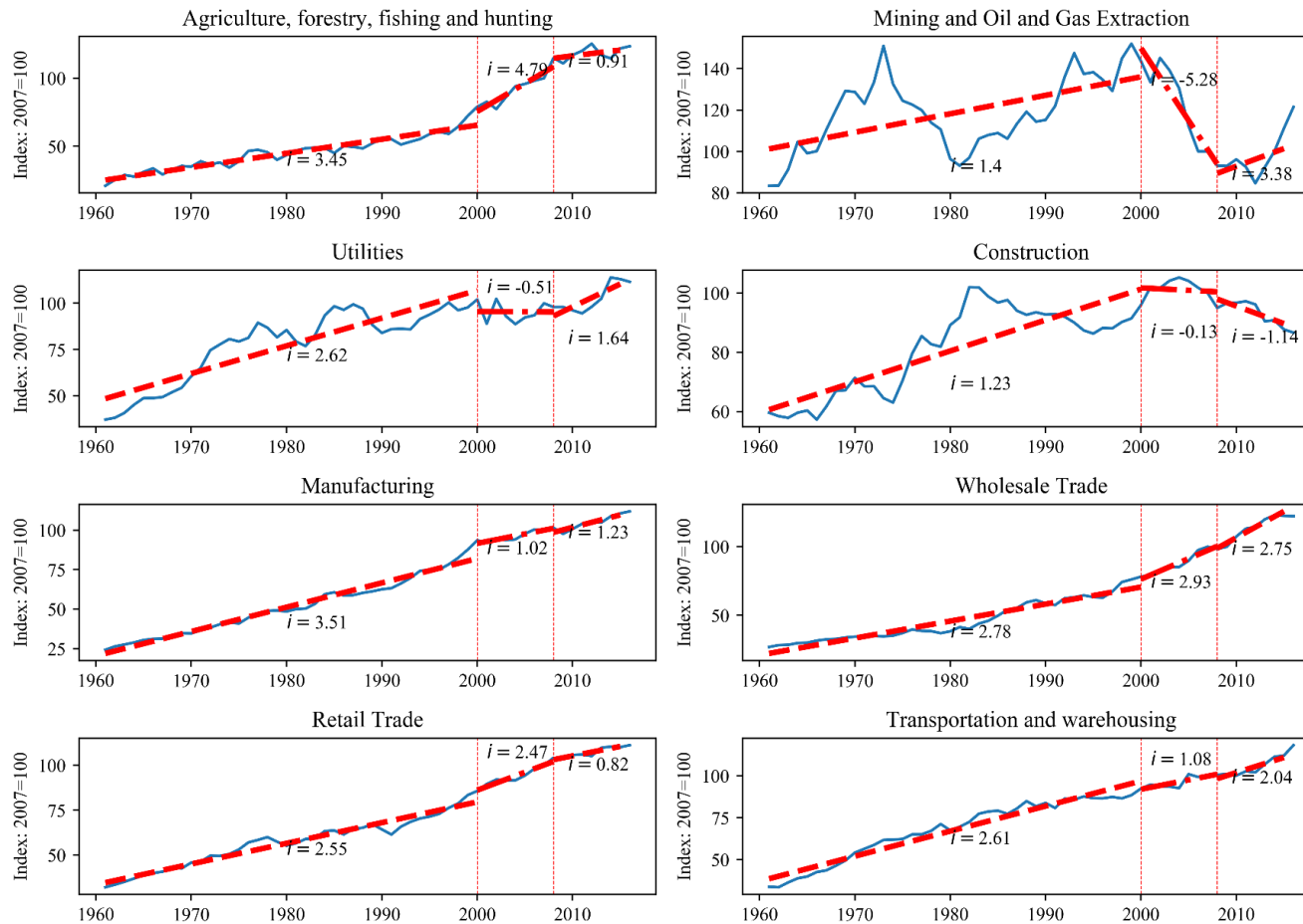


Appendix

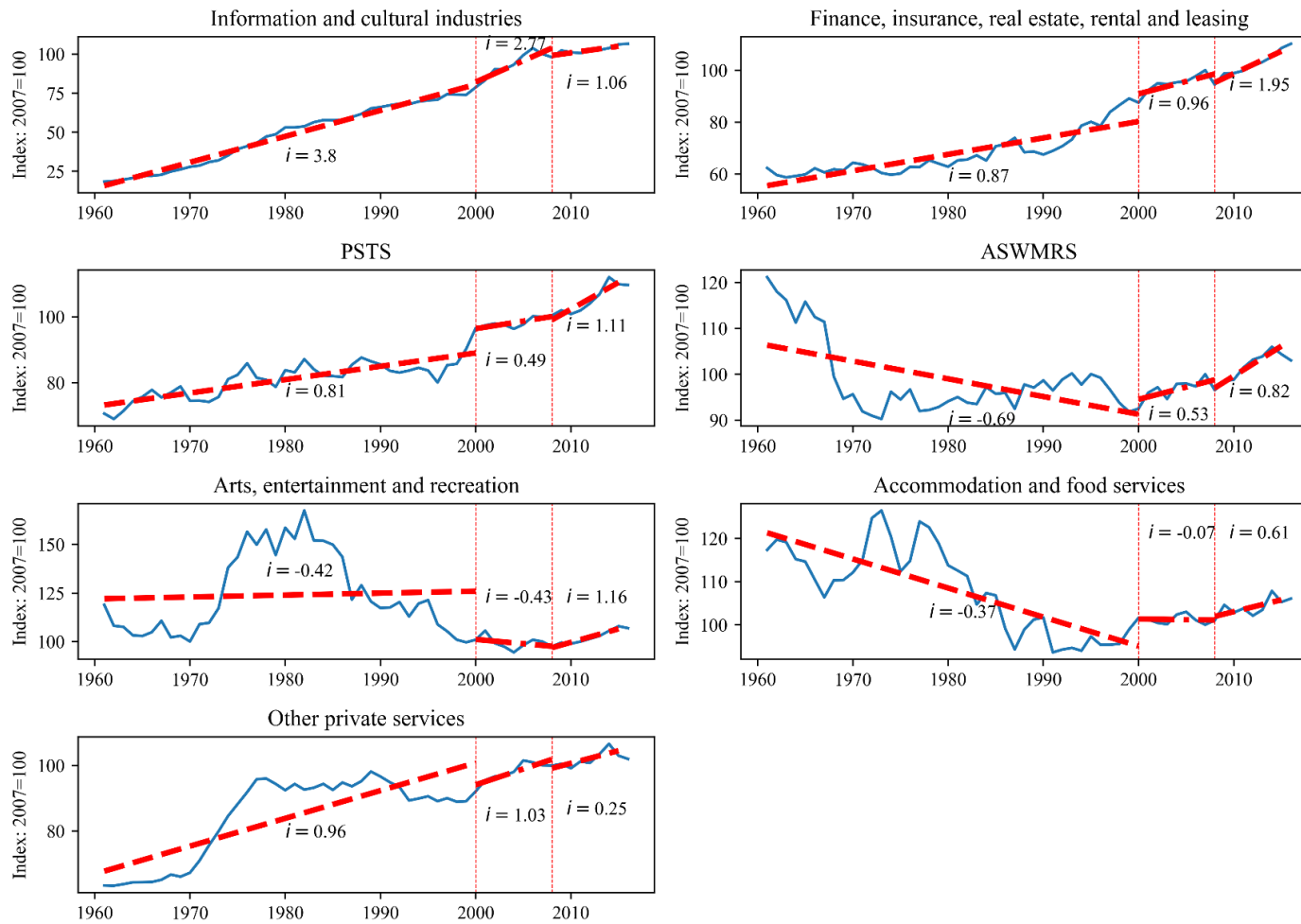
I. Charts

Appendix Chart 1: Labour Productivity by Industry in Canada, 1961 – 2016



Note: ASWMRS stands for administrative and support, waste management and remediation services. PSTS stands for professional, scientific and technical services. In each