

Insights from China

Understanding sectoral sources of aggregate
productivity growth: a cross-country analysis



About this report

This report analyses sectoral sources of labour productivity growth in China during the 1998–2018 period. The overall project includes an overview report for eight economies, a summary report, and eight economy-specific studies for China, France, Germany, the Republic of Korea, Taiwan, Singapore, the United Kingdom and the United States. Together, they seek to inform policies aimed at boosting productivity by improving the understanding of how sectors account for aggregate productivity gains and losses and how this differs across economies.

Contributors

The authors of this report are Jennifer Castañeda-Navarrete and Carlos López-Gómez.

Ana Rincon-Aznar, Principal Economist at National Institute of Economic and Social Research (NIESR), provided scientific advice.

Design by Ella Whellams, IfM Engage, University of Cambridge. Cover image: Adobe Stock
Copy-editing by Amanda George, Perfect Words.

Acknowledgements

This report has been made possible by core funding from the Gatsby Charitable Foundation.

Disclaimer

Names of countries and territories follow widely accepted conventions and do not imply the expression of any opinion whatsoever on the part of the authors or their affiliated institutions concerning the legal status of any country, territory, city or area, or its authorities. Any mention of firm names or commercial products does not constitute an endorsement by the authors or their affiliated institutions.

Insights from China

Key messages

How does China's productivity performance compare with that observed in other economies?

- Among the eight economies examined in this report, China stands out for its fast productivity growth, at 8.3%, on average, during the 1998–2017 period (labour productivity measured as output per worker).
- Despite its fast growth, productivity levels in China are still a fraction of those observed in developed economies, at US\$21,706 (constant PPP, 2009 = 100) in 2017. China's productivity levels are one-third of those observed in the United Kingdom and Korea and less than one-fifth of those seen in Singapore, the economy with the highest productivity levels in our sample of economies.
- Similar to other economies, China's productivity growth has declined markedly in the last decade, from an annual average rate of 9.5% in 1998–2007 to 7.3% in 2011–2017.

Which sectors are the main sources of China's aggregate labour productivity growth?

- The sectors with the largest contributions to China's aggregate productivity during the period of 1998–2018 include: manufacturing; community, social and personal services; financial and insurance activities; and wholesale and retail trade.
- During the post-crisis period (2011–18), however, the contribution of manufacturing to aggregate productivity declined, while the service sectors increased their contributions. This includes both high-productivity services, such as financial activities, and services with relatively lower productivity, such as community, social and personal services, which saw the largest increase.

How do sectoral dynamics explain recent trends in aggregate productivity growth?

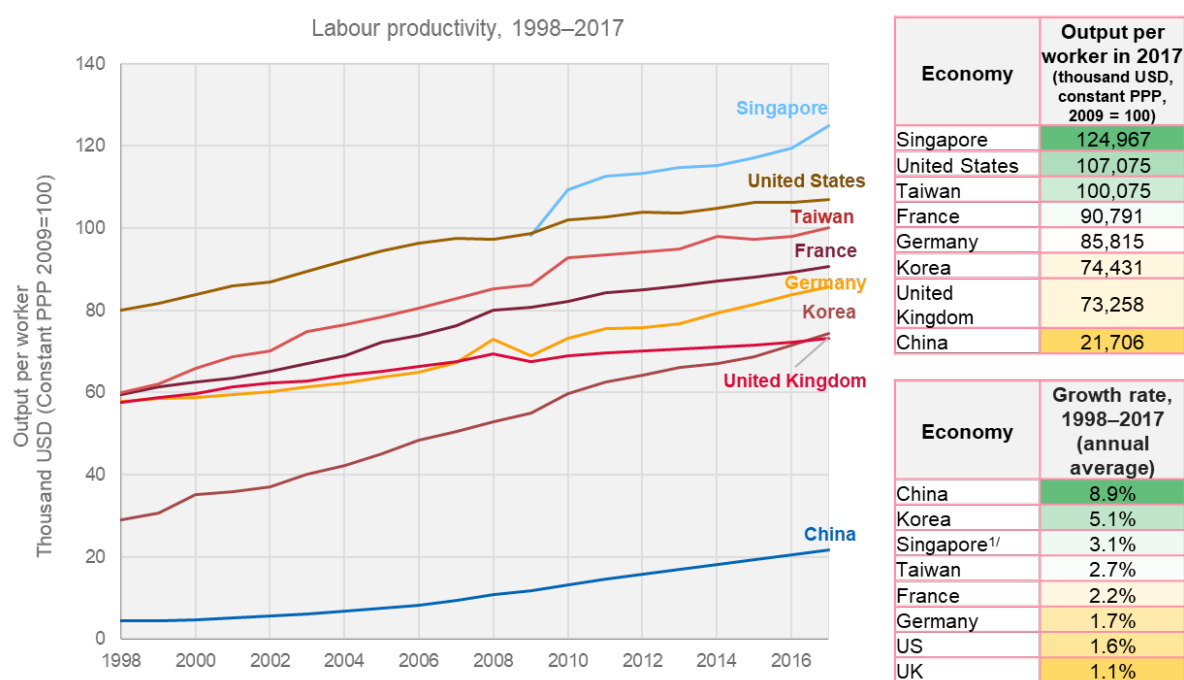
- The large contribution of manufacturing to aggregate productivity growth is explained by its high productivity growth (8.3% annual average, 1998–2018). However, this sector experienced reductions in output shares and relative output prices between 1998 and 2018, reducing its contributions to aggregate productivity growth.
- The main structural change observed in China is the reduction in size of the agriculture sector. To give a sense of the scale of this structural change, around 150 million workers left the farms in China between 1998 and 2018. However, the productivity of this sector has also seen strong growth, at 6.8% between 1998 and 2018, leading to positive contributions to aggregate productivity.
- In comparison, service activities have shown a sustained expansion during the period analysed. This trend, and its increasing productivity, have had a large contribution to China's aggregate productivity growth.

