

# Productivity and structural change: Cross-country evidence

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# Introduction

- The structural shift in economic activity towards the service sector and away from manufacturing is often identified as the main reason for the slowdown in productivity growth in advanced economies.
- We quantify the role played by different sectors in aggregate labour productivity performance of eight economies at different stages of development: China, South Korea, Taiwan, Singapore, Germany, France, US and UK.
- We distinguish productivity developments within sectors from effects of changes in composition of the economies.
- We look at period 1998-2017 and identify differences over time in particular between the post vs. pre-financial crisis periods.

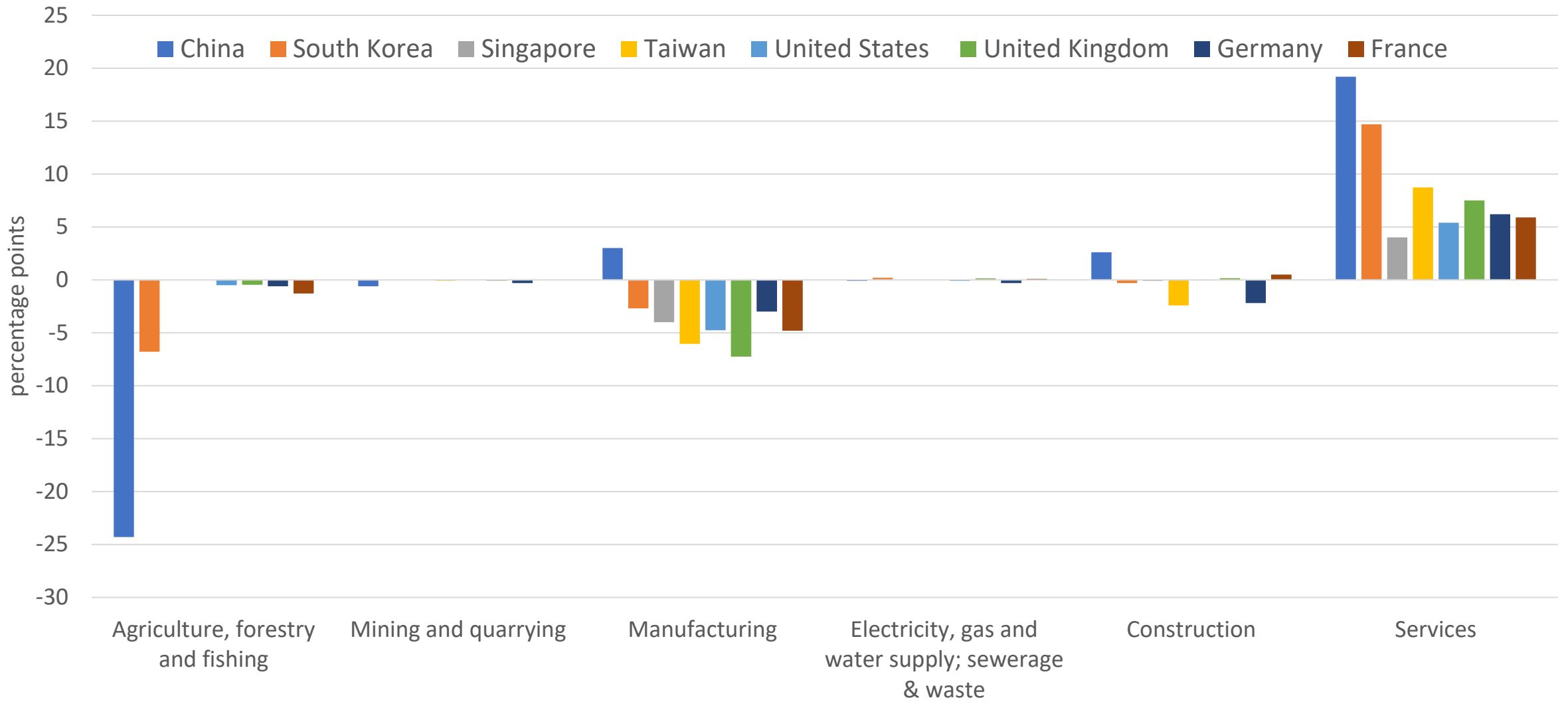
# Aggregate labour productivity growth rates