sub-plot, the trendline spans from 1961 to 2000, 2000 to 2008 and 2008 to 2016 from the left to the right. i near each trendline indicates the compound annual growth rate in the sub-period. Source: CANSIM Table 383-0021.

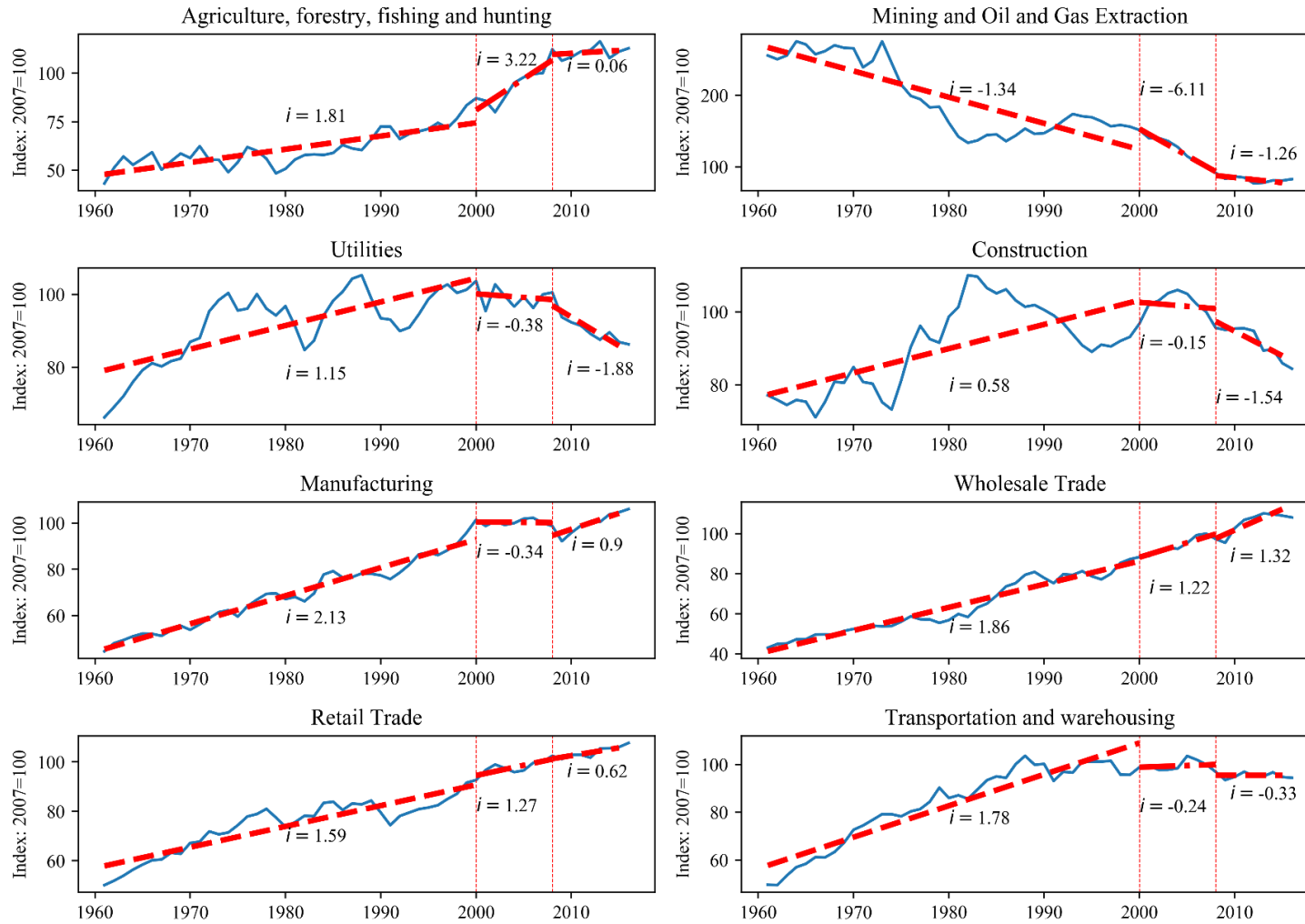
Appendix Chart 1: Labour Productivity by Industry in Canada, 1961 – 2016 (cont'd)