1. How does China's productivity performance compare with that observed in other economies?

Among the eight economies examined in this report,¹ China stands out for its fast productivity growth, at 8.3%, on average, during the 1998–2017 period (labour productivity measured as output per worker) (Figure 1). Factors explaining this strong performance include: an industrial policy prioritising investments in high-productivity sectors, the development of national production and innovation capabilities, and increasing participation in global value chains, particularly since China's accession to the World Trade Organization (WTO) in 2001..²

Despite its fast growth, productivity levels in China are still a fraction of those observed in developed economies, at US\$21,706 output per worker.³ in 2017 (Figure 1). China's productivity levels are a third of those observed in the United Kingdom and Korea and less than a fifth of those seen in Singapore, the economy with the highest productivity levels in the sample of economies analysed. Nonetheless, because of its large workforce and fast productivity growth, China has become the second-largest economy in the world after the United States and the largest manufacturing economy..⁴

FIGURE 1: WHOLE ECONOMY LABOUR PRODUCTIVITY GROWTH, 1998–2017, SELECTED ECONOMIES



Note: ^{1/} The period of 2010–17 for Singapore.

Source: Authors' computation, based on data from Asian Productivity Organization (APO) Productivity Database 2020 Ver.1 (5 August 2020); OECD Structural Analysis Database (2020 ed.); Singapore Department of Statistics; Singapore Ministry of Trade and Industry; Manpower Research & Statistics Department; Taiwan Statistical Bureau UK Office for National Statistics; US Bureau of Economic Analysis and US Bureau of Labor Statistics.

¹ China, France, Germany, Korea, Taiwan, Singapore, the United Kingdom and the United States.

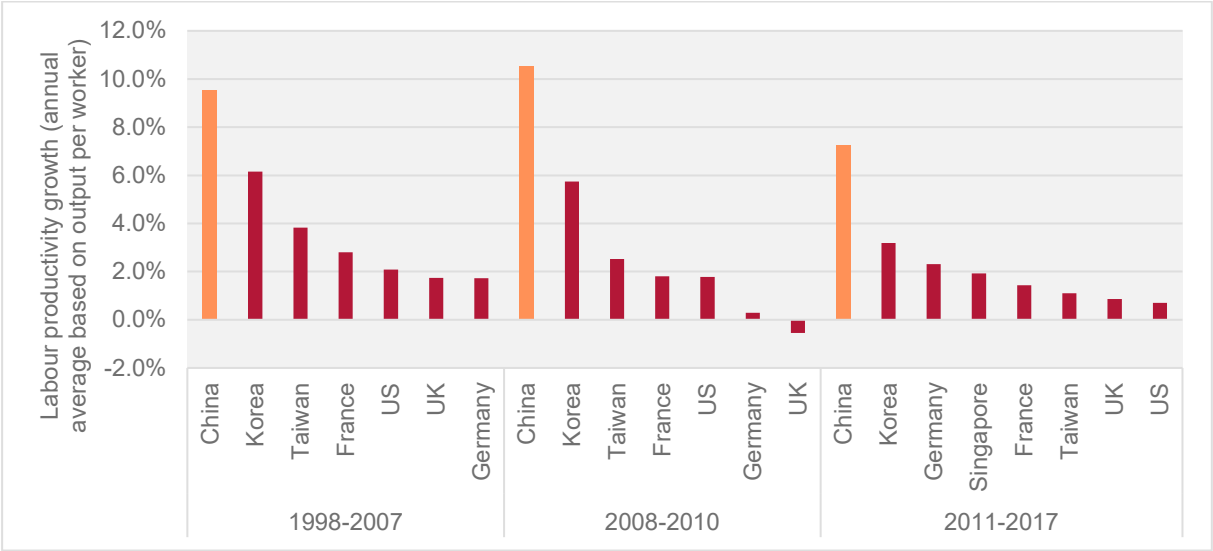
² UNCTAD (2022). China's structural transformation. *What can developing countries learn?* New York: United Nations.

³ Constant purchasing power parity (PPP), 2009 = 100.

⁴ Ibid.