Economy	Whole period of analysis (1998–2017)	Sub-periods		
		(1) Pre-crisis (1998–2007)	(2) Crisis (2008–10)	(3) Post-crisis (2011–17)
China	8.9%	9.5%	10.5%	7.3%
Korea	5.1%	6.2%	5.7%	3.2%
Singapore	3.1%	N/A	N/A	1.9%
Taiwan	2.7%	3.8%	2.5%	1.1%
France	2.2%	2.8%	1.8%	1.4%
Germany	1.7%	1.7%	0.3%	2.3%
US	1.6%	2.1%	1.8%	0.7%
UK	1.1%	1.7%	-0.5%	0.9%

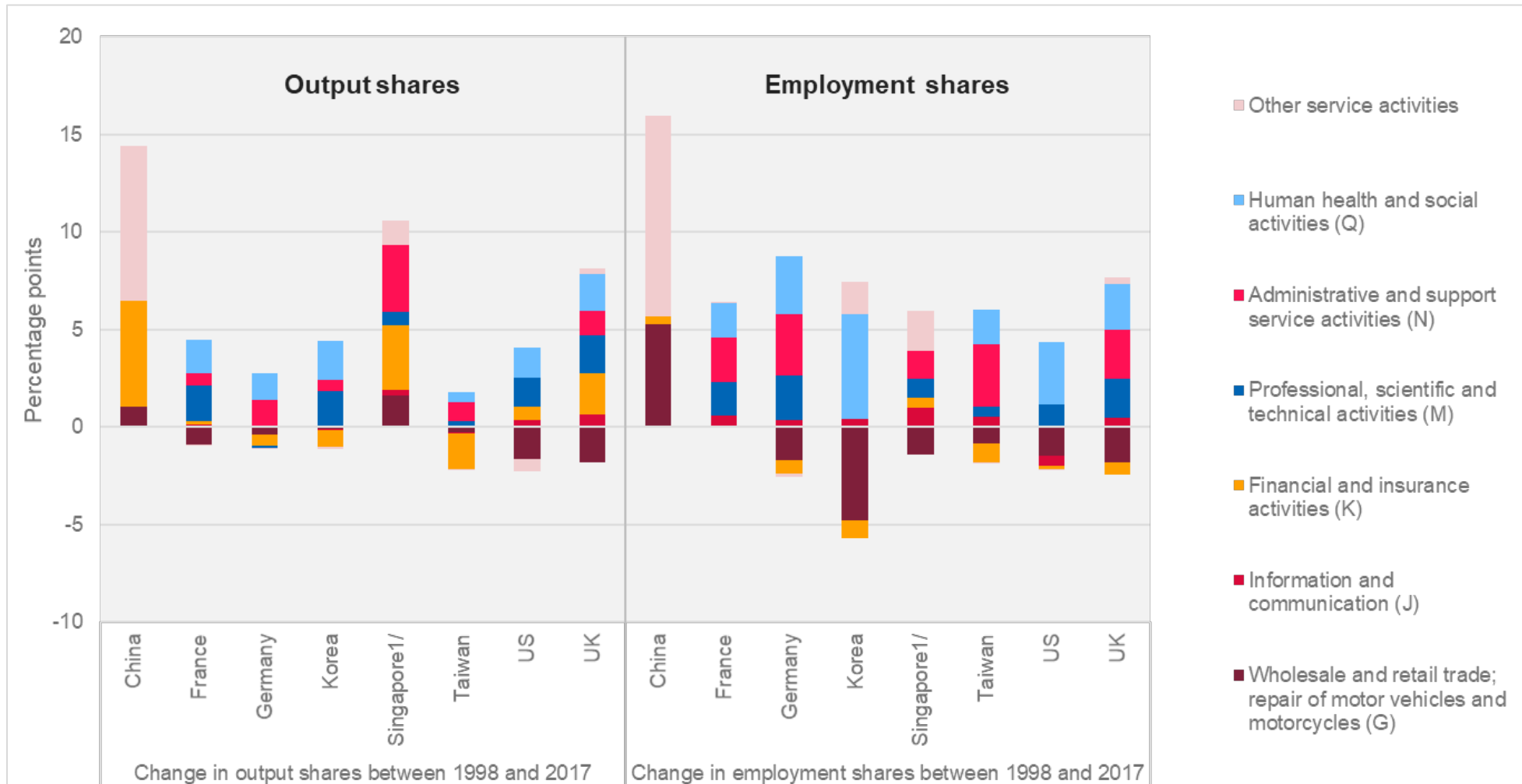
# Labour productivity growth rates by country and industry

Economic sectors		Output per person (average annual growth rate, 1998–2017)							
									