Note: ASWMRS stands for administrative and support, waste management and remediation services. PSTS stands for professional, scientific and technical services. In each sub-plot, the trendline spans from 1961 to 2000, 2000 to 2008 and 2008 to 2016 from the left to the right. i near each trendline indicates the compound annual growth rate in the sub-period.

Source: CANSIM Table 383-0021.

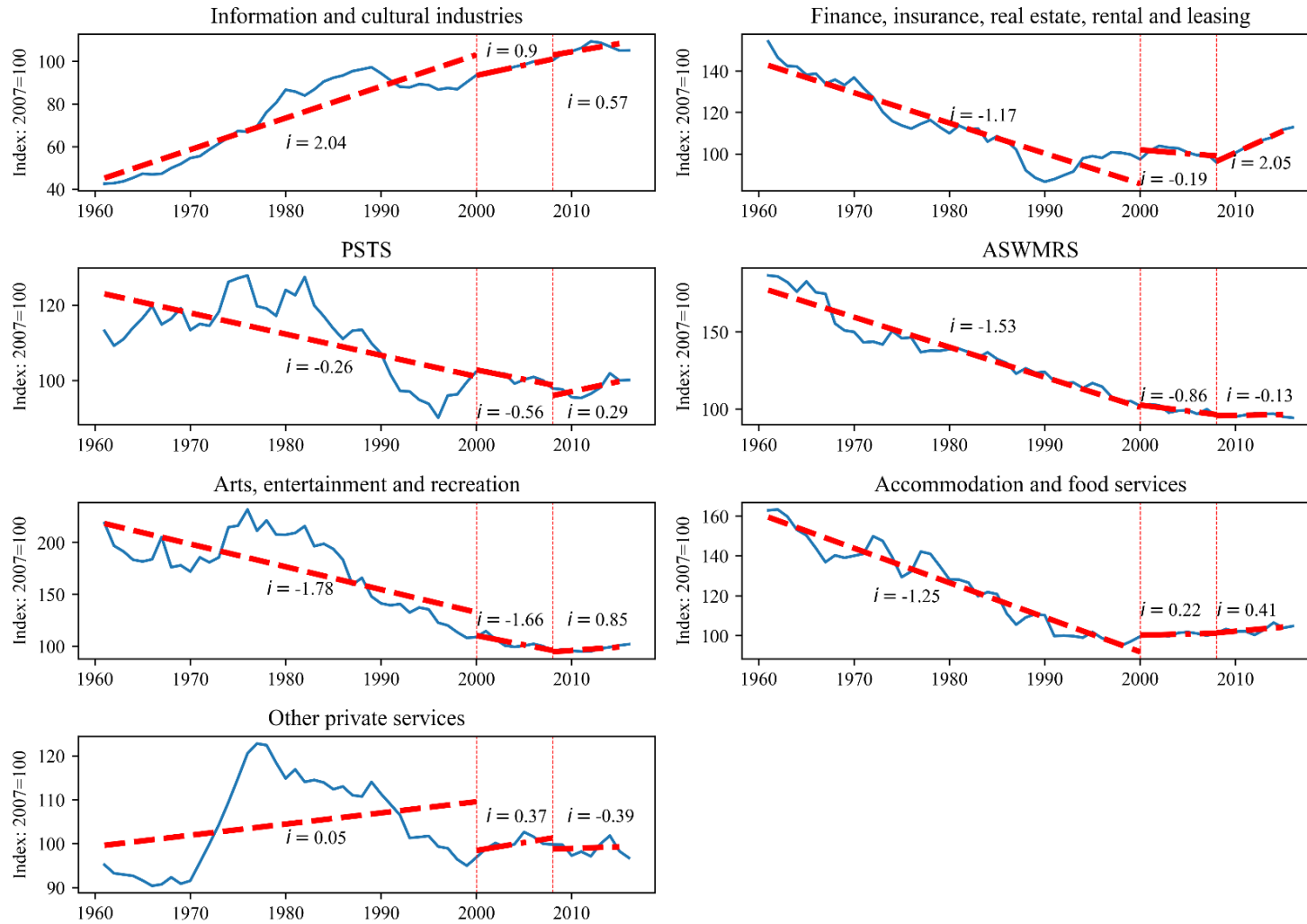
Appendix Chart 2: Total Factor Productivity by Industry in Canada, 1961 - 2016