Productivity growth, however, has declined markedly in the last decade, from an annual average rate of 9.5% in the 1998–2007 period to 7.3% in the period of 2011–17 (Figure 2). Factors that help to explain this trend include: reallocation of labour towards low-productivity service activities, weak international trade, and slower efficiency gains from technology adoption and trade integration.⁵

FIGURE 2: WHOLE ECONOMY LABOUR PRODUCTIVITY GROWTH, 1998–2017, SELECTED ECONOMIES



Source: Authors' computation, based on data from Asian Productivity Organization (APO) Productivity Database 2020 Ver.1 (5 August 2020); OECD Structural Analysis Database (2020 ed.); Korea Productivity Center; Singapore Department of Statistics; Singapore Ministry of Trade and Industry; Manpower Research & Statistics Department; Taiwan Statistical Bureau UK Office for National Statistics; US Bureau of Economic Analysis and US Bureau of Labor Statistics.

⁵ Brandt, L., Litwack, J., Mileva, E., Wang, L., Zhang, Y. and Zhao, L. (2020). China's Productivity Slowdown and Future Growth Potential. Policy Research Working Paper; No. 9298. World Bank, Washington, DC. World Bank.

2. Which sectors are the main sources of China's aggregate labour productivity growth?

The sectors that made the largest contributions to China's aggregate productivity during the 1998–2018 period include: manufacturing (28.6%); community, social and personal services (19.6%); financial and insurance activities (13.8%); wholesale and retail trade (11.1%); and transportation and storage (8.2%) (Figure 3).

During the post-crisis period (2011–18), the contribution of manufacturing to aggregate productivity declined (in relative and absolute terms), while service sectors increased their contributions, but mainly on relative terms, while their absolute contributions saw reductions in most cases. This includes both high-productivity services, such as financial activities, and services with relatively lower productivity, such as community, social and personal services, which saw the largest increase.

FIGURE 3: TOP FIVE SECTORS CONTRIBUTING TO CHINA'S AGGREGATE PRODUCTIVITY GROWTH (1998–2018)

China: top five sectors <i>(based on their contribution to aggregate productivity growth measured as output per worker)</i>							
Pre-crisis (1998–2007) <i>Aggregate productivity growth rate: 9.5%</i>				Crisis (2008–2010) <i>Aggregate productivity growth rate: 10.5%</i>			
	Sector	% of aggregate productivity growth	Percentage points		Sector	% of aggregate productivity growth	Percentage points
	Manufacturing	29.9	2.9		Manufacturing	30.5	3.2
	Community, social and personal services	18.6	1.8		Community, social and personal services	15.9	1.7
	Financial intermediation, real estate, renting and business activities	11.1	1.1		Financial intermediation, real estate, renting and business activities	15.2	1.6
	Wholesale and retail trade	8.8	1.0		Wholesale and retail trade	12.9	1.4
	Transportation and storage	9.2	0.9		Construction	9.3	1.0
Post-crisis (2011–2018) <i>Aggregate productivity growth rate: 7.0%</i>				Whole period (1998–2018) <i>Aggregate productivity growth rate: 8.7%</i>			
	Sector	% of aggregate productivity growth	Percentage points		Sector	% of aggregate productivity growth	Percentage points
	Manufacturing	25.3	1.8		Manufacturing	28.6	2.5
	Community, social and personal services	23.4	1.6		Community, social and personal services	19.6	1.7
	Financial intermediation, real estate, renting and business activities	17.6	1.2		Financial intermediation, real estate, renting and business activities	13.8	1.2
	Wholesale and retail trade	12.2	0.9		Wholesale and retail trade	11.1	1.0
	Transportation and storage	9.0	0.6		Transportation and storage	8.2	0.7

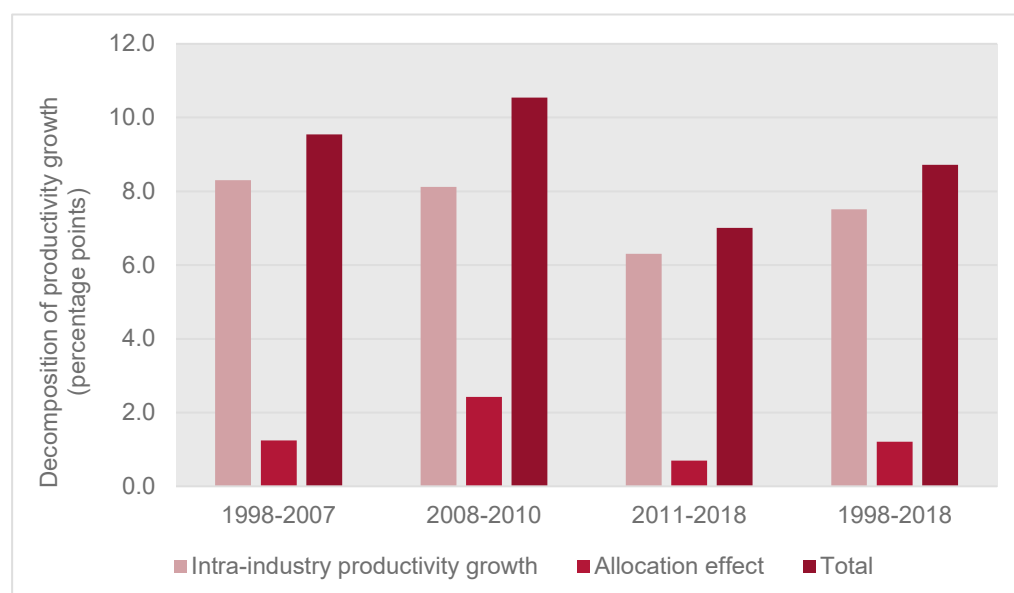
Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

