

# On-line Appendix to “Industry Productivity Performance in G7 Countries after the Global Financial Crisis: A Canadian Perspective”

## Results on the Decomposition of Aggregate Productivity Growth for G7 Countries<sup>1</sup>

In this Appendix, we estimate industry contribution to the productivity acceleration or deceleration after the global financial crisis for each of the G7 countries. The overall contribution from each industry is due to the industry’s changes from three sources or components: productivity, output/input price, and size. We will focus our discussion on the change in business sector productivity between the 2000-2010 and 2011-2015 sub-periods by industry and estimate the three components of this overall contribution.

Based on the KLEMS database, Canada’s labour productivity growth increased from 1.07 per cent per year in 2000-2010 to 1.34 per cent per year in 2011-2015, an improvement of 0.26 percentage points (Table 1). The improvement was entirely due to industry labour productivity improvements (0.79 percentage points), which was largely offset by a negative size effect (-0.51 percentage points). The indus-

try productivity effect was mainly driven by the productivity improvement in mining and quarrying while the negative size effect was mainly driven by the decrease in the size of this industry (in terms of its labour share in the business sector).

The largest industry contributor to the labour productivity growth acceleration was manufacturing (0.90 percentage points), which was driven by improvement in output price (0.55 percentage points) and the increase in size (0.38 percentage points). In contrast, the largest industry laggard was mining and quarrying (-1.12 percentage points), driven by the collapse of oil and other commodity prices (-1.35 percentage points) and the decrease in size (-0.48 percentage points), which was partly offset by a productivity improvement in the industry (0.72 percentage points).

The acceleration in aggregate MFP between the two sub-periods was 0.80 percentage points, which was much larger than

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<sup>1</sup> The main article is available at [http://www.csls.ca/ipm/39/Tang\\_Wang.pdf](http://www.csls.ca/ipm/39/Tang_Wang.pdf).

**Table 1: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in Canada, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.10	-0.06	-0.09	-0.01	-0.06	0.09	0.09	-0.04	0.00	0.14
Mining and quarrying	-0.43	0.53	0.45	0.01	0.56	0.29	-0.81	-0.04	0.00	-0.57
Manufacturing	0.28	-0.41	-0.56	-0.01	-0.70	0.25	0.14	-0.18	0.00	0.20
Utilities	-0.03	-0.02	0.03	0.00	-0.03	0.08	0.04	-0.06	-0.01	0.04
Construction	0.02	0.14	0.23	0.00	0.38	0.08	0.12	0.13	0.00	0.33
Wholesale and retail trade	0.34	-0.14	0.01	-0.01	0.21	0.20	0.01	-0.06	-0.01	0.14
Transportation and storage	0.08	-0.04	-0.02	0.00	0.02	0.09	0.09	0.02	0.00	0.20
Accommodation and food services	0.02	0.01	-0.01	0.00	0.01	0.04	0.02	0.02	0.00	0.08
Information and communication	0.12	-0.05	-0.01	0.00	0.06	0.05	-0.01	-0.04	0.00	0.00
FIRE	0.14	-0.11	0.17	0.00	0.20	0.29	0.08	-0.04	0.00	0.33
PSTAS	0.08	0.08	0.14	0.00	0.30	0.08	0.12	0.11	0.00	0.31
Community social and personal services	0.05	0.05	0.03	0.00	0.13	0.02	0.11	0.01	0.00	0.13
<b>Total Business Sector</b>	0.76	-0.02	0.36	-0.02	1.07	1.55	-0.03	-0.15	-0.03	1.34
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.03	-0.06	-0.07	0.00	-0.09	0.06	0.02	0.04	0.01	0.13
Mining and quarrying	-0.45	0.44	0.35	0.08	0.42	-0.12	-0.29	-0.38	0.13	-0.66
Manufacturing	-0.10	-0.24	-0.63	0.00	-0.97	0.11	-0.01	-0.03	0.00	0.08
Utilities	-0.04	0.01	-0.04	0.00	-0.07	-0.03	0.04	0.02	0.00	0.02
Construction	-0.07	0.04	0.30	0.00	0.27	0.10	0.01	0.12	0.00	0.24
Wholesale and retail trade	0.10	-0.16	0.08	0.00	0.02	0.02	-0.02	0.03	0.00	0.02
Transportation and storage	-0.02	-0.05	0.01	0.00	-0.06	-0.03	0.05	0.13	0.00	0.15
Accommodation and food services	-0.01	0.00	-0.01	0.00	-0.03	0.02	-0.02	0.05	0.00	0.05
Information and communication	0.02	-0.05	0.02	0.00	0.00	0.01	-0.01	-0.04	0.00	-0.04
FIRE	0.07	-0.10	0.02	-0.01	-0.01	0.20	-0.12	0.12	0.00	0.20
PSTAS	-0.11	0.13	0.15	0.00	0.16	-0.06	0.09	0.18	-0.01	0.21
Community social and personal services	-0.05	0.03	0.07	0.00	0.05	-0.01	0.06	0.02	0.00	0.07
<b>Total Business Sector</b>	-0.62	-0.01	0.25	0.05	-0.33	0.28	-0.20	0.26	0.12	0.47