Note: ASWMRS stands for administrative and support, waste management and remediation services. PSTS stands for professional, scientific and technical services. In each sub-plot, the trendline on the left spans from 1961 to 2016 and the right one spans from 2000 to 2016. i near each trendline indicates the compound annual growth rate in the sub-period.

Source: CANSIM Table 383-0021.

Appendix Chart 2: Total Factor Productivity by Industry in Canada, 1961 – 2016 (cont'd)



Note: ASWMRS stands for administrative and support, waste management and remediation services. PSTS stands for professional, scientific and technical services. In each sub-plot, the trendline on the left spans from 1961 to 2016 and the right one spans from 2000 to 2016. i near each trendline indicates the compound annual growth rate in the sub-period.

Source: CANSIM Table 383-0021.

II. Tables

Appendix Table 1: Compound Annual Growth Rates of Labour Productivity by Industry in Canada, 1961 – 2016

	1961 - 2016	1961 - 1973	1961 - 2000	1973 - 2000	1973 - 1981	1981 - 1989	1989 - 2000	1997 - 2016
Business sector industries	1.87	3.5	2.27	1.73	1.82	1.51	1.83	1.26
Agriculture, forestry, fishing and hunting	3.27	5.1	3.45	2.73	2.59	1.36	3.84	3.95
Mining and oil and gas extraction	0.69	5.07	1.4	-0.18	-5.86	2.61	2.09	-0.32
Utilities	2.01	6.33	2.62	1.01	0.26	1.34	1.32	0.56
Construction	0.68	0.66	1.23	1.48	4.51	0.23	0.23	-0.09
Manufacturing	2.81	4.31	3.51	3.15	2.7	2.56	3.91	1.89
Wholesale trade	2.79	2.14	2.78	3.06	2.25	4.99	2.27	3.2
Retail trade	2.29	3.69	2.55	2.05	1.69	2.17	2.23	2.01
Transportation and warehousing	2.3	5.15	2.61	1.51	1.51	2.04	1.11	1.61
Information and cultural industries	3.25	4.74	3.8	3.39	6.52	2.62	1.72	1.91
Finance, insurance, real estate, rental and leasing	1.04	-0.26	0.87	1.38	0.97	0.64	2.23	1.44
Professional, scientific and technical services	0.8	0.58	0.81	0.91	1.19	0.49	1.01	1.33
Administrative and support, waste management and remediation services	-0.29	-2.43	-0.69	0.09	0.65	0.27	-0.44	0.34
Arts, entertainment and recreation	-0.19	-0.12	-0.42	-0.55	3.38	-2.92	-1.61	0.08
Accommodation and food services	-0.18	0.63	-0.37	-0.81	-1.45	-1.32	0.04	0.56
Other private services	0.87	1.95	0.96	0.53	2.09	0.49	-0.58	0.66
	1981 - 2000	2000 - 2016	(a)	2000 - 2008	2008 - 2016	(b)		
Business sector industries	1.7	0.88	-0.82	0.79	0.97	0.18		
Agriculture, forestry, fishing and hunting	2.79	2.83	0.04	4.79	0.9	-3.89		
Mining and oil and gas extraction	2.31	-1.04	-3.35	-5.28	3.38	8.66		
Utilities	1.33	0.56	-0.77	-0.51	1.64	2.15		
Construction	0.23	-0.64	-0.87	-0.13	-1.14	-1.01		
Manufacturing	3.34	1.12	-2.22	1.02	1.23	0.21		
Wholesale trade	3.41	2.84	-0.57	2.93	2.75	-0.18		
Retail trade	2.21	1.64	-0.57	2.47	0.82	-1.65		
Transportation and warehousing	1.5	1.56	0.06	1.08	2.04	0.96		
Information and cultural industries	2.1	1.91	-0.19	2.77	1.06	-1.71		
Finance, insurance, real estate, rental and leasing	1.55	1.45	-0.10	0.96	1.95	0.99		
Professional, scientific and technical services	0.79	0.8	0.01	0.49	1.11	0.62		
Administrative and support, waste management and remediation services	-0.14	0.68	0.82	0.53	0.82	0.29		
Arts, entertainment and recreation	-2.16	0.36	2.52	-0.43	1.16	1.59		
Accommodation and food services	-0.54	0.27	0.81	-0.07	0.61	0.68		
Other private services	-0.13	0.64	0.77	1.03	0.25	-0.78		

Note: Column (a) is the difference of growth rates between 2000 – 2016 and 1981 – 2000. Column (b) is the difference of growth rates between 2000 – 2008 and 2008 – 2016.
Source: CANSIM table 383-0021.

