.51	2.34	0.34	0.11	0.06	0.01	0.37
	C10–14	1.01	0.25	1.75	0.3	0.94	0.23	0.84	3.99	0.4	0.26	0.27
	C15–37	42.41	13.91	32.13	7.59	8.42	3.99	19.1	31.88	12.75	1.58	10.06
	C40–41	0.34	0.55	6.93	0.11	0.49	0.19	0.38	0.34	1.08	0.04	0.24
	C45	15.07	1.49	4.55	3.02	2.07	1.11	6.89	1.46	0.91	1.9	3.01

	C50–95	39.52	83.63	53.21	88.73	87.56	92.14	72.45	62.22	84.81	96.21	86.05
The whole sample (mean) (users by sector)	C01–05	3.95	0.72	2.47	0.53	2.27	0.56	0.52	0.65	0.53	7.30	0.90
	C10–14	0.95	0.97	2.70	0.50	0.88	0.65	0.86	1.53	0.84	0.69	1.06
	C15–37	43.64	14.83	34.77	12.18	16.58	10.45	50.29	23.47	17.34	11.39	16.05
	C40–41	1.49	0.70	2.18	1.11	1.97	1.07	1.82	1.67	1.44	0.68	1.45
	C45	10.22	3.56	6.90	2.91	4.30	5.12	2.20	7.79	2.42	2.39	2.43
	C50–95	39.76	79.22	50.99	82.78	74.00	82.15	44.31	64.89	77.41	77.55	78.10

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: The sectors as producer service providers are C50–52 for "wholesale and retail trade and repairs," C55 for "hotels and restaurants," C60 for "land transport and transport via pipelines," C64 for "post and telecommunications," C65–67 for "finance and insurance," C70 for "real estate activities," C73 for "research and development," C74 for "other business activities," C80 for "education," C85 for "health and social work," and C90–93 for "other community, social and personal services." The sectors as producer service users are C01–05 for "agriculture, hunting, forestry and fishing," C10–14 for "mining and quarrying," C15-37 for "manufacturing," C40–41 for "electricity, gas and water supply," C45 for "construction" and C50–95 for "services." The aggregate for a specific economy and a specific producer service providing sector is 100 percent. Data for other periods and other individual economies are available upon request.

4. Which Service Sectors Can Be Characterized as Producer Services?

A larger producer services ratio means more output of a specific service sector is being used as input to other parts of the economy; this suggests that the sector is more like a producer service. If this ratio is low for a specific service sector it suggests that it is functioning more like a consumer service. Frequently in the literature, 50 percent or above is taken as a threshold to judge which service sector can be better characterized as producer services.

For the developed economies, the service sectors with a producer services ratio averaging 50 percent or more are other business activities (C74) (>80 percent in the three sub-periods), post and telecommunications (C64) (>65 percent), finance and insurance (C65 to C67) (>60 percent), R&D (C73) (>60 percent), and land transport and transport via pipelines (C60) (>55 percent) (see Table 5). The remaining sectors with averages index values below 50 percent are more closely aligned with consumer services. In broad terms, the values for the developing/transitional sample are similar to those for the developed sample.

In the absence of more detailed data it is only possible to focus on the equivalent producer service index values for China in the mid-2000s. Six activities have more than 60 percent of output used as producer services: wholesale and retail trade and repairs, hotels and restaurants, land transport and transport via pipelines, post and telecommunications, finance and insurance, and other business activities. The evidence suggests that although R&D behaves more as a producer service in most sample economies, it is more akin to a consumer service in China, along with real estate activities, education, health and social work, and other community, social and personal services. Contrary to the general case for other economies, wholesale and retail trade and repairs and hotels and restaurants in China act more as producer services than as consumer services.[6]

[6]The possible reason is that, in China, doing business relies heavily on "*guanxi*" (relationship), and lots of deals are

Table 5. The Extent to Which a Specific Service Sector is a Producer Service: Based on Producer Services Ratios ($\frac{SI}{SO} = \frac{Services\ input}{Services\ output}$) in the Mid-2000s

			C50–52	C55	C60	C64	C65–67	C70	C73	C74	C80	C85	C90–93
Developing /transitional economies	China		61.96	67.82	77.96	75.29	74.59	20.13	37.29	76.22	9.46	13.18	44.81
	All	Mean	46.70	25.26	54.39	64.91	67.60	29.53	59.48	90.94	6.12	6.03	35.67
		Maximum	61.96	67.82	77.96	76.55	81.65	46.00	99.07	92.65	14.09	13.18	49.45
		Minimum	37.01	13.32	33.00	43.71	42.48	15.65	20.22	65.12	0.76	0.11	12.43
		N	13	13	13	13	13	13	9	13	11	13	13
Developed economies	USA		30.14	21.16	70.81	65.88	56.05	32.05	89.65	78.78	17.38	2.09	59.98
	All	Mean	37.27	29.18	59.10	66.74	64.99	26.76	88.79	86.05	7.33	8.28	38.20
		Maximum	59.08	66.96	91.30	93.26	87.62	40.87	90.50	87.63	20.16	32.98	59.98
		Minimum	23.33	4.12	14.50	51.38	46.23	13.20	17.41	78.78	1.18	1.02	16.07
		N	24	23	24	24	24	24	21	22	24	24	24
The whole sample		Mean	40.58	27.76	57.45	66.10	65.90	27.73	75.95	87.47	6.95	7.49	37.32