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

0.26 percentage points for aggregate labour productivity. Again, the MFP growth acceleration was mainly due to the improvements in MFP at the industry level. The largest industry contributor was manufacturing (1.05 percentage points), driven by the recovery in the size of the industry (0.60 percentage points) and to a lesser extent an improvement in MFP (0.22 percentage points) and an increase in output price (0.23 percentage points). In contrast, the largest laggard was mining and quarrying (-1.08 percentage points), driven by the price collapse in oil and other mining products (-0.73 percentage points) and the shrinking of the industry (-0.73 percentage points).

## France

For France, both labour productivity and MFP growth fell off slightly in 2011-2015 compared to in 2000-2010 (Table 2). Business sector labour productivity growth fell off by -0.15 percentage points. The small change was due to the industry labour productivity effect (-0.10 percentage points) and the price effect (-0.12 percentage points), which was partly offset by a positive size effect (0.05 percentage points). The change in business sector MFP growth was also small, only -0.12 percentage points. Unlike labour productivity, there was a significant improvement in the productivity effect (0.40 percentage

**Table 2: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in France, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.07	-0.04	-0.06	-0.01	-0.05	0.05	0.01	-0.04	-0.01	0.01
Mining and quarrying	0.00	0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing	0.50	-0.38	-0.40	-0.02	-0.30	0.35	-0.04	-0.15	-0.01	0.15
Utilities	-0.01	0.00	0.00	-0.01	-0.02	-0.01	0.10	0.01	0.00	0.10
Construction	-0.08	0.17	0.09	0.00	0.18	-0.08	0.08	-0.08	0.00	-0.08
Wholesale and retail trade	0.06	-0.03	0.02	0.00	0.05	0.16	-0.12	-0.05	0.00	-0.01
Transportation and storage	0.05	0.01	0.01	0.00	0.06	0.07	0.00	-0.02	0.00	0.04
Accommodation and food services	-0.02	0.03	0.04	0.00	0.05	0.01	0.00	0.02	0.00	0.04
Information and communication	0.19	-0.18	0.04	-0.01	0.04	0.14	-0.16	0.04	0.00	0.01
FIRE	0.25	0.13	0.01	0.01	0.39	0.21	-0.08	0.02	0.00	0.15
PSTAS	-0.04	0.11	0.17	0.00	0.24	-0.04	0.01	0.20	0.00	0.16
Community social and personal services	0.07	0.15	0.10	0.00	0.31	0.08	0.04	0.11	0.00	0.23
<b>Total Business Sector</b>	1.02	-0.04	0.01	-0.05	0.95	0.93	-0.16	0.06	-0.03	0.80
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.05	-0.05	-0.06	-0.01	-0.07	0.01	-0.02	0.01	0.00	-0.01
Mining and quarrying	-0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing	0.22	-0.35	-0.28	-0.02	-0.43	0.22	-0.08	-0.08	-0.01	0.05
Utilities	-0.10	-0.03	0.11	-0.02	-0.04	0.04	0.09	-0.04	-0.01	0.08
Construction	-0.08	0.11	0.10	0.00	0.12	-0.14	0.09	-0.08	0.00	-0.13
Wholesale and retail trade	-0.11	0.01	0.04	0.00	-0.06	-0.01	-0.10	0.00	0.00	-0.11
Transportation and storage	0.02	-0.01	0.01	0.00	0.02	0.03	-0.02	-0.01	0.00	0.00
Accommodation and food services	-0.03	0.02	0.03	0.00	0.02	0.02	-0.03	0.02	0.00	0.01
Information and communication	0.02	-0.09	0.07	-0.01	-0.01	0.07	-0.04	-0.07	0.00	-0.04
FIRE	-0.04	0.09	0.19	0.00	0.24	0.09	-0.10	0.01	0.00	-0.01
PSTAS	-0.23	0.16	0.20	0.00	0.12	-0.21	0.08	0.18	0.00	0.05
Community social and personal services	-0.02	0.00	0.18	0.00	0.16	-0.03	-0.03	0.13	0.00	0.07
<b>Total Business Sector</b>	-0.31	-0.13	0.58	-0.07	0.07	0.09	-0.16	0.06	-0.04	-0.05

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

points), but the positive productivity effect was more than offset by a negative size effect (-0.52).