Production	Agriculture, forestry and fishing (A)	6.8%	3.3%	3.3%	4.2%	N/A	N/A	2.9%	4.7%
	Mining and quarrying (B)	11.6%	4.8%	4.2%	2.2%	N/A	1.1%	2.6%	-5.2%
	Manufacturing (C)	8.3%	2.5%	3.0%	5.7%	7.0%	6.0%	3.7%	4.2%
	Electricity, gas, steam and air conditioning supply (D)	N/A	2.4%	3.9%	4.5%	N/A	2.8%	N/A	0.7%
	Water supply; sewerage, waste management and remediation activities (E)	N/A	2.0%	2.7%	N/A	N/A	2.5%	N/A	-2.6%
	Construction (F)	6.9%	2.7%	2.1%	4.0%	1.7%	-0.2%	-0.9%	-0.3%
Knowledge-intensive services	Information and communication (J)	N/A	1.4%	1.6%	1.6%	1.1%	5.0%	6.5%	9.7%
	Financial and insurance activities (K)	6.7%	3.0%	2.9%	3.7%	4.5%	2.0%	2.3%	2.0%
	Professional, scientific and technical activities (M)	N/A	2.2%	-0.7%	3.2%	-1.0%	1.0%	1.4%	0.4%
	Education (P)	N/A	2.3%	1.1%	3.9%	N/A	1.2%	-0.4%	-1.8%
Other services	Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	7.1%	1.7%	2.4%	5.5%	4.0%	2.2%	2.1%	0.7%
	Transportation and storage (H)	7.3%	2.4%	1.9%	4.4%	1.0%	2.7%	0.6%	0.1%
	Accommodation and food service activities (I)	N/A	2.1%	1.2%	4.1%	1.6%	-1.8%	0.0%	-0.2%
	Real estate activities (L)	N/A	3.4%	1.2%	2.4%	0.8%	2.3%	1.9%	-1.5%
	Administrative and support service activities (N)	N/A	1.0%	0.4%	2.4%	7.6%	0.4%	N/A	0.2%
	Public administration and defence; compulsory social security (O)	N/A	2.6%	2.7%	4.3%	N/A	N/A	0.0%	1.7%
	Human health and social activities (Q)	N/A	2.7%	1.6%	-0.4%	N/A	-1.2%	0.6%	0.0%
	Arts, entertainment and recreation (R)	N/A	2.0%	1.0%	4.7%	N/A	0.6%	0.6%	0.0%
	Activities of households (T)	N/A	0.1%	1.5%	N/A	N/A	N/A	N/A	4.6%
	Other service activities	6.9%	1.8%	0.8%	N/A	0.9%	2.4%	-1.2%	-1.3%
<b>Whole economy</b>		<b>8.9%</b>	<b>2.2%</b>	<b>1.7%</b>	<b>4.2%</b>	<b>3.1%</b>	<b>2.7%</b>	<b>1.6%</b>	<b>1.1%</b>

# Change in employment shares across broad sectors (Difference in employment shares between 1998 and 2018)



# Change in output and employment shares services sectors, 1998-2017.



# Decomposition of labour productivity growth

- We compute the sectoral contributions to total LP growth (Tang and Wang, 2004):