3. How do sectoral dynamics explain recent trends in aggregate productivity growth?

Overall, labour productivity growth can be explained by an intra-industry productivity growth effect (or ‘within’ effect), which captures the productivity growth of each industrial sector and its relative weight in the overall economy; and by an allocation effect (or ‘between-industries’ effect), which captures the impacts on aggregate productivity growth because of the expansion or contraction of sectors with different levels of productivity.

In order to understand how different sectors have contributed to either aggregate productivity growth or slowdown, labour productivity (measured as output per worker) growth rates by sector were decomposed into these components using the Generalised Exactly Additive Decomposition (GEAD) methodology, as described in Tang and Wang 2004.⁶ Appendix II explains this decomposition in more detail.

FIGURE 4: DECOMPOSITION OF CHINA'S AGGREGATE PRODUCTIVITY GROWTH (1998–2018)



Note: Decomposition based on output per worker measures of productivity.

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

Figure 4 shows how over 80% of China's productivity growth is explained by intra-industry productivity growth. During the 2008–10 period, an increase in the relevance of the allocation effect was observed, explaining 23% of the growth experienced in labour productivity in this period. This is explained by the reallocation of resources towards the financial sector and other service activities. The reform of the Chinese financial system is likely to be contributing to this trend, and it is expected to accelerate in the coming years. Changes in the financial system have

⁶ Tang, J. and Wang, W. (2004). Sources of aggregate labour productivity growth in Canada and the United States. *Canadian Journal of Economics*, Volume 37, Number 2.

involved opening up to the participation of private and foreign banks and liberalising interest rates..⁷

The decomposition was also conducted excluding the real estate sector, considering that the inclusion of imputed rents from owner-occupied dwellings affects the measure of the value added of this sector. Results from this decomposition include smaller overall allocation effects, lower contributions to aggregate productivity growth from financial intermediation, renting and business activities and higher contributions to aggregate productivity from manufacturing and community, social and personal services during 1998–2018. Table 6 presents the results of this decomposition.

As mentioned in Section 2, the economic sectors with the largest contributions to China's aggregate productivity during the 1998–2018 period include: manufacturing; community, social and personal services; financial and insurance activities; wholesale and retail trade; and transportation and storage. Figure 5 depicts sectoral contributions to China's aggregate productivity growth, while Tables 2–5 present detailed data of these contributions and changes in output and employment shares for 1998–2007, 2008–10, 2011–18 and 1998–2018.

In the decade before the financial crisis of 2008 (1998–2007), the sectors that observed the fastest productivity growth included: electricity, gas and water supply (18.2%); mining and quarrying (15.2%); and transportation and storage (9.2%). Meanwhile, in the decade after the crisis (2011–18) agriculture, forestry and fishing (8.5%) and other production activities (mining and quarrying, manufacturing, etc.) showed the strongest performance (Table 1).

During the global financial crisis, the productivity growth of China's sectors was less affected than in other countries. However, sluggish growth has been observed since 2011, and the sectors that experienced the largest declines in productivity growth from 1998–2007 to 2011–17 include: electricity, gas and water supply (-10.5 percentage points); mining and quarrying (-7.5 percentage points); and transportation and storage (-4.6 percentage points).

The large contribution of manufacturing to aggregate productivity growth is explained by its high productivity growth (8.3% annual average, 1998–2018). This sector reduced its output shares by 4.6 percentage points, while its employment shares expanded by 3 percentage points between 1998 and 2018. However, reductions in the relative output prices of this sector (-17.39 percentage points) resulted in a negative allocation effect on aggregate productivity (-0.2 percentage points), and thus a smaller contribution to aggregate productivity growth (Table 5).