The largest industry contributor to the business sector labour productivity growth deceleration was manufacturing (0.45 percentage points), driven by an improvement in the output price (0.33 percentage points) and less of a decline in size (0.25 percentage points). The largest industry laggard was construction (-0.26 percentage points), which was followed by finance, insurance and real estate activities (-0.24 percentage points). The slower pace of the fall in the relative size of the construction sector was mainly responsible for the industry's fall in

its contribution to aggregate labour productivity growth. For FIRE, it was the decrease in the industry's relative output price.

As in labour productivity, the largest industry contributor to the business sector MFP growth deceleration was manufacturing (0.48 percentage points), driven by an improvement in output price relative to input price (0.27 percentage points) and an increase in size (0.21 percentage points). The industry laggards were construction (-0.26 percentage points) and FIRE (-0.25 percentage points). The weaker performance of construction was driven by its size effect (-0.18 percentage points), and

**Table 3: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in Germany, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.03	-0.03	-0.03	0.01	-0.02	-0.02	0.04	-0.02	0.00	-0.01
Mining and quarrying	0.01	0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01
Manufacturing	0.71	-0.13	-0.27	0.00	0.30	0.30	-0.11	0.13	-0.01	0.31
Utilities	0.08	0.06	-0.03	-0.01	0.10	-0.02	-0.06	0.01	-0.01	-0.08
Construction	0.01	0.04	-0.11	0.00	-0.05	0.01	0.12	-0.03	0.00	0.09
Wholesale and retail trade	0.28	-0.08	-0.07	-0.01	0.12	0.31	-0.14	-0.11	0.00	0.06
Transportation and storage	0.13	-0.01	-0.01	0.00	0.11	-0.08	0.05	0.01	0.00	-0.01
Accommodation and food services	-0.02	0.03	0.00	0.00	0.01	0.03	0.02	-0.01	0.00	0.04
Information and communication	0.14	-0.15	0.08	-0.01	0.06	0.20	-0.10	0.02	0.00	0.12
FIRE	0.24	0.11	-0.14	0.00	0.20	0.22	-0.12	-0.22	-0.01	-0.12
PSTAS	-0.21	0.03	0.36	0.00	0.17	0.01	0.08	0.10	0.00	0.19
Community social and personal services	-0.02	0.11	0.19	0.00	0.29	-0.05	0.21	0.07	0.00	0.23
<b>Total Business Sector</b>	1.38	-0.02	-0.04	-0.02	1.29	0.90	-0.01	-0.06	-0.03	0.80
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.03	-0.03	-0.01	-0.01	-0.02	-0.03	0.02	-0.01	0.00	-0.01
Mining and quarrying	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.02	0.00	-0.02
Manufacturing	0.16	-0.25	0.20	-0.01	0.11	0.25	0.13	-0.10	-0.02	0.25
Utilities	-0.04	0.01	0.12	-0.01	0.08	0.01	-0.01	-0.08	-0.01	-0.09
Construction	0.00	0.03	-0.11	0.00	-0.09	-0.05	0.12	0.02	0.00	0.08
Wholesale and retail trade	0.13	-0.12	0.03	-0.01	0.03	0.25	-0.09	-0.13	0.00	0.03
Transportation and storage	0.02	-0.04	0.10	0.00	0.07	-0.07	0.08	-0.03	0.00	-0.03
Accommodation and food services	-0.03	0.03	-0.01	0.00	0.00	0.02	0.00	0.01	0.00	0.03
Information and communication	0.03	-0.08	0.08	-0.01	0.02	0.18	-0.05	-0.03	0.00	0.10
FIRE	-0.16	0.18	0.05	-0.02	0.06	0.06	0.11	-0.32	-0.01	-0.16
PSTAS	-0.29	0.27	0.10	0.00	0.07	0.03	0.14	-0.01	0.00	0.16
Community social and personal services	-0.12	0.18	0.11	-0.01	0.15	-0.10	0.24	0.05	0.00	0.19
<b>Total Business Sector</b>	-0.27	0.17	0.65	-0.09	0.46	0.54	0.69	-0.63	-0.06	0.54

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

that for FIRE was due to the decrease in the output price relative to input price (-0.19 percentage points) and the decrease in the size of the industry (-0.18 percentage points).

## Germany

Germany also experienced a slowdown in labour productivity growth, declined 0.49 percentage points from 1.29 percent per year in 2000-2010 to 0.80 percent per year in 2011-2015 (Table 3). For MFP, however, it increased slightly from 0.46 percent per year to 0.54 percent per year.