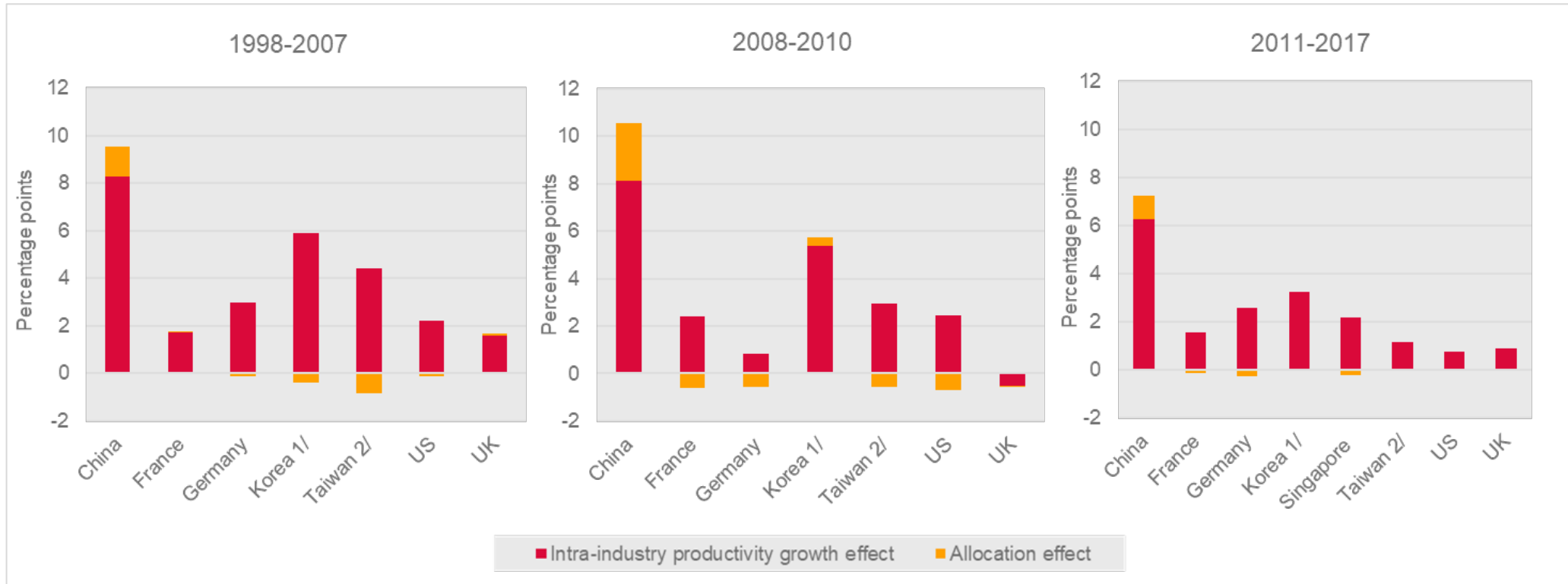
$$g_t = \underbrace{g_{it} \sum_i \frac{Y_{it-1}}{Y_{t-1}}}_{\text{within effect (1)}} + \underbrace{\sum_i (1 + g_{it}) \frac{Z_{it-1}}{Z_{t-1}} (p_{it}l_{it} - p_{it-1}l_{it-1})}_{\text{between effect (2)}}$$

- (1) Within effect: Considers each sectors' productivity growth rate and its relative size.
  - Will always be positive when an industry experiences positive labour productivity growth.
- (2) Between effect: Considers changes in the relative size of sectors over time, given their relative productivity levels.
  - Will always be positive when a sector expands and negative when it contracts.