Appendix Table 2: Contribution by Sector to Aggregate Labour Productivity Growth, 1961 – 2016 (cont'd)

Compound Annual Growth Rate (100%)	1981 - 2000				2000 - 2016				(a)			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	1.6	1.85	-0.05	-0.3	0.91	0.98	0.09	-0.17	-0.69	-0.87	0.14	0.13
Agriculture, forestry, fishing and hunting	0.18	0.1	0.08	0.01	0.09	0.07	0.03	-0.01	-0.09	-0.03	-0.05	-0.02
Mining and oil and gas extraction	0.18	0.35	-0.12	-0.07	0.03	-0.11	0.18	-0.04	-0.15	-0.46	0.3	0.03
Utilities	0.03	0.06	-0.03	-0.01	0.00	0.02	-0.01	0.00	-0.03	-0.04	0.02	0.01
Construction	0.02	0.03	-0.02	0.02	-0.10	-0.05	0.01	-0.07	-0.12	-0.08	0.03	-0.09
Manufacturing	0.8	0.84	0.06	-0.11	0.18	0.25	-0.05	-0.03	-0.62	-0.59	-0.11	0.08
Wholesale trade	0.18	0.18	-0.02	0.01	0.21	0.22	0.01	-0.02	0.03	0.04	0.03	-0.03
Retail trade	0.16	0.15	0.01	0.00	0.08	0.11	-0.03	0.00	-0.08	-0.04	-0.04	0.00
Transportation and warehousing	0.09	0.09	0.00	0.00	0.10	0.10	0.00	0.00	0.01	0.01	0.00	0.00
Information and cultural industries	0.09	0.07	0.01	0.01	0.07	0.08	-0.01	0.00	-0.02	0.01	-0.02	-0.01
Finance, insurance, real estate, rental and leasing	0.25	0.24	0.01	0.00	0.26	0.22	0.02	0.01	0.01	-0.02	0.01	0.01
Professional, scientific and technical services	0.02	0.04	0.01	-0.03	0.05	0.05	-0.01	0.00	0.03	0.01	-0.02	0.03
ASWMRS	-0.09	00.00	-0.03	-0.05	-0.01	0.02	-0.02	-0.01	0.08	0.02	0.01	0.04
Arts, entertainment and recreation	-0.04	-0.02	0.01	-0.03	0.00	0.00	0.00	0.00	0.04	0.02	-0.01	0.03
Accommodation and food services	-0.04	-0.02	-0.01	-0.01	-0.02	0.01	-0.02	-0.01	0.02	0.03	-0.01	0.00
Other private services	-0.06	-0.01	-0.02	-0.03	0.02	0.04	-0.01	0.00	0.08	0.05	0.01	0.03
	2000 - 2008				2008 - 2016				(b)			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	0.85	0.57	0.64	-0.36	0.97	1.42	-0.36	-0.14	0.12	0.85	-1.00	0.22
Agriculture, forestry, fishing and hunting	0.16	0.12	0.06	-0.02	0.02	0.02	0.00	0.00	-0.14	-0.10	-0.06	0.02
Mining and oil and gas extraction	-0.11	-0.52	0.67	-0.28	0.17	0.41	-0.18	-0.06	0.28	0.93	-0.85	0.22
Utilities	0.00	-0.02	0.02	0.00	0.01	0.05	-0.04	-0.01	0.01	0.07	-0.06	-0.01
Construction	-0.02	-0.01	0.01	-0.02	-0.15	-0.10	-0.01	-0.04	-0.13	-0.09	-0.02	-0.02
Manufacturing	0.14	0.22	-0.07	-0.01	0.16	0.20	-0.03	-0.01	0.02	-0.02	0.04	0.00
Wholesale trade	0.20	0.20	0.01	-0.01	0.20	0.21	0.00	-0.01	0.00	0.01	-0.01	0.00
Retail trade	0.13	0.16	-0.04	0.00	0.04	0.06	-0.02	0.00	-0.09	-0.10	0.02	0.00
Transportation and warehousing	0.07	0.06	0.00	0.00	0.12	0.12	0.00	0.00	0.05	0.06	0.00	0.00
Information and cultural industries	0.11	0.11	0.00	0.00	0.03	0.05	-0.01	0.00	-0.08	-0.06	-0.01	0.00
Finance, insurance, real estate, rental and leasing	0.19	0.14	0.05	0.00	0.32	0.31	0.00	0.00	0.13	0.17	-0.05	0.00
Professional, scientific and technical services	0.02	0.03	-0.01	0.00	0.08	0.08	0.00	0.00	0.06	0.05	0.01	0.00
ASWMRS	-0.05	0.02	-0.06	-0.01	0.04	0.03	0.01	0.00	0.09	0.01	0.07	0.01
Arts, entertainment and recreation	-0.01	0.00	-0.01	0.00	0.02	0.01	0.01	0.00	0.03	0.01	0.02	0.00
Accommodation and food services	0.01	0.00	0.01	0.00	-0.04	0.02	-0.05	-0.01	-0.05	0.02	-0.06	-0.01
Other private services	0.05	0.06	0.00	0.00	-0.01	0.01	-0.02	0.00	-0.06	-0.05	-0.02	0.00

Note: (a) is the difference between 1981 – 2000 and 2000 – 2016. (b) is the difference between 2000 – 2008 and 2008 – 2016.