The slowdown in labour productivity was entirely due to the industry labour pro-

ductivity effect, largely driven by manufacturing (-0.41 percentage points). The largest industry contributor was construction (0.14 percentage points), mainly due to an improvement in output price relative to intermediate input price (0.08 percentage points) and an increase in the size of the industry (0.08 percentage points). The largest laggard was FIRE (-0.32 percentage points), largely due to a decrease of output price relative to intermediate input price (-0.23 percentage points).

The increase in MFP growth was small, but there were significant changes in the components. The industry productivity and the price effects were improved signif-



icantly at 0.81 percentage points and 0.52 percentage points, but the gain was almost offset by a decline in the size effects (-1.28 percentage points). The industry productivity effect was mainly due to the productivity improvement in FIRE and PSTAS. The gain in the price effect was mainly due to the output price improvement associated with manufacturing. The decline in the size effect was mainly due to the decline of manufacturing and FIRE.

The largest positive industry contributors to MFP growth were construction (0.17 percentage points) and manufacturing (0.14 percentage points). The contribution of the former was driven by the price effect (0.09 percentage points) and the size effect (0.13 percentage points). The contribution of the latter was driven by the price effect (0.38 percentage points) and the productivity effect (0.09 percentage points), which was offset by the size effect (-0.30 percentage points).

The largest laggards to MFP growth were FIRE (-0.22 percentage points) and utility (-0.16 percentage points). The former was due to the size effect (-0.38 percentage points), which was partly offset by a positive productivity effect (0.22 percentage points).

## Italy

Like Canada, Italy also experienced a growth acceleration in both labour productivity growth (0.11 percentage points) and MFP growth (0.76 percentage points) over the two sub-periods, although the improvements were smaller compared with Canada (Table 4).

The increase in labour productivity growth was driven by the productivity ef-

fect (0.24 percentage points), which was offset by the price effect (-0.09 percentage points) and the size effect (-0.07 percentage points). The productivity effect was due to the productivity improvement in FIRE (0.24 percentage points) and wholesale and retail trade (0.20 percentage points), offset by productivity deceleration in information and communication (-0.19 percentage points) and utilities (-0.13 percentage points).

The largest industry contributor to the acceleration in labour productivity growth was manufacturing (0.36 percentage points), followed by wholesale and retail trade (0.22 percentage points). For manufacturing, the contribution was due to the price effect (0.17 percentage points) and the size effect (0.24 percentage points) while for wholesale and retail trade, it was mainly driven by the productivity effect (0.20 percentage points).

The acceleration in MFP was much larger than that in labour productivity. This was due to the productivity effect (0.95 percentage points) and the price effect (0.57 percentage points), which were offset by a negative size effect (-0.79 percentage points). The productivity effect was mainly due to the productivity improvement in wholesale and retail trade (0.28 percentage points) and FIRE (0.27 percentage points). The price effect was due to manufacturing (0.28 percentage points). The negative size effect was mainly due to the shrink of construction (-0.35 percentage points) and FIRE (-0.21 percentage points).

The largest industry contributors were manufacturing (0.49 percentage points) and wholesale and retail trade (0.31 per-

**Table 4: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in Italy, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.02	-0.06	-0.05	0.00	-0.09	0.03	0.03	0.01	0.00	0.07
Mining and quarrying	-0.01	0.00	-0.01	0.00	-0.02	0.04	-0.02	-0.01	0.00	0.01
Manufacturing	0.25	-0.19	-0.37	-0.01	-0.32	0.19	-0.01	-0.14	0.00	0.04
Utilities	0.00	0.04	-0.01	-0.01	0.03	-0.14	0.12	0.03	0.00	0.01
Construction	-0.10	0.10	0.11	0.00	0.11	0.02	0.06	-0.25	-0.01	-0.17
Wholesale and retail trade	0.02	-0.11	-0.05	0.00	-0.14	0.22	-0.09	-0.04	0.00	0.08
Transportation and storage	0.08	-0.01	-0.03	0.00	0.04	-0.04	0.06	0.04	0.00	0.05
Accommodation and food services	-0.05	0.01	0.07	0.00	0.03	0.00	-0.01	0.06	0.00	0.04
Information and communication	0.16	-0.15	0.03	0.00	0.04	-0.03	-0.13	0.01	0.00	-0.15
FIRE	0.09	0.23	0.07	0.00	0.39	0.33	0.04	-0.04	0.00	0.34
PSTAS	-0.22	0.03	0.27	-0.01	0.08	-0.19	0.06	0.18	0.00	0.04
Community social and personal services	-0.06	0.14	0.05	0.00	0.13	-0.02	-0.14	0.18	0.00	0.02
<b>Total Business Sector</b>	0.18	0.04	0.09	-0.04	0.27	0.42	-0.04	0.02	-0.01	0.38
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	-0.01	-0.04	-0.07	0.00	-0.12	0.03	-0.01	0.04	0.0	0.06
Mining and quarrying	-0.01	0.00	-0.02	0.00	-0.03	0.02	-0.03	0.02	0.00	0.01
Manufacturing	-0.10	-0.25	-0.12	-0.03	-0.49	0.03	0.03	-0.06	-0.01	-0.01
Utilities	-0.06	-0.01	0.08	-0.01	0.00	-0.08	0.08	0.01	-0.01	0.00
Construction	-0.03	0.03	0.04	0.00	0.05	0.05	0.08	-0.30	-0.01	-0.19
Wholesale and retail trade	-0.10	-0.10	-0.06	0.00	-0.26	0.18	-0.15	0.02	0.00	0.04
Transportation and storage	0.02	-0.07	0.03	-0.01	-0.02	-0.02	0.00	0.04	0.00	0.03
Accommodation and food services	-0.04	-0.01	0.04	0.00	0.00	0.02	-0.02	0.03	0.00	0.03
Information and communication	0.13	-0.15	0.02	0.00	-0.01	-0.02	-0.01	-0.13	0.00	-0.16
FIRE	-0.11	-0.04	0.38	-0.01	0.22	0.16	-0.05	0.17	0.00	0.28
PSTAS	-0.14	0.05	0.07	0.00	-0.02	-0.02	0.11	-0.07	0.00	0.02
Community social and personal services	-0.19	0.03	0.17	-0.01	0.01	-0.01	-0.02	0.02	0.00	-0.02
<b>Total Business Sector</b>	-0.63	-0.55	0.58	-0.07	-0.67	0.32	0.02	-0.22	-0.03	0.09