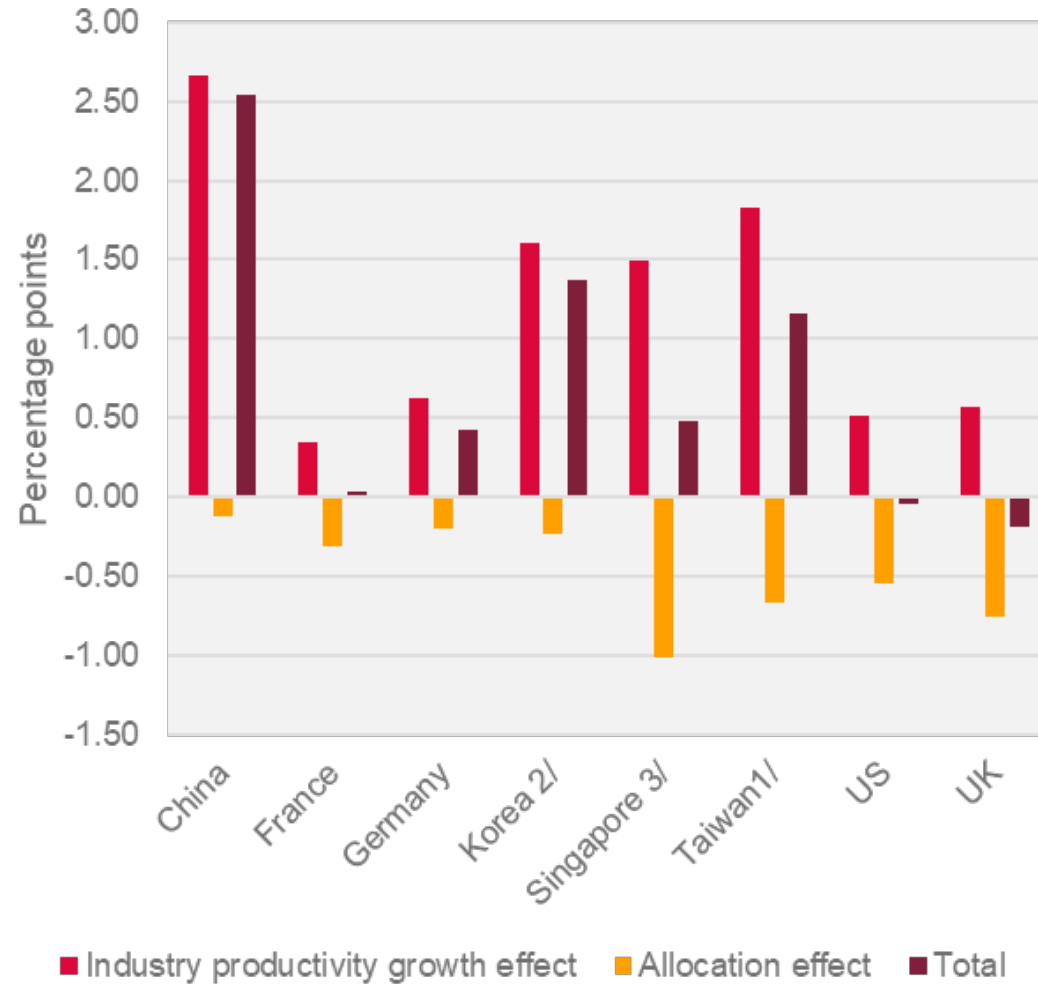
<b>Intra-industry productivity growth (within) effect</b> <b>(annual average 1998–2017)</b>								
Economic sector	China	France	Germany	Korea <sup>1/</sup>	Singapore <sup>2/</sup>	Taiwan <sup>3/</sup>	US	UK
Agriculture, forestry and fishing (A)	0.74	0.07	0.03	0.10	-0.11	N/A	0.03	0.04
Mining and quarrying (B)	0.51	0.01	0.01	0.00		0.00	0.06	-0.11
Utilities (D–E)	0.31	0.06	0.09	0.12		0.06	0.03	-0.03
Manufacturing (C)	2.66	0.35	0.63	1.61	1.50	1.82	0.51	0.56
Construction (F)	0.42	0.14	0.09	0.22	0.10	0.00	-0.04	-0.03
Knowledge-intensive services	0.69	0.47	0.23	0.50	0.52	0.44	0.55	0.64
Other services	2.23	1.29	0.82	1.52	1.34	0.76	0.60	-0.05
Whole economy	7.56	2.38	1.90	4.06	3.34	3.03	1.74	1.02
<b>Allocation (between) effect</b> <b>(annual average 1998–2017)</b>								
Economic sector	China	France	Germany	Korea <sup>1/</sup>	Singapore <sup>2/</sup>	Taiwan <sup>3/</sup>	US	UK
Agriculture, forestry and fishing (A)	-0.25	-0.07	-0.03	-0.09	0.13	N/A	-0.04	-0.05
Mining and quarrying (B)	-0.17	-0.01	-0.01	0.00		-0.01	-0.02	0.07
Utilities (D–E)	0.00	-0.02	-0.05	-0.03		-0.04	-0.02	0.05
Manufacturing (C)	-0.12	-0.31	-0.21	-0.24	-1.02	-0.67	-0.55	-0.76
Construction (F)	0.16	0.02	-0.08	-0.03	-0.15	-0.04	0.12	0.17
Knowledge-intensive services	0.55	0.10	0.11	0.19	0.29	-0.23	-0.06	-0.05
Other services	1.21	0.08	0.09	0.39	0.54	0.38	0.39	0.63
Whole economy	1.34	-0.21	-0.18	0.19	-0.22	-0.61	-0.19	0.06
<b>Total contribution to productivity growth</b> <b>(annual average 1998–2017)</b>								
Economic sector	China	France	Germany	Korea <sup>1/</sup>	Singapore <sup>2/</sup>	Taiwan <sup>3/</sup>	US	UK
Agriculture, forestry and fishing (A)	0.49	0.00	0.01	0.00	0.01	N/A	0.00	-0.01
Mining and quarrying (B)	0.33	0.00	0.00	0.00		-0.01	0.04	-0.04
Utilities (D–E)	0.31	0.04	0.04	0.09		0.02	0.01	0.02
Manufacturing (C)	2.54	0.03	0.42	1.37	0.48	1.15	-0.04	-0.19
Construction (F)	0.59	0.16	0.01	0.19	-0.06	-0.04	0.07	0.14
Knowledge-intensive services	1.24	0.57	0.34	0.69	0.81	0.21	0.49	0.58
Other services	3.44	1.37	0.91	1.91	1.88	1.14	0.99	0.58
Whole economy	8.90	2.17	1.72	4.26	3.12	2.43	1.55	1.08