Source: CANSIM table 383-0021.

Appendix Table 3: Compound Annual Growth Rates of Total Factor Productivity by Industry in Canada, 1961 – 2016

	1961 - 2016	1961 - 1973	1961 - 2000	1973 - 2000	1973 - 1981	1981 - 1989	1989 - 2000	1997 - 2016
Business sector industries	0.46	1.55	0.73	0.37	0.18	0.39	0.5	0.1
Agriculture, forestry, fishing and hunting	1.76	2.09	1.81	1.69	0.02	2.17	2.56	2.4
Mining and oil and gas extraction	-2.03	0.62	-1.34	-2.19	-7.94	0.33	0.33	-3.31
Utilities	0.48	3.34	1.15	0.19	-0.93	1	0.43	-0.91
Construction	0.16	-0.21	0.58	0.93	3.78	0.07	-0.46	-0.37
Manufacturing	1.59	2.71	2.13	1.87	1.28	1.73	2.41	0.97
Wholesale trade	1.69	1.87	1.86	1.85	1.36	3.82	0.8	1.6
Retail trade	1.4	2.91	1.59	1.01	0.84	1.38	0.86	1.25
Transportation and warehousing	1.18	3.98	1.78	0.82	1.2	1.73	-0.1	-0.38
Information and cultural industries	1.66	3.1	2.04	1.57	4.26	1.58	-0.35	0.97
Finance, insurance, real estate, rental and leasing	-0.57	-2.05	-1.17	-0.78	-0.71	-3.08	0.88	0.6
Professional, scientific and technical services	-0.22	0.36	-0.26	-0.53	0.46	-1.36	-0.64	0.22
Administrative and support, waste management and remediation services	-1.23	-2.26	-1.53	-1.21	-0.24	-1.47	-1.72	-0.71
Arts, entertainment and recreation	-1.38	-1.36	-1.78	-1.96	1.51	-4.24	-2.75	-0.86
Accommodation and food services	-0.8	-0.82	-1.25	-1.45	-1.75	-1.8	-0.96	0.39
Other private services	0.03	0.77	0.05	-0.27	1.43	-0.31	-1.47	-0.12
	1981 - 2000	2000 - 2016	(a)	2000 - 2008	2008 - 2016	(b)		
Business sector industries	0.45	-0.2	-0.65	-0.55	0.16	0.71		
Agriculture, forestry, fishing and hunting	2.4	1.63	-0.77	3.22	0.06	-3.16		
Mining and oil and gas extraction	0.33	-3.71	-4.04	-6.11	-1.26	4.85		
Utilities	0.67	-1.13	-1.8	-0.38	-1.88	-1.5		
Construction	-0.24	-0.85	-0.61	-0.15	-1.54	-1.39		
Manufacturing	2.12	0.28	-1.84	-0.34	0.9	1.24		
Wholesale trade	2.06	1.27	-0.79	1.22	1.32	0.10		
Retail trade	1.08	0.94	-0.14	1.27	0.62	-0.65		
Transportation and warehousing	0.67	-0.29	-0.96	-0.24	-0.33	-0.09		
Information and cultural industries	0.45	0.74	0.29	0.9	0.57	-0.33		
Finance, insurance, real estate, rental and leasing	-0.81	0.92	1.73	-0.19	2.05	2.24		
Professional, scientific and technical services	-0.95	-0.14	0.81	-0.56	0.29	0.85		
Administrative and support, waste management and remediation services	-1.61	-0.49	1.12	-0.86	-0.13	0.73		
Arts, entertainment and recreation	-3.38	-0.41	2.97	-1.66	0.85	2.51		
Accommodation and food services	-1.32	0.32	1.64	0.22	0.41	0.19		
Other private services	-0.98	-0.01	0.97	0.37	-0.39	-0.76		

Note: Column (a) is the difference of growth rates between 2000 – 2016 and 1981 – 2000. Column (b) is the difference of growth rates between 2000 – 2008 and 2008 – 2016.

Source: CANSIM table 383-0021.

Appendix Table 4: Contribution By Industry to Aggregate Total Factor Productivity Growth in Canada, 1961 – 2016