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

centage points). For manufacturing, it was mainly due to the price effect (0.28 percentage points), followed by the productivity effect (0.13 percentage points). For wholesale and retail trade, it was mainly due to the productivity effect (0.28 percentage points).

## Japan

Japan also experienced an acceleration in MFP growth (0.54 percentage points), but its labour productivity growth declined by 0.32 percentage points) (Table 5).

The decline in labour productivity growth was driven by the price effect (-0.57 percentage points) and the size effect (-0.30

percentage points), which was partially offset by an increase in productivity effect (0.49 percentage points). The overall negative price effect was mainly attributable to FIRE (-0.41 percentage points), and the overall positive productivity effect was largely attributable to FIRE (0.39 percentage points) and construction (0.36 percentage points), offset by a decline in the productivity effect in manufacturing.

The largest industry contributor to the deceleration in labour productivity growth was FIRE (-0.25 percentage points), followed by community, social and personal services (-0.16 percentage points) and mining (-0.15 percentage points). For FIRE,

**Table 5: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in Japan, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.03	-0.01	-0.04	0.00	-0.02	0.02	0.03	-0.03	0.00	0.01
Mining and quarrying	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
Manufacturing	0.64	0.08	-0.28	-0.06	0.38	0.29	0.11	-0.15	-0.01	0.23
Utilities	0.64	0.08	-0.28	-0.06	0.38	0.29	0.11	-0.15	-0.01	0.23
Construction	-0.15	0.12	-0.10	-0.01	-0.13	0.21	0.05	0.02	0.00	0.28
Wholesale and retail trade	0.31	0.15	-0.07	0.00	0.38	0.37	-0.04	-0.05	0.00	0.29
Transportation and storage	-0.01	0.08	0.07	0.00	0.14	0.05	0.06	0.00	0.00	0.11
Accommodation and food services	-0.08	0.05	0.03	0.00	-0.01	0.04	0.01	-0.02	0.00	0.03
Information and communication	0.10	-0.05	0.15	0.00	0.20	0.09	-0.08	0.06	0.00	0.06
FIRE	0.02	0.12	0.12	-0.01	0.26	0.42	-0.28	-0.09	-0.02	0.01
PSTAS	-0.01	0.00	0.01	0.00	0.00	0.01	0.01	-0.02	0.00	0.00
Community social and personal services	0.11	0.00	0.30	0.00	0.41	-0.09	0.08	0.27	0.00	0.25
<b>Total Business Sector</b>	0.93	0.52	0.26	-0.10	1.61	1.42	-0.05	-0.04	-0.04	1.29
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.00	-0.02	-0.02	0.00	-0.04	0.00	0.00	0.01	0.00	0.00
Mining and quarrying	0.00	0.00	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
Manufacturing	0.01	-0.26	0.30	-0.03	0.02	0.00	0.29	-0.14	-0.04	0.12
Utilities	-0.03	-0.05	0.04	0.00	-0.04	-0.01	-0.01	0.04	-0.01	0.00
Construction	-0.10	0.13	-0.25	-0.01	-0.23	0.05	-0.03	0.24	0.00	0.25
Wholesale and retail trade	-0.10	0.01	0.25	-0.01	0.15	0.20	0.06	-0.06	0.00	0.20
Transportation and storage	-0.04	0.05	0.05	0.00	0.06	-0.03	0.08	0.03	0.00	0.08
Accommodation and food services	-0.10	0.07	-0.03	0.00	-0.06	0.03	-0.01	-0.01	0.00	0.01
Information and communication	-0.01	0.00	0.14	-0.01	0.12	0.02	-0.01	0.03	0.00	0.03
FIRE	-0.17	0.19	0.10	-0.01	0.11	0.31	-0.23	-0.10	-0.01	-0.03
PSTAS	0.00	0.00	-0.01	0.00	-0.02	-0.01	0.00	0.01	0.00	0.00
Community social and personal services	0.08	-0.02	0.19	-0.01	0.24	-0.01	0.15	0.04	0.00	0.19
<b>Total Business Sector</b>	-0.46	0.11	0.74	-0.08	0.31	0.55	0.29	0.09	-0.07	0.85