# Decomposition of aggregate labour productivity growth (1998–2017)

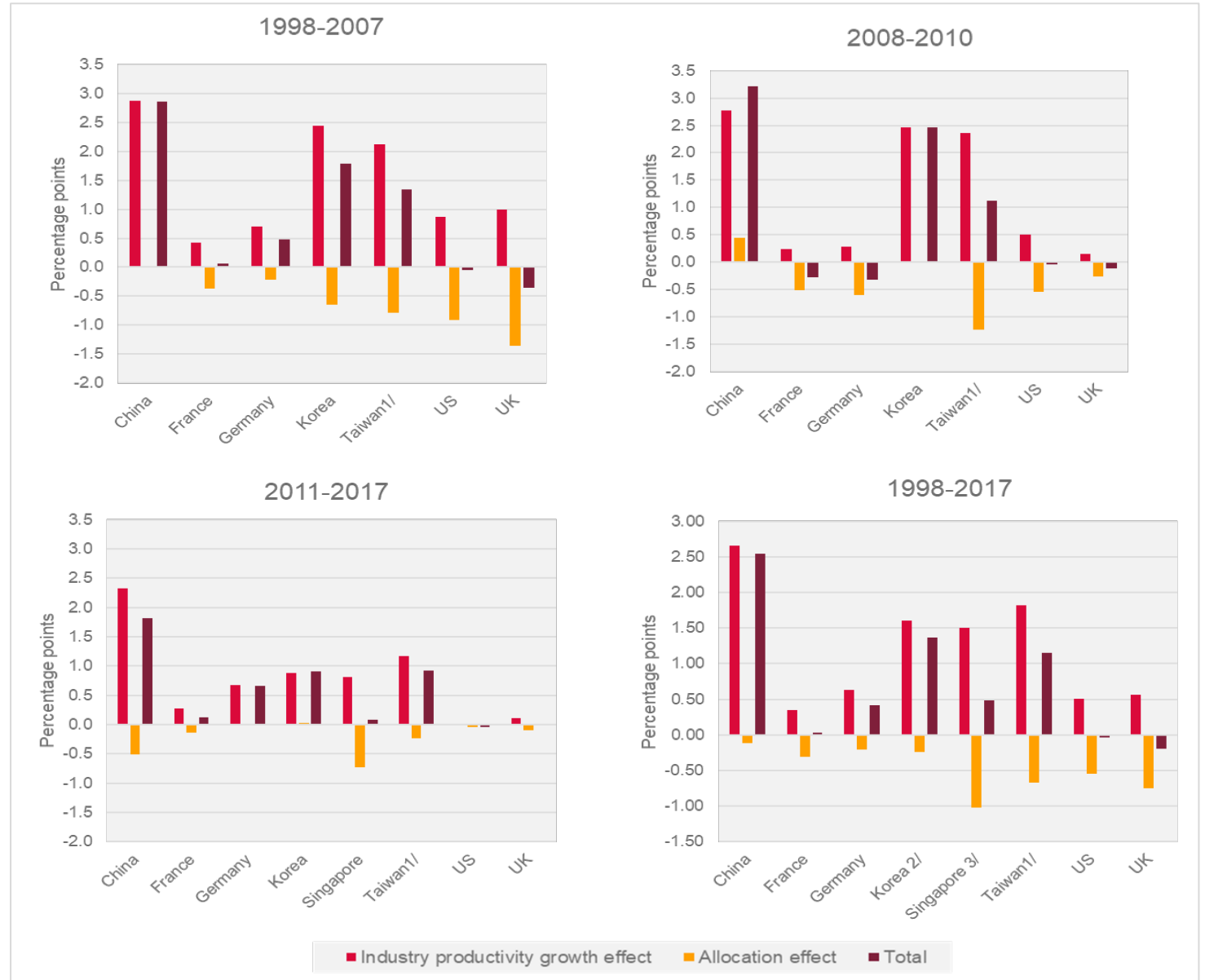


# Contribution of manufacturing to labour productivity growth across countries (1998–2017)

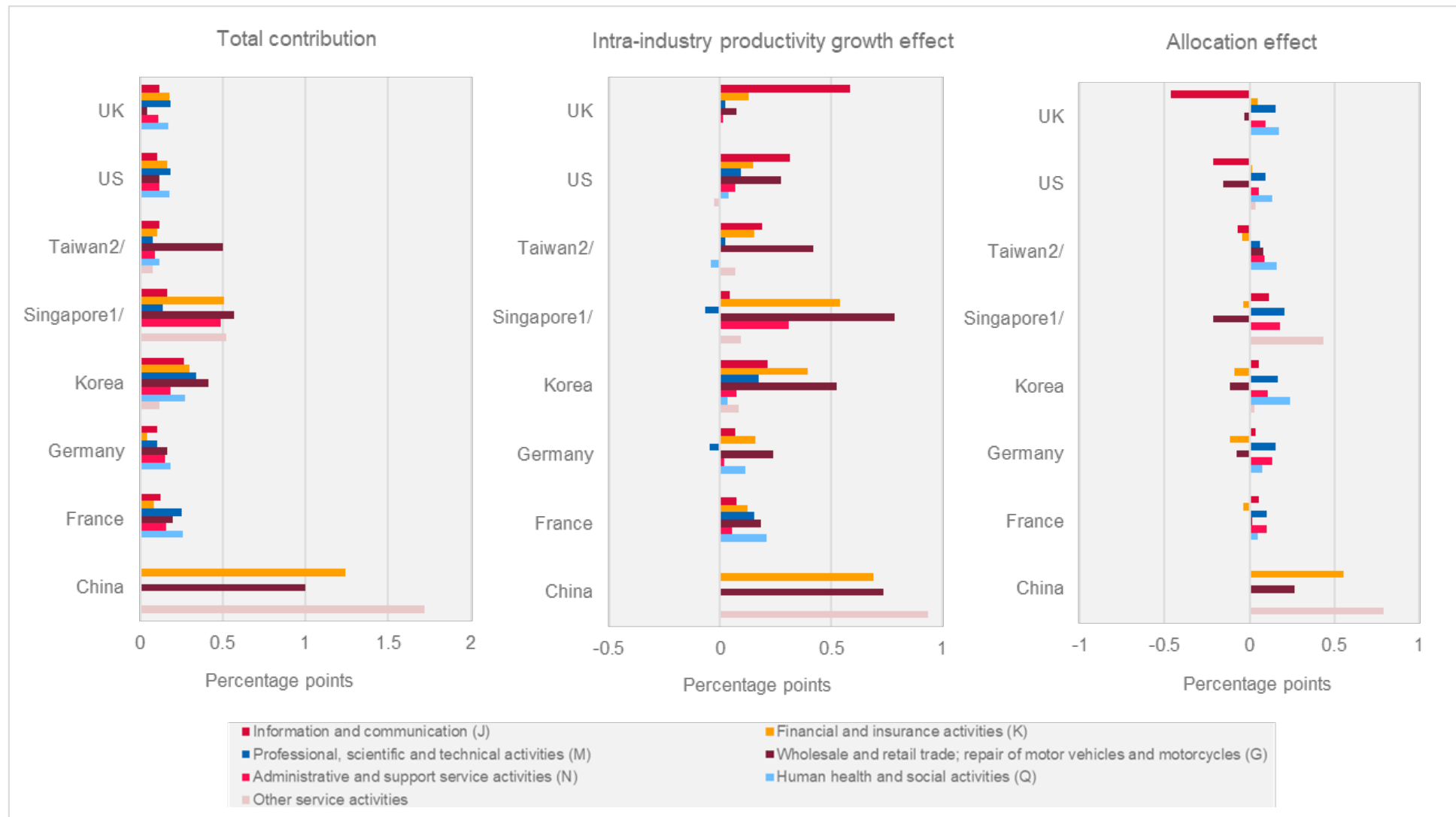


## Contributions of manufacturing to aggregate productivity growth, by subperiod.

- ✓ Manufacturing has been making a small negative contribution to overall productivity growth in some Western economies, mainly because of the between effect, which was however a little larger in the decade before the financial crisis.
- ✓ In Asian economies the contribution of manufacturing to the rate of labour productivity growth has slowed down mainly due to the within effect.



# Contribution of selected service activities to aggregate productivity growth (1998–2017)



# Country specific findings & context

## China



- ❑ Sectors with the largest contributions to China's aggregate productivity include: *manufacturing; community, social and personal services; financial and insurance activities; and wholesale and retail trade.*
- ❑ China's productivity growth has declined steadily since the global financial crisis.
- ❑ The contribution of manufacturing to aggregate productivity has declined, while the service sectors increased their contributions.
- ❑ This is the case for 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 expansion.