Compound Annual Growth Rate (100%)	1961 - 2016				1961 - 1973				1973 - 1981			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	0.53	0.57	0.72	-1.32	1.69	1.14	0.78	-0.17	0.20	-0.28	0.92	-0.49
Agriculture, forestry, fishing and hunting	0.11	0.15	0.04	-0.08	0.23	0.12	0.10	0.01	0.03	0.00	0.03	0.00
Mining and oil and gas extraction	-0.28	-0.22	0.32	-0.46	0.41	0.11	0.30	0.00	-1.12	-1.23	0.44	-0.35
Utilities	0.01	0.01	0.00	0.00	0.11	0.10	0.00	0.01	-0.03	-0.03	0.01	-0.01
Construction	0.02	0.02	-0.01	0.01	-0.03	-0.03	-0.02	0.02	0.37	0.43	0.00	-0.06
Manufacturing	0.40	0.43	0.13	-0.18	0.59	0.58	0.00	0.00	0.44	0.28	0.19	-0.03
Wholesale trade	0.09	0.09	-0.01	0.01	0.04	0.07	-0.03	-0.01	0.08	0.06	0.02	0.00
Retail trade	0.10	0.10	0.00	0.00	0.17	0.16	0.01	0.00	0.05	0.05	0.00	0.00
Transportation and warehousing	0.10	0.08	0.02	0.00	0.33	0.26	0.09	-0.01	0.08	0.07	0.02	0.00
Information and cultural industries	0.03	0.04	-0.01	0.01	0.04	0.05	-0.01	0.00	0.08	0.08	-0.02	0.01
Finance, insurance, real estate, rental and leasing	-0.03	-0.06	0.16	-0.14	-0.14	-0.23	0.22	-0.14	0.00	-0.08	0.11	-0.03
Professional, scientific and technical services	0.01	-0.01	0.06	-0.05	0.04	0.01	0.04	-0.01	0.06	0.01	0.04	0.00
ASWMRS	0.00	-0.01	0.09	-0.09	0.02	-0.02	0.08	-0.04	0.03	0.00	0.03	0.00
Arts, entertainment and recreation	-0.01	0.00	0.02	-0.02	0.01	-0.01	0.02	-0.01	0.03	0.01	0.02	0.00
Accommodation and food services	-0.03	-0.03	0.01	-0.01	-0.03	-0.04	0.02	0.00	-0.03	-0.07	0.05	-0.02
Other private services	0.00	0.00	0.00	0.00	0.04	0.05	-0.01	0.00	0.08	0.08	0.00	0.00
	1981 - 1989				1989 - 2000				1961 - 2000			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	0.50	0.34	0.37	-0.21	0.55	0.59	0.09	-0.13	0.82	0.77	0.71	-0.87
Agriculture, forestry, fishing and hunting	0.10	0.07	0.05	-0.01	0.08	0.07	0.02	-0.02	0.15	0.13	0.06	-0.04
Mining and oil and gas extraction	0.03	0.04	-0.02	0.00	0.04	0.04	-0.01	0.00	-0.14	-0.18	0.17	-0.14
Utilities	0.04	0.04	0.00	0.00	0.02	0.02	0.00	0.00	0.04	0.04	0.00	0.00
Construction	0.00	0.01	-0.01	0.00	-0.07	-0.05	-0.04	0.02	0.07	0.09	-0.03	0.01
Manufacturing	0.43	0.36	0.10	-0.02	0.52	0.52	0.05	-0.05	0.56	0.56	0.11	-0.11
Wholesale trade	0.17	0.17	-0.01	0.00	0.03	0.04	-0.02	0.00	0.08	0.09	-0.02	0.01
Retail trade	0.08	0.08	0.00	0.00	0.05	0.05	0.00	0.00	0.11	0.10	0.00	0.00
Transportation and warehousing	0.12	0.10	0.02	0.00	-0.01	-0.01	-0.01	0.00	0.16	0.13	0.04	-0.01
Information and cultural industries	0.04	0.04	0.00	0.00	-0.03	-0.01	-0.01	-0.01	0.03	0.04	-0.02	0.01
Finance, insurance, real estate, rental and leasing	-0.40	-0.38	0.09	-0.12	0.11	0.12	-0.01	0.00	-0.13	-0.12	0.24	-0.27
Professional, scientific and technical services	-0.02	-0.06	0.05	-0.02	-0.01	-0.03	0.04	-0.03	0.01	-0.01	0.07	-0.06
ASWMRS	0.01	-0.03	0.06	-0.02	-0.03	-0.04	0.03	-0.02	0.00	-0.01	0.11	-0.10
Arts, entertainment and recreation	-0.03	-0.04	0.02	-0.01	-0.02	-0.02	0.01	-0.01	-0.01	-0.01	0.03	-0.03
Accommodation and food services	-0.07	-0.07	0.00	0.00	-0.03	-0.03	0.00	0.00	-0.05	-0.05	0.02	-0.02
Other private services	0.00	-0.02	0.02	0.00	-0.08	-0.08	0.01	-0.01	0.00	0.00	0.01	0.00

Source: CANSIM Tables 383-0021

Appendix table 4: Contribution By Industry to Aggregate Total Factor Productivity Growth in Canada, 1961 – 2016 (cont'd)