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

the decline was due to the price effect (-0.41 percentage points) and the size effect (-0.22 percentage points), which was offset by its positive productivity effect (0.39 percentage points).

Unlike labour productivity, MFP accelerated by 0.55 percentage points over the two sub-periods. The acceleration was largely due to the productivity effect (1.01 percentage points), which were partially offset by a negative size effect (-0.65 percentage points). The productivity effect was mainly due to the productivity improvement in FIRE (0.47 percentage points) and in wholesale and retail trade (0.31 percentage points). The negative size

effect was mainly due to the shrink of manufacturing (-0.44 percentage points) and wholesale and retail trade (-0.30 percentage points).

The largest industry contributor was construction (0.48 percentage points). The contribution was mainly due to the size effect (0.49 percentage points).

## United Kingdom

The United Kingdom experienced a sharp slowdown in both labour productivity growth (-1.43 percentage points) and MFP growth (-0.66 percentage points) (Table 6). The slowdown in labour productivity was mainly due to the indus-

**Table 6: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in the UK, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.02	-0.02	0.00	-0.01	-0.01	0.00	0.02	-0.03	-0.01	-0.02
Mining and quarrying	0.08	0.04	-0.05	0.00	0.08	-0.28	0.01	0.03	-0.01	-0.25
Manufacturing	0.57	-0.27	-0.57	-0.02	-0.29	0.18	-0.06	-0.17	0.00	-0.06
Utilities	-0.01	-0.01	0.05	-0.01	0.03	0.03	0.02	0.01	-0.01	0.04
Construction	0.05	0.06	0.02	0.00	0.13	0.02	0.11	-0.03	0.00	0.09
Wholesale and retail trade	0.41	-0.17	-0.09	-0.01	0.14	0.16	-0.15	-0.09	0.00	-0.08
Transportation and storage	0.10	-0.04	-0.03	0.00	0.02	0.09	0.01	-0.03	0.00	0.08
Accommodation and food services	-0.01	0.02	0.02	0.00	0.03	0.05	0.01	0.04	0.00	0.10
Information and communication	0.36	-0.25	0.03	-0.02	0.12	0.19	-0.17	0.07	0.00	0.08
FIRE	0.26	-0.06	0.16	0.01	0.38	0.56	-0.20	-0.27	-0.02	0.08
PSTAS	0.20	-0.04	0.16	0.00	0.32	-0.06	0.03	0.26	0.00	0.23
Community social and personal services	0.29	0.00	0.33	0.00	0.63	-0.32	0.13	0.04	0.00	-0.16
<b>Total Business Sector</b>	2.31	-0.75	0.05	-0.04	1.57	0.61	-0.25	-0.16	-0.06	0.14
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.02	-0.01	-0.02	-0.01	-0.01	-0.02	0.01	0.00	0.00	-0.02
Mining and quarrying	0.05	0.00	0.03	-0.02	0.06	-0.30	0.23	-0.14	-0.03	-0.25
Manufacturing	0.15	-0.18	-0.38	0.00	-0.41	0.06	-0.05	-0.08	-0.01	-0.07
Utilities	-0.04	0.01	0.06	-0.02	0.01	0.00	0.04	0.02	-0.01	0.04
Construction	-0.04	0.08	0.04	-0.01	0.07	-0.06	0.09	0.06	0.00	0.08
Wholesale and retail trade	0.20	-0.08	-0.08	0.00	0.03	0.02	-0.05	-0.07	0.00	-0.10
Transportation and storage	0.01	-0.01	-0.03	0.00	-0.02	0.05	-0.03	0.06	0.00	0.07
Accommodation and food services	-0.04	0.05	-0.01	0.00	0.00	0.09	-0.03	0.04	0.00	0.10
Information and communication	0.21	-0.16	0.02	-0.01	0.06	0.19	-0.13	0.02	0.00	0.07
FIRE	-0.11	0.14	0.19	-0.03	0.19	0.50	-0.29	-0.15	-0.02	0.05
PSTAS	0.01	0.05	0.15	0.00	0.21	-0.01	0.05	0.17	0.00	0.21
Community social and personal services	0.07	-0.02	0.43	0.48	-0.46	0.36	-0.07	-0.01	-0.19	
<b>Total Business Sector</b>	0.48	-0.12	0.41	-0.10	0.67	0.07	0.19	-0.17	-0.08	0.01