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: C50–52 are for "wholesale and retail trade and repairs," C55 for "hotels and restaurants," C60 for "land transport and transport via pipelines," C64 for "post and telecommunications," C65–67 for "finance and insurance," C70 for "real estate activities," C73 for "R&D," C74 for "other business activities," C80 for "education," C85 for "health and social work" and C90–93 for "other community, social and personal services."

5. The Impact of Producer Services on the National Economy

Service industries have an impact on a national economy and its constituent industries via producer services that are used as inputs. The services input ratio can be used to measure the extent to which every industry depends upon inputs from producer services and how important different producer services are to relevant sectors. Moreover, an analysis of the industrial linkage coefficients for service industries will help to trace the influence of producer services on the national economy.

By comparison with the other sample economies, China has fairly low service input ratios for almost all industries except electricity, gas and water supply (C40 to C41) (Table 6). The service input ratios for services (C50 to C95) rise to over 50 percent and in some cases more than 70 percent and incorporate an upward trend for most economies, but for China they are at 40 percent or below and exhibit a decreasing trend over time. Table 6 also shows that agriculture, hunting, forestry and fishing (C01 to C05) and mining and quarrying (C10 to C14) are the only activities in China that have used an increasing share of services as inputs, while manufacturing (C15 to C37) has a service input ratio towards the bottom of the national range for all other sectors as well as compared to other economies.

Table 6. Services Input Ratios ($\frac{SI}{II} = \frac{Services\ input}{Intermediate\ input}$) in All Industries (%)

	C01–05	C10–14	C15–37	C40–41	C45	C50–95

made over meals. Therefore, the relevant expenditures are frequently regarded as a firm's business input costs. Indeed, the fact that wholesale and retail trade and repairs as part of the distribution system is more important in production than in consumption may indicate that China is still at the stage of industrialization rather than post-industrialization. However, it is unsatisfactory that R&D as part of the innovation system contributes so little to production in China.

Mid-1990s	Developing /transitional economies	China		12.63	19.92	14.14	22.74	15.61	40.73
		All	Mean	22.01	31.18	20.16	22.91	25.82	52.51
			Maximum	33.67	41.48	25.52	50.00	33.29	62.72
			Minimum	12.63	15.14	14.14	14.31	15.61	39.76
			N	13	13	13	13	13	13
	Developed economies	USA		26.94	35.56	25.18	20.25	38.94	59.32
		All	Mean	26.41	40.88	23.69	26.44	30.04	62.69
			Maximum	41.22	62.88	37.03	47.52	44.08	81.24
			Minimum	10.52	18.08	16.07	9.08	16.98	51.90
			N	24	24	24	24	24	24
	The whole sample		Mean	24.86	37.47	22.45	25.20	28.56	59.12
Early-2000s	Developing /transitional economies	China		13.19	20.59	12.66	21.72	23.16	39.12
		All	Mean	21.05	35.44	19.76	19.21	25.98	54.55
			Maximum	31.82	57.39	26.87	34.67	34.06	69.32
			Minimum	10.16	10.50	12.65	4.23	15.86	35.35
			N	16	16	16	16	16	16
	Developed economies	USA		27.35	45.55	30.32	30.15	43.10	62.01
		All	Mean	26.96	42.61	25.89	24.23	31.91	65.97
			Maximum	41.86	64.85	43.28	54.21	64.08	90.58
			Minimum	14.49	13.44	13.86	12.23	15.04	54.98
			N	25	25	25	25	25	25
	The whole sample		Mean	24.66	39.81	23.50	22.27	29.60	61.51
Mid-2000s	Developing /transitional economies	China		15.94	23.88	14.34	18.18	19.33	36.75
		All	Mean	22.30	35.41	19.12	18.37	26.75	55.07
			Maximum	36.02	56.22	25.48	29.65	38.21	69.69
			Minimum	12.78	17.19	12.09	7.40	19.12	36.75
			N	13	13	13	13	13	13
	Developed economies	USA		26.30	41.59	30.57	22.53	43.55	62.18
		All	Mean	26.25	37.96	26.04	22.94	31.39	67.64
			Maximum	41.03	53.69	55.29	45.07	63.57	91.55
			Minimum	16.95	9.89	14.38	6.81	13.19	52.40
			N	24	24	24	24	24	24
	The whole sample		Mean	24.87	37.07	23.61	21.34	29.76	63.23

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: C01–05 are for "agriculture, hunting, forestry and fishing," C10–14 for "mining and quarrying," C15–37 for "manufacturing," C40–41 for "electricity, gas and water supply," C45 for "construction" and C50–95 for "services."