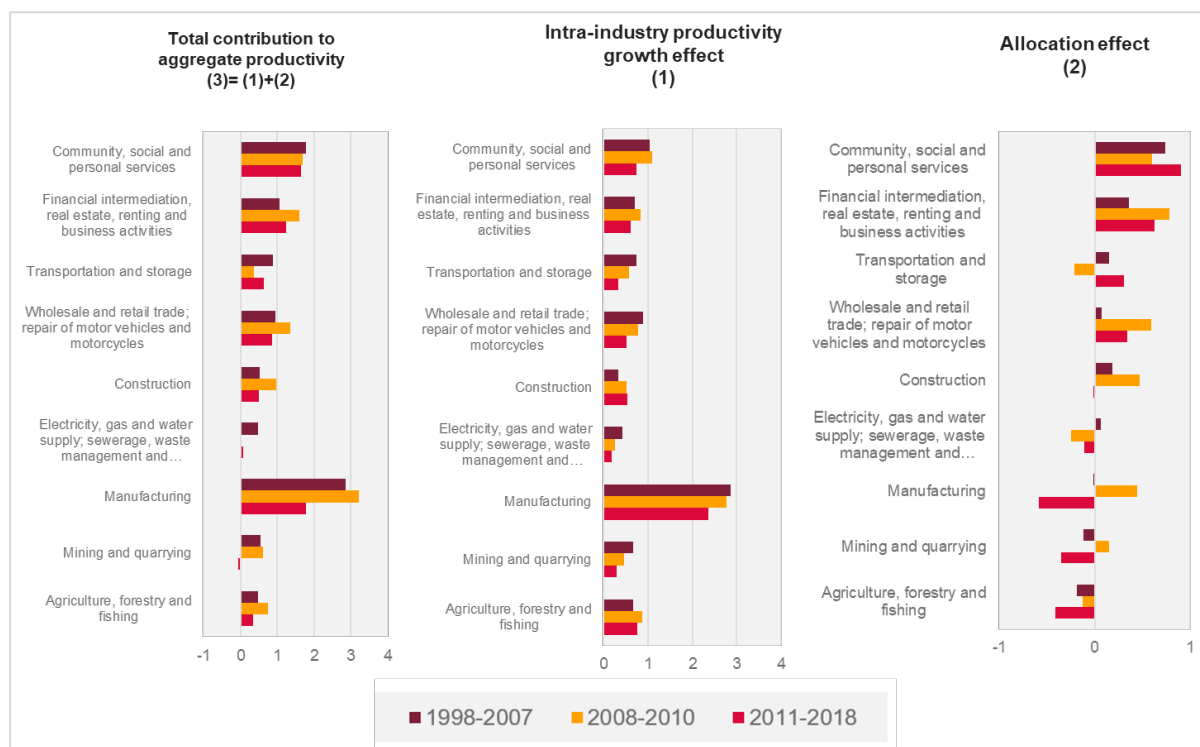
The output (-9.9 percentage points) and employment shares (-24.3 percentage points) of the agriculture sector have declined, resulting in negative allocation effects in the period analysed. To give a sense of this scale, around 150 million workers left the farms in China between 1998 and 2018. The productivity of this sector, however, has experienced strong growth, at 6.8% in 1998–2018, leading to a positive contribution of 0.5 percentage points (on average per year) to aggregate productivity.

In comparison, service activities have shown a sustained expansion during the period analysed. This trend, together with its increasing productivity, have had a large contribution to China's

⁷ Allen, F., Qian, J.Q. and Gu, X. (2017). An overview of China's financial system. *Annual Review of Financial Economics*, 9, 191–231.

aggregate productivity growth, 4.6 percentage points between 1998 and 2018. This is the sum of the contributions of: community, social and personal services (1.7 percentage points); financial and insurance activities (1.2 percentage points); wholesale and retail trade (1.0 percentage points); and transportation and storage (0.7 percentage points) (Table 5).

FIGURE 5: SECTORAL CONTRIBUTION TO CHINA'S AGGREGATE PRODUCTIVITY GROWTH, 1998–2018



Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

TABLE 1: CHINA: PRODUCTIVITY LEVELS AND GROWTH RATES BY SECTOR, 1998–2018

Economic sector	Output per person (annual average)							
	1998–2007		2008–2010		2011–2018		1998–2018	
	Average absolute value (thousand yuan 2018 prices)	Average annual growth	Average absolute value (thousand yuan 2018 prices)	Average annual growth	Average absolute value (thousand yuan 2018 prices)	Average annual growth	Average absolute value (thousand yuan 2018 prices)	Average annual growth
Agriculture, forestry and fishing	10.5	5.1%	16.5	8.4%	26.7	8.5%	17.5	6.8%
Mining and quarrying	31.5	15.2%	51.7	8.5%	68.5	7.7%	215.5	11.4%
Manufacturing	28.3	8.7%	45.9	8.5%	69.8	7.7%	95.7	8.3%
Electricity, gas and water supply; sewerage, waste management and remediation activities	144.1	18.2%	247.6	8.5%	376.2	7.7%	247.3	12.8%
Construction	541.0	6.0%	971.1	8.5%	1,286.8	7.7%	46.6	7.0%
Wholesale and retail trade; repair of motor vehicles and motorcycles	58.5	8.8%	94.0	7.6%	142.8	4.6%	59.5	7.0%
Transportation and storage	126.3	9.2%	215.4	7.6%	327.2	4.6%	110.0	7.2%
Financial intermediation, real estate, renting and business activities	72.0	7.9%	116.9	7.6%	154.9	4.6%	886.6	6.6%
Community, social and personal services	37.2	8.2%	64.4	7.6%	85.4	4.6%	48.5	6.8%
Whole economy	27.5	9.5%	52.5	10.5%	82.0	7.0%	51.8	8.7%