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

try labour productivity effect, driven by many industries, including community, social and personal services (-0.62 percentage points), manufacturing (-0.39 percentage points) and mining (-0.36 percentage points).

The largest industry contributor to the labour productivity growth decline was community, social and personal services (-0.79 percentage points), mainly due to a decline in labour productivity (-0.62 percentage points) and a decline in the size of the industry (-0.29 percentage points). The other laggards included mining (-0.32 percentage points) and FIRE (-0.30 percentage points).

The decline in MFP growth was also relatively large (-0.66 percentage points). This was mainly driven by a decline in the size effect (-0.58 percentage points) and in the productivity effects (-0.41 percentage points), offset partly by a positive gain in the price effect (0.31 percentage points). The decline in the size effect was mainly due to the decline of community, social and personal services (-0.50 percentage points) and FIRE (-0.34 percentage points) while the industry productivity effect was mainly due to the decline in productivity of community, social and personal services (-0.54 percentage points) and mining (-0.35 percentage points). Over

these two sub-periods, the productivity effect from FIRE increased substantially 0.62 percentage points.

The largest positive industry contributors to MFP growth were manufacturing (0.34 percentage points) and accommodation and food services (0.10 percentage points). The contribution of the former was driven by the size effect (0.30 percentage points). The largest laggards to MFP growth were community, social and personal services (-0.66 percentage points) and utility (-0.31 percentage points). The former was mainly due to the productivity effect (-0.54) and the size effect (-0.50 percentage points), which was partly offset by a positive price effect (0.37 percentage points).

## United States

Like the United Kingdom, the United States experienced a deceleration in both aggregate labour productivity and MFP growth. In fact, the slowdown in productivity growth in the United States was the largest among G7 countries. The drop in aggregate labour productivity growth rate was almost 2 percentage points, from 2.21 percent per year in 2000-2010 to only 0.28 percent per year in 2011-2015 (Table 7). To a lesser extent, its MFP growth rate also declined 0.51 percentage points, from 0.79 percent per year to 0.28 percent per year.

The decline in labour productivity growth was entirely due to the productivity effect (-2.13 percentage points), driven mainly by manufacturing (-0.96 percentage points), FIRE (-0.59 percentage points), and information and communication (-0.29 percentage points).

The largest industry contributors were

FIRE (-0.49 percentage points), community, social and Personal services (-0.43 percentage points) and mining and quarrying (-0.28 percentage points). The weak performance of FIRE was due to the productivity effect (-0.59 percentage points) and the size effect (-0.19 percentage points), which were partly offset by a positive price effect (0.28 percentage points). For community, social and personal services was due to the price effect (-0.16 percentage points) and the size effect (-0.30 percentage points). Finally, for mining and quarrying, its weak performance was due to the price effect (-0.39 percentage points), which was partly offset by a positive productivity effect (0.12 percentage points).

Like labour productivity, the decline in MFP growth rate was entirely due to the productivity effect (-1.07 percentage points), which was offset by a positive price effect (0.28 percentage points) and a positive size effect (0.14 percentage points). The productivity effect was mainly driven by manufacturing (-0.74 percentage points).

The largest industry contributors to the MFP growth deceleration were mining and quarrying (-0.25 percentage points) and community, social and personal services (-0.25 percentage points). The weak performance of mining and quarrying was due to the price effect (-0.16 percentage points) and the size effect (-0.20 percentage points), and the weak performance of community, social and personal services was due to the price effect (-0.12 percentage points) and the size effect (-0.16 percentage points).