With a focus on China, we now turn to calculating the backward and forward linkages coefficients that enable us to examine the linkage of services within the economy (Table 7). In the mid-2000s, R&D (C73), other business activities (C74), education (C80), and health and social work (C85) have above average backward linkage coefficients, even compared with those for most of the sample economies, including the USA. As we know, R&D, education, and health and social work are more closely related to the real economy of innovation and human capital accumulation, mattering a great deal for an economy's sustainable and healthy growth. Thus, the fact that these sectors have greater backward influence on the rest of the Chinese economy is encouraging. However, the backward linkage coefficients of real estate activities (C70) and finance and insurance (C65 to C67) are obviously much smaller (only 0.57 and 0.74, respectively) in the mid-2000s. It is concerning that real estate activities (C70) exhibit a decreasing backward linkage to the rest of the economy, and the backward linkage coefficients of finance and insurance are also consistently small by international standards since the early 2000s. In view of the macroeconomic situation in China during the past decade, there is good reason to believe that both real estate and finance and insurance are standing at a crossroad of development and reform, the

outcome of which will exert a significant influence on the strength and direction of China's future economic growth.[7]

Table 7. Backward and Forward Linkages Coefficients by Service Sector in the Mid-2000s

				C50–52	C55	C60–63	C64	C65–67	C70	C73	C74	C75	C80	C85	C90–93
Backward Linkage Coefficients	Developing /transitional economies	China		0.80	1.01	0.97	0.97	0.74	0.57	1.09	1.14	0.84	0.78	1.16	0.95
		All	Mean	0.88	1.04	1.05	0.91	0.82	0.75	0.86	0.95	0.79	0.69	0.93	0.91
			Maximum	1.28	1.49	1.50	1.46	1.17	1.17	1.09	1.42	1.19	1.00	1.44	1.26
			Minimum	0.69	0.82	0.85	0.71	0.67	0.55	0.69	0.76	0.53	0.57	0.71	0.67
			N	14	14	14	14	14	14	8	14	14	13	14	14
	Developed economies	USA		0.80	0.97	0.95	1.02	0.85	0.77	0.88	0.78	0.87	0.86	0.84	0.89
		All	Mean	0.85	0.96	1.01	0.90	0.85	0.67	0.85	0.85	0.78	0.63	0.77	0.87
			Maximum	1.06	1.14	1.20	1.07	1.84	0.86	1.07	1.04	1.03	0.86	1.03	1.20
			Minimum	0.59	0.79	0.82	0.65	0.53	0.52	0.63	0.71	0.55	0.50	0.65	0.69
			N	24	24	24	24	24	24	21	22	24	24	24	24
	The whole sample		Mean	0.86	0.99	1.02	0.90	0.84	0.70	0.85	0.89	0.78	0.65	0.83	0.89
Forward Linkage Coefficients	Developing /transitional economies	China		1.29	0.90	1.72	0.84	0.90	0.49	0.40	1.07	0.36	0.42	0.45	0.72
		All	Mean	2.14	0.64	1.80	1.04	1.32	0.89	0.48	1.71	0.53	0.50	0.52	0.80
			Maximum	2.86	0.90	2.49	1.76	2.31	1.45	0.60	3.05	0.73	0.62	0.72	1.16
			Minimum	1.29	0.47	1.19	0.73	0.85	0.49	0.40	0.68	0.36	0.41	0.40	0.54
			N	14	14	14	14	14	14	8	14	14	13	14	14
	Developed economies	USA		1.93	0.68	1.47	1.19	1.73	1.30	1.83	1.38	0.77	0.53	0.51	1.64
		All	Mean	2.03	0.68	1.65	0.98	1.60	0.98	0.80	2.43	0.58	0.53	0.52	0.88
			Maximum	2.90	0.96	2.79	1.22	3.26	1.55	2.75	4.21	0.77	0.68	0.79	1.64
			Minimum	1.41	0.47	0.78	0.63	0.84	0.57	0.46	0.87	0.42	0.39	0.39	0.67
			N	24	24	24	24	24	24	21	22	24	24	24	24
	The whole sample		Mean	2.07	0.66	1.70	1.00	1.50	0.95	0.71	2.15	0.56	0.52	0.52	0.85

Source: Authors' calculation based on input–output tables of the sample economies.