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

TABLE 2: CHINA: SECTORAL CONTRIBUTIONS TO OVERALL PRODUCTIVITY GROWTH, 1998–2007

Economic sector	Output shares		Employment shares		Structural change (1998–2007, percentage points)			Contribution to productivity growth (1998–2007, average, percentage points)			Labour productivity growth (1998–2007)
	1998	2007	1998	2007	Output	Employment	Relative output prices	Intra-industry productivity growth effect (1)	Allocation effect (2)	Total (3) = (1) + (2)	
Agriculture, forestry and fishing	17.4%	10.5%	49.8%	40.8%	-6.8	-9.0	7.2	0.7	-0.2	0.5	5.1%
Mining and quarrying	4.1%	5.0%	1.3%	1.1%	4.0	-0.2	0.0	0.7	-0.1	0.5	15.2%
Manufacturing	33.9%	32.7%	15.4%	17.0%	-0.2	1.6	0.0	2.9	0.0	2.9	8.7%
Electricity, gas and water supply; sewerage, waste management and remediation activities	2.0%	3.6%	0.6%	0.7%	1.6	0.1	0.3	0.4	0.1	0.5	18.2%
Construction	5.9%	5.7%	6.2%	8.0%	1.6	1.8	-0.3	0.3	0.2	0.5	6.0%
Wholesale and retail trade; repair of motor vehicles and motorcycles	10.2%	9.8%	7.6%	8.8%	-1.2	1.3	-7.8	0.9	0.1	1.0	8.8%
Transportation and storage	7.4%	7.9%	3.3%	3.7%	0.9	0.5	4.8	0.7	0.2	0.9	9.2%
Financial intermediation, real estate, renting and business activities	9.1%	10.7%	0.8%	0.9%	0.5	0.1	8.0	0.7	0.4	1.1	7.9%
Community, social and personal services	10.0%	14.0%	15.1%	18.9%	-0.4	3.8	14.2	1.0	0.7	1.8	8.2%
Whole economy	100.0%	100.0%	100.0%	100.0%	N/A	N/A	N/A	8.3	1.2	9.5	9.5%

Note: N/A, not applicable. Decomposition based on output per worker measures of productivity.

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

TABLE 3: CHINA: SECTORAL CONTRIBUTIONS TO OVERALL PRODUCTIVITY GROWTH, 2008–2010

Economic sector	Output shares		Employment shares		Structural change (2008–10, percentage points)			Contribution to productivity growth (2008–10, average, percentage points)			Labour productivity growth (2008–10)
	2008	2010	2008	2010	Output	Employment	Relative output prices	Intra-industry productivity growth effect (1)	Allocation effect (2)	Total (3) = (1) + (2)	
Agriculture, forestry and fishing	10.5%	9.6%	39.4%	36.3%	-0.9	-3.2	3.9	0.9	-0.1	0.7	8.4%
Mining and quarrying	6.2%	5.2%	1.4%	1.3%	0.3	-0.2	-2.0	0.5	0.1	0.6	8.5%
Manufacturing	32.5%	32.1%	17.1%	18.0%	0.7	0.9	-2.0	2.8	0.4	3.2	8.5%
Electricity, gas and water supply; sewerage, waste management and remediation activities	2.6%	2.8%	0.5%	0.6%	0.2	0.1	-2.1	0.2	-0.2	0.0	8.5%
Construction	5.9%	6.6%	8.0%	9.1%	1.6	1.1	2.4	0.5	0.5	1.0	8.5%
Wholesale and retail trade; repair of motor vehicles and motorcycles	10.3%	10.6%	9.4%	10.1%	-0.3	0.7	1.9	0.8	0.6	1.4	7.6%
Transportation and storage	7.6%	6.7%	3.7%	3.6%	-1.1	-0.1	-2.3	0.6	-0.2	0.4	7.6%
Financial intermediation, real estate, renting and business activities	10.4%	12.0%	0.9%	0.9%	-0.9	0.1	9.6	0.8	0.8	1.6	7.6%
Community, social and personal services	14.1%	14.4%	19.5%	20.1%	0.3	0.6	4.1	1.1	0.6	1.7	7.6%
Whole economy	100%	100%	100%	100%	N/A	N/A	N/A	8.1	2.4	10.5	10.5%

Note: N/A, not applicable. Decomposition based on output per worker measures of productivity.

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

TABLE 4: CHINA: SECTORAL CONTRIBUTIONS TO OVERALL PRODUCTIVITY GROWTH, 2011–2018

Economic sector	Output shares		Employment shares		Structural change (2011–18, percentage points)			Contribution to productivity growth (2011–18, average, percentage points)			Labour productivity growth (2011–18)
	2011	2018	2011	2018	Output	Employment	Relative output prices	Intra- industry productivity growth effect (1)	Allocation effect (2)	Total (3) = (1) + (2)	
Agriculture, forestry and fishing	9.5%	7.5%	34.3%	25.5%	-2.0	-8.8	-3.6	0.8	-0.4	0.4	8.5%
Mining and quarrying	5.4%	2.6%	1.4%	0.7%	4.0	-0.7	-14.8	0.3	-0.4	-0.1	7.7%
Manufacturing	32.1%	29.3%	18.5%	18.4%	0.1	-0.1	-14.8	2.4	-0.6	1.8	7.7%
Electricity, gas and water supply; sewerage, waste management and remediation activities	2.5%	2.0%	0.6%	0.5%	-0.5	-0.1	-14.8	0.2	-0.1	0.1	7.7%
Construction	6.7%	6.9%	9.3%	8.8%	2.3	-0.5	-0.5	0.5	0.0	0.5	7.7%
Wholesale and retail trade; repair of motor vehicles and motorcycles	10.7%	11.1%	10.5%	13.0%	-2.8	2.5	-2.5	0.5	0.3	0.9	4.6%
Transportation and storage	6.6%	7.8%	3.7%	5.0%	-2.8	1.3	1.0	0.3	0.3	0.6	4.6%
Financial intermediation, real estate, renting and business activities	12.1%	14.3%	1.0%	1.1%	1.2	0.2	13.4	0.6	0.6	1.2	4.6%
Community, social and personal services	14.4%	18.5%	20.8%	26.9%	0.4	6.2	10.7	0.7	0.9	1.6	4.6%
Whole economy	100.0%	100.0%	100.0%	100.0%	N/A	N/A	N/A	6.3	0.7	7.0	7.0%