On the other hand, manufacturing and construction contributed positively to oth-

**Table 7: Industry Contribution by Component to Aggregate Labour Productivity and MFP Growth in the United States, 2000-2010 and 2011-2015 (Average percentage points per year)**

Effects on Aggregate Labour Productivity										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.07	-0.01	-0.01	0.00	0.04	0.00	-0.01	-0.01	0.00	-0.02
Mining and quarrying	0.02	0.13	0.05	-0.02	0.19	0.14	-0.26	0.04	-0.01	-0.09
Manufacturing	0.89	-0.30	-0.53	-0.04	0.03	-0.08	0.09	-0.06	0.00	-0.05
Utilities	0.00	0.05	0.01	-0.01	0.05	-0.04	0.00	-0.02	0.00	-0.06
Construction	-0.06	0.17	-0.05	0.00	0.05	-0.04	0.08	0.06	0.00	0.10
Wholesale and retail trade	0.31	-0.06	-0.03	-0.01	0.20	0.19	-0.02	-0.09	0.00	0.07
Transportation and storage	0.05	0.02	-0.02	0.00	0.05	-0.09	0.07	0.03	0.00	0.02
Accommodation and food services	0.02	0.03	0.02	0.00	0.07	-0.02	0.03	0.04	0.00	0.06
Information and communication	0.41	-0.18	-0.04	-0.02	0.17	0.12	-0.14	0.02	0.00	-0.01
FIRE	0.62	-0.08	0.06	0.00	0.60	0.03	0.21	-0.12	0.00	0.11
PSTAS	0.18	0.07	0.08	0.00	0.33	0.11	-0.07	0.10	0.00	0.14
Community social and personal services	0.03	0.17	0.22	0.01	0.43	0.07	0.01	-0.08	0.00	0.01
<b>Total Business Sector</b>	2.53	0.02	-0.24	-0.10	2.21	0.40	0.00	-0.09	-0.02	0.28
Effects on Aggregate MFP Growth										
	2000-2010					2011-2015				
	Productivity	Price	Size	Interaction	Total	Productivity	Price	Size	Interaction	Total
Agriculture, forestry and fishing	0.06	-0.03	0.00	0.00	0.02	-0.01	-0.01	0.00	0.00	-0.02
Mining and quarrying	0.09	0.00	0.10	-0.03	0.16	0.17	-0.16	-0.10	0.00	-0.09
Manufacturing	0.51	-0.37	-0.28	-0.05	-0.19	-0.23	0.32	-0.11	-0.03	-0.05
Utilities	0.02	0.04	0.01	-0.05	0.02	-0.03	0.08	-0.10	-0.01	-0.06
Construction	-0.09	0.17	-0.10	0.00	-0.03	-0.04	0.06	0.08	0.00	0.10
Wholesale and retail trade	0.02	0.04	-0.05	-0.02	0.00	0.12	-0.07	0.03	0.00	0.07
Transportation and storage	0.02	-0.01	-0.01	-0.01	0.00	-0.11	0.12	0.01	0.00	0.02
Accommodation and food services	-0.01	0.04	0.00	0.00	0.02	-0.02	0.02	0.06	0.00	0.06
Information and communication	0.23	-0.09	-0.04	-0.02	0.07	0.05	-0.06	0.01	0.00	-0.01
FIRE	0.17	0.05	0.09	-0.02	0.29	0.02	0.07	0.03	-0.01	0.11
PSTAS	0.00	0.10	0.07	-0.01	0.17	0.00	-0.03	0.17	0.00	0.14
Community social and personal services	-0.12	0.19	0.19	0.00	0.25	-0.09	0.07	0.03	0.00	0.01
<b>Total Business Sector</b>	0.89	0.13	-0.03	-0.21	0.79	-0.18	0.41	0.11	-0.06	0.28

Note: FIRE stands for financial, insurance and real estate activities; PSTAS stands for professional, scientific, technical, administrative, and support service activities.

erwise more miserable MFP performance. They increased MFP growth rate by 0.14 and 0.13 percentage points, respectively. For manufacturing, it was due to the price effect (0.69 percentage points) and the size effect (0.17 percentage points), which were offset by a negative productivity effect (-0.74 percentage points). For construction, it was mainly due to the size effect (0.19 percentage points).

The sharp decline in productivity growth in the United States has been a great concern to researchers and policy makers. Despite extensive research, however, the causes of the productivity slowdown are still subject to debate. Various con-

jectures and counter arguments associated with both supply and demand factors have been put forward. Some argued that the slowdown was due to the slowdown in important innovation (Gordon (2012) or the waning of the ICT-related productivity boom which took place in the second half of 1990s (for example, McKinsey Global Institute. 2018). But the argument has been challenged by Sichel (2016) and no solid evidence has been found to support it (Byrne *et al.*, 2018, Syverson, 2013). The productivity slowdown has also been attributed to measurement issues such that current output estimates do not fully capture the services provided by using ICTs and other

related technologies. However, subsequent research shows that the measurement issue was not an important factor (for example, Byrne *et al.*, 2016; Ahmad and Schreyer, 2016; Syverson, 2016).