Notes: C50–52 are for "wholesale and retail trade and repairs," C55 for "hotels and restaurants," C60–63 for "transport and storage," C64 for "post and telecommunications," C65–67 for "finance and insurance," C70 for "real estate activities," C73 for "R&D," C74 for "other business activities," C80 for "education," C85 for "health and social work," and C90–93 for "other community, social and personal services." Data for other periods and other individual economies are available upon request.

Forward linkage coefficients that summarize the linkages of service sectors to downstream sectors in the mid-2000s show values for wholesale and retail trade and repairs (C50 to C52), transport and storage (C60 to C63), and other business activities (C74) that are bigger than one (Table 7). The values for the other sectors are much smaller, with five sectors scoring less than 0.5.[8] Comparison with the international evidence reveals that almost all the service sectors except hotels and restaurants (C55) and transport and storage have much smaller forward linkage coefficients than the average for the sample economies. The fact that every sector of the economy depends to a significant degree on hotels and restaurants and on transport and storage again confirms the earlier findings that these services are used more as producer services and they have performed a key role in industrialization. Once again, the forward linkage coefficient for real estate activities is less than 0.5 and is the lowest among all the sample economies. It is 40 percent below the average for developing/transitional economies and just half of the average for developed economies. It is clear that Chinese real estate activities cannot exert strong pulling or

[7]The abnormal development of real estate in recent years should be a cause for government concern. The potential for the real estate bubble to burst is considerable. With respect to financial services, the absence of competition and efficiency will suffocate this sector, and, hence, damage the real economy.

[8]In the USA, R&D (C73) has had a forward linkage coefficient well above 1.7 since the early 2000s, approximately four times the level for China.

pushing powers on the rest of economy; that is, this sector is much independent of (not strongly connected to) the rest of economy as both linkage coefficients are well below one.

V. Concluding Remarks

Producer services that are used as intermediate inputs for the production of other goods or services perform an important economic function with implications for economic development. It is difficult to identify producer services using the existing classification of service activities used for economic and other censuses, not least for China. For the purposes of the present paper, input–output analysis has been used in an effort to overcome this difficulty. This analysis is based upon assumptions about the intrinsic nature of producer services instead of specific service sectors that are used to establish five stylized facts about China's producer services since the mid-1990s.

First, the overall services input ratio is less than 20 percent in China, which is the lowest relative to other sample economies, irrespective of income levels.

Second, more than 50 percent of producer services are supplied by the traditional labor-intensive sectors: wholesale and retail trade and repairs, hotels and restaurants, and land transport and transport via pipelines. While the knowledge and human capital-intensive R&D services account for nearly 14 percent of producer services in the USA, they represent a negligible share of 0.6 percent in China.

Third, most sample economies have between 50 and 70 percent of producer services used by services. However, the converse is true for China where manufacturing is the biggest user of producer services (40 percent) while services only consume a slowly increasing share, from 36.6 percent in the mid-1990s to nearly 40 percent in the mid-2000s.

Compared to other economies, China's wholesale and retail trade and repairs and hotels and restaurants perform a role that is more aligned to producer services than to consumer services, with R&D activities acting more as consumer services than as producer services.

Fifth, relative to other sample economies, China has fairly low service input ratios in all industries except electricity, gas and water supply. The backward linkage coefficients are larger for R&D, other business activities, education, and health and social work, but smaller for real estate activities and finance and insurance. In relation to the forward linkage coefficients, almost all the service sectors except hotels and restaurants and transport and storage have much lower values. The fact that every sector of the economy depends greatly on hotels and restaurants and transport and storage testifies the fourth point above. Both linkage coefficients of real estate activities and finance and insurance are small, implying that these sectors do not exert the sort of powerful pulling force on the rest of economy nor react strongly to the demand from other sectors in the way typical of more advanced economies.

The policy implications of our study are threefold. First, the underdevelopment of market-transacted producer services remains an integral part of the Chinese economic structure imbalances. This is mainly caused by market distortions and the lower level of specialized division of labor in producer services themselves and between producer services and other

industries in the market rather than the fact that China is still at an earlier stage in the economic development process than many of the sample economies. Therefore, the strategic goal for the government is to remove numerous obstacles to the development of specialization and the division of labor. It is insufficient to rely solely on the introduction of various preferential industrial policies and the designation, for example, of land and buildings as service development zones. The government needs to standardize its behavior so as to improve the social credibility system and public service functions.

Second, considering the decoupling of real estate development from China's real economy, policies should be prioritized to strictly squeeze out the pervasive speculations and bubbles in this sector, so as to prevent the consequential chronic damages to the real economy.

Third, there is also an urgent need to eliminate monopolies in services such as finance, transport, and post and telecommunications, and to promote greater openness to private and foreign investors. This will have the effect of allowing more competition in the provision of producer services, thereby driving down producer service prices as well as helping to improve their efficiency and quality, and their integration with the rest of national economy.

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