Note: N/A, not applicable. Decomposition based on output per worker measures of productivity.

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

TABLE 5: CHINA: SECTORAL CONTRIBUTIONS TO OVERALL PRODUCTIVITY GROWTH, 1998–2018

Economic sector	Output shares		Employment shares		Structural change (1998–2018, percentage points)			Contribution to productivity growth (1998–2018, average, percentage points)			Labour productivity growth (1998–2018)
	1998	2018	1998	2018	Output	Employment	Relative output prices	Intra-industry productivity growth effect (1)	Allocation effect (2)	Total (3) = (1) + (2)	
Agriculture, forestry and fishing	17.4%	7.5%	49.8%	25.5%	-9.9	-24.3	13.7	0.7	-0.3	0.5	6.8%
Mining and quarrying	4.1%	2.6%	1.3%	0.7%	-1.6	-0.6	-17.9	0.5	-0.2	0.3	11.4%
Manufacturing	33.9%	29.3%	15.4%	18.4%	-4.6	3.0	-17.9	2.7	-0.2	2.5	8.3%
Electricity, gas and water supply; sewerage, waste management and remediation activities	2.0%	2.0%	0.6%	0.5%	0.0	-0.1	-17.6	0.3	0.0	0.3	12.8%
Construction	5.9%	6.9%	6.2%	8.8%	1.0	2.7	6.9	0.4	0.1	0.6	7.0%
Wholesale and retail trade; repair of motor vehicles and motorcycles	10.2%	11.1%	7.6%	13.0%	0.9	5.5	-7.6	0.7	0.2	1.0	7.0%
Transportation and storage	7.4%	7.8%	3.3%	5.0%	0.4	1.8	-0.2	0.6	0.2	0.7	7.2%
Financial intermediation, real estate, renting and business activities	9.1%	14.3%	0.8%	1.1%	5.2	0.4	33.0	0.7	0.5	1.2	6.6%
Community, social and personal services	10.0%	18.5%	15.1%	26.9%	8.5	11.8	29.1	0.9	0.8	1.7	6.8%
Whole economy	100.0%	100.0%	100.0%	100.0%	N/A	N/A	N/A	7.5	1.2	8.7	8.7%

Note: N/A, not applicable. Decomposition based on output per worker measures of productivity.

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

TABLE 6: CHINA: PRODUCTIVITY GROWTH DECOMPOSITION, EXCLUDING THE REAL ESTATE SECTOR, 1998–2018

Economic sector	All sectors			Excluding real estate		
	Contribution to productivity growth (1998–2018, average, percentage points)			Contribution to productivity growth (1998–2018, average, percentage points)		
	Intra- industry productivity growth effect (1)	Allocation effect (2)	Total (3) = (1) + (2)	Intra- industry productivity growth effect (1)	Allocation effect (2)	Total (3) = (1) + (2)
Agriculture, forestry and fishing	0.73	-0.26	0.47	0.77	-0.29	0.49
Mining and quarrying	0.49	-0.17	0.32	0.52	-0.19	0.33
Manufacturing	2.66	-0.17	2.49	2.80	-0.19	2.61
Electricity, gas and water supply; sewerage, waste management and remediation activities	0.30	-0.05	0.25	0.32	-0.06	0.26
Construction	0.43	0.15	0.58	0.46	0.16	0.61
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.73	0.25	0.97	0.76	0.26	1.02
Transportation and storage	0.55	0.16	0.71	0.58	0.16	0.75
Financial intermediation, real estate, renting and business activities	0.69	0.52	1.21	0.43 ^{1/}	0.22 ^{1/}	0.65 ^{1/}
Community, social and personal services	0.93	0.78	1.71	0.98	0.82	1.80
Whole economy	7.51	1.21	8.72	7.62	0.89	8.51

Note: Decomposition based on output per worker measures of productivity. ^{1/} Excluding real estate sector.

Source: Authors' computation, based on data from APO Productivity Database 2020 Ver.1 (5 August 2020).