## South Korea



- ❑ The sectors that made the largest contributions to Korea's labour productivity growth include: *manufacturing; wholesale and retail trade; real estate activities; public administration and defence; and professional, scientific and technical activities.*
- ❑ The sizeable contribution of Korea's manufacturing sector is explained the fast productivity growth and the relatively large size, but: it has declined.
- ❑ Computer, electronic and optical products is the sub-sector that made the largest contribution to aggregate productivity growth.
- ❑ Key strengths in the electronics value chain are in integrated circuits (memory), led by Samsung and Hynix, displays (Samsung, LG) and mobile phones (Samsung, LG).

## Taiwan



- ❑ Slowdown in labour productivity in the post-crisis period reflects a broad-based slowdown in productivity growth across sectors.
- ❑ Manufacturing employment share has decreased by 6 p.p., and this drags overall productivity growth by -0.7 p.p.
- ❑ The semiconductor industry plays a key role in the Taiwanese economy- accounts for 28% of the total valued added of Taiwan's economy.
- ❑ Taiwan is home to the world's largest semiconductor foundry, the Taiwan Semiconductor Manufacturing Company, and the largest integrated circuit packaging and testing firm, Advanced Semiconductor Engineering, Inc. (ASE).

## Singapore



- ❑ Manufacturing plays a key role in Singapore's economy, and it constitutes a priority in national industrial and innovation policy.
- ❑ While the share of manufacturing in total employment has decreased by 10 percentage points between 2005 and 2015, this trend seems to have stalled, and the share of manufacturing in total output is above 20%.
- ❑ Electronics and precision engineering are two of the main industries driving productivity growth in manufacturing.
- ❑ Sectors that have increased their contribution are: *financial services, administrative and support service activities, information and communication, and professional and scientific activities.*

## Germany



- ❑ The contribution of manufacturing to aggregate productivity growth is explained by its large size and its high productivity growth.
- ❑ Although manufacturing continues to be a key driver of Germany's productivity growth, their contraction has dragged overall productivity growth.
- ❑ Manufacturing sub-sectors that experienced the fastest productivity include: *the manufacture of transport equipment, the manufacture of machinery and equipment; the manufacture of computer, electronic and optical products; and the manufacture of textiles, wearing apparel, leather and related products.*

## France



- ❑ Manufacturing is the sector with the second-largest within-industry productivity growth effect, but it has experienced a significant contraction.
- ❑ The good performance of wholesale and retail trade sector continue to spur total labour productivity growth.
- ❑ Professional, scientific and technical activities, with higher than average productivity, have experienced an expansion in size and contribution has risen steadily.
- ❑ Other sectors that made a sizable contribution during include real estate activities; construction, and administrative and support service activities.

## United States



- ❑ The sectors that made the largest contribution the US' aggregate productivity growth during 1998–2019 are in the services sector and include: *professional, scientific and technical activities; financial and insurance activities, real estate and rental and leasing; public administration and defence; human health and social work activities.*
- ❑ The large contribution from the professional, scientific and technical activities and financial and insurance activities is explained by their positive productivity growth performance.
- ❑ Important differences are found in sectoral contributions when we compare the pre- and post-financial crisis.
- ❑ The US manufacturing sector has experienced a decline in size, and overall this sector makes a negative (but small) contribution to aggregate productivity growth.

## United Kingdom



- ❑ The productivity slowdown has been felt across most industry sectors.
- ❑ Important differences are found in the sectors' contributions between the pre- and post-financial crisis periods.
- ❑ The market sectors that to a larger extent, help to explain the slowdown in the UK's productivity growth in the last decade include: *financial and insurance activities; professional, scientific and technical activities; information and communication; wholesale and retail trade.*
- ❑ The shrinking of manufacturing lowers aggregate lower productivity growth in just under-0.20 pp per year.



# Concluding remarks

- A slowdown in productivity growth in all economies examined, but this reflects a mix of common and idiosyncratic factors in each of the countries.
- Since the late 90s, we observe a structural shift from the manufacturing sector towards services in most of the economies examined here.
- Manufacturing continues to be a key driver of national productivity growth, and make positive contributions to overall growth in those economies where it accounts for more than 20 per cent of value added, such as China, Korea and Taiwan as well as Germany.
- In the US and UK developments in the manufacturing sector represent a drag from overall growth (up to -0.2 per year in the UK).
- These are the result mainly of negative reallocation that reflects reallocation of resources away from a higher-than average productivity sector.
- Labour productivity slowdown largely reflect a decline in productivity growth across wide range of sectors, including manufacturing, that vary in importance across countries.