Compound Annual Growth Rate (100%)	1981 - 2000				1997 - 2016				(a)			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	0.53	0.54	0.26	-0.29	0.07	0.18	0.21	-0.33	-0.46	-0.36	-0.05	-0.04
Agriculture, forestry, fishing and hunting	0.09	0.08	0.04	-0.03	0.05	0.06	0.01	-0.02	-0.04	-0.02	-0.03	0.01
Mining and oil and gas extraction	0.03	0.04	-0.01	0.00	-0.41	-0.33	0.13	-0.21	-0.44	-0.37	0.14	-0.21
Utilities	0.03	0.03	0.00	0.00	-0.03	-0.03	0.00	0.00	-0.06	-0.06	0.00	0.00
Construction	-0.04	-0.03	-0.03	0.02	-0.02	-0.03	0.01	-0.01	0.02	0.00	0.04	-0.03
Manufacturing	0.50	0.49	0.08	-0.08	0.17	0.20	0.05	-0.08	-0.33	-0.29	-0.03	0.00
Wholesale trade	0.09	0.10	-0.02	0.01	0.11	0.11	0.01	-0.01	0.02	0.01	0.03	-0.02
Retail trade	0.07	0.06	0.00	0.00	0.08	0.08	0.00	0.00	0.01	0.02	0.00	0.00
Transportation and warehousing	0.04	0.04	0.00	0.00	-0.03	-0.02	-0.01	0.00	-0.07	-0.06	-0.01	0.00
Information and cultural industries	0.00	0.01	-0.01	0.00	0.03	0.04	0.00	0.00	0.03	0.03	0.01	0.00
Finance, insurance, real estate, rental and leasing	-0.11	-0.10	0.05	-0.06	0.09	0.09	0.00	0.00	0.20	0.19	-0.05	0.06
Professional, scientific and technical services	-0.02	-0.04	0.07	-0.05	0.02	0.01	0.01	0.00	0.04	0.05	-0.06	0.05
ASWMRS	-0.02	-0.03	0.05	-0.04	-0.02	-0.02	0.01	-0.01	0.00	0.01	-0.04	0.03
Arts, entertainment and recreation	-0.03	-0.03	0.03	-0.03	-0.01	-0.01	0.00	0.00	0.02	0.02	-0.03	0.03
Accommodation and food services	-0.05	-0.05	0.00	0.00	0.01	0.01	0.00	0.00	0.06	0.06	0.00	0.00
Other private services	-0.05	-0.05	0.02	-0.01	-0.01	-0.01	0.00	0.00	0.04	0.04	-0.02	0.01
	2000 - 2008				2008 - 2016				(b)			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	-0.56	-0.50	0.23	-0.29	0.21	0.33	-0.02	-0.10	0.77	0.83	-0.25	0.19
Agriculture, forestry, fishing and hunting	0.06	0.08	0.01	-0.03	0.00	0.00	0.00	0.00	-0.06	-0.08	-0.01	0.03
Mining and oil and gas extraction	-0.66	-0.59	0.18	-0.25	-0.18	-0.13	-0.03	-0.02	0.48	0.46	-0.21	0.23
Utilities	-0.01	-0.01	0.00	0.00	-0.06	-0.06	0.00	0.00	-0.05	-0.05	0.00	0.00
Construction	0.02	-0.01	0.02	0.00	-0.13	-0.14	0.03	-0.02	-0.15	-0.13	0.01	-0.02
Manufacturing	-0.08	-0.07	0.01	-0.01	0.12	0.15	0.00	-0.02	0.20	0.22	-0.01	-0.01
Wholesale trade	0.08	0.08	0.00	0.00	0.10	0.10	0.00	0.00	0.02	0.02	0.00	0.00
Retail trade	0.08	0.08	0.00	0.00	0.04	0.05	0.00	0.00	-0.04	-0.03	0.00	0.00
Transportation and warehousing	0.00	-0.01	0.01	0.00	-0.05	-0.02	-0.03	0.00	-0.05	-0.01	-0.04	0.00
Information and cultural industries	0.03	0.03	0.00	0.00	0.03	0.02	0.00	0.00	0.00	-0.01	0.00	0.00
Finance, insurance, real estate, rental and leasing	-0.03	-0.03	0.00	0.00	0.31	0.33	0.00	-0.02	0.34	0.36	0.00	-0.02
Professional, scientific and technical services	-0.03	-0.04	0.01	0.00	0.02	0.02	0.00	0.00	0.05	0.06	-0.01	0.00
ASWMRS	-0.02	-0.02	0.01	0.00	-0.01	0.00	0.00	0.00	0.01	0.02	-0.01	0.00
Arts, entertainment and recreation	-0.01	-0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.02	0.00	0.00
Accommodation and food services	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00
Other private services	0.02	0.02	0.00	0.00	-0.02	-0.02	0.00	0.00	-0.04	-0.04	0.00	0.00

Note: (a) is the difference between 1981 – 2000 and 2000 – 2016. (b) is the difference between 2000 – 2008 and 2008 – 2016.

Source: CANSIM table 383-0021.

Appendix Table 5: Contribution By Primary, Secondary and Tertiary Industry to Aggregate Labour Productivity Growth, 1961 – 2016

	1961 - 1973				1973 - 1981				1981 - 1989			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	3.46	3.13	0.67	-0.22	1.50	0.98	0.84	-0.29	1.38	1.59	-0.12	-0.11
Primary industries	1.38	1.37	0.06	-0.05	-0.56	-0.87	0.47	-0.19	0.16	0.40	-0.20	-0.05
Secondary industries	1.32	1.28	0.04	0.02	0.95	1.14	-0.09	-0.11	0.51	0.63	-0.09	-0.04
Tertiary industries	1.20	0.84	0.58	-0.19	1.10	0.65	0.47	0.01	0.76	0.62	0.17	-0.02
	1989 - 2000				2000 - 2008				2008 - 2016			
	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE	Total	WSE	RLE	RGE
Business sector industries	1.76	1.94	-0.05	-0.17	0.85	0.57	0.64	-0.36	0.97	1.42	-0.36	-0.14
Primary industries