Appendix I. Definitions of variables and data sources

Variable	Measure, units	Source
Labour (people)	Total employment, thousand persons	APO Productivity Database 2020 Ver.1 (5 August 2020)
Output (real values)	GDP at constant prices, billion yuan (2018 prices)	
Output (nominal values)	GDP at current prices, billion yuan	

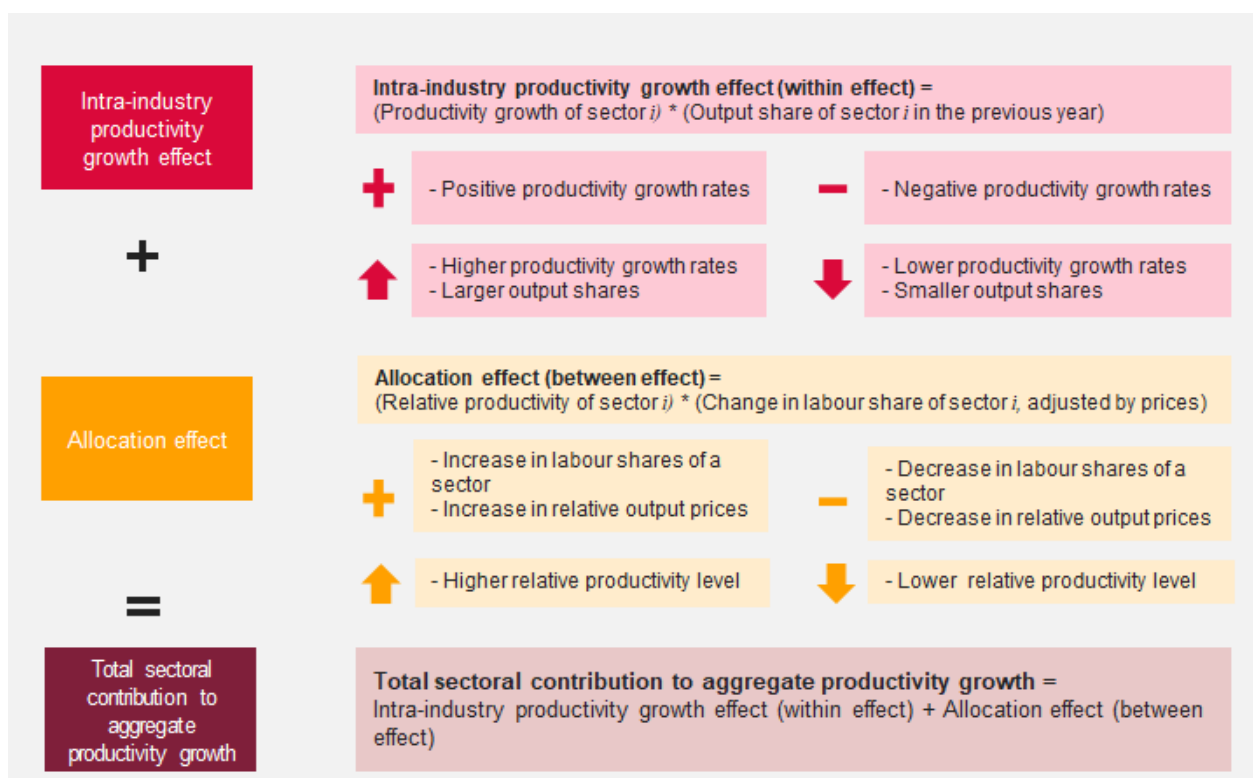
Appendix II. Decomposition of productivity growth

Economic sectors contribute disparately to aggregate productivity growth, depending on their productivity gains over time, as well as their weight in the total economy and relative productivity differences.

In order to understand the extent and nature of these contributions, we decompose the economy-wide labour productivity growth rates into sectoral contribution effects, as described in Tang and Wang:⁸ (i) an intra-industry effect that captures the productivity growth of each economic sector, given the relative importance in the economy (within effect); and (ii) an allocation effect (between-industries effect) that captures the effects of changes in the relative size of sectors.

The *intra-industry productivity growth effect* of a given sector i takes positive (negative) values whenever the sector shows positive (negative) productivity growth. Its magnitude depends on the productivity growth rate and how large the sector is in relation to other sectors in the economy. Assuming that a sector i shows a productivity level above the national average, then the *allocation effect* will take positive (negative) values if the sector increases (decreases) in size. The relative size is determined by changes in the labour shares and relative output prices of sector i . By changes in relative output prices, we mean how much the output prices in sector i change in relation to changes in the output prices of the whole economy.

FIGURE A.1: DECOMPOSITION OF SECTORAL CONTRIBUTION TO AGGREGATE PRODUCTIVITY GROWTH



Source: Authors, based on Tang and Wang (2004).

⁸ Tang, J. and Wang, W. (2004). Sources of aggregate labour productivity growth in Canada and the United States. *Canadian Journal of Economics*, Volume 37, Number 2.



Cambridge Industrial Innovation Policy is based at the Institute for Manufacturing (IfM), a division of the University of Cambridge's Department of Engineering. CIIP brings together the Centre for Science, Technology & Innovation Policy at the Institute for Manufacturing, the Policy Links Unit from IfM Engage, and the Babbage Policy Forum.

Cambridge Industrial Innovation Policy, 17 Charles Babbage Road, Cambridge, CB3 0FS, United Kingdom

ciip.group.cam.ac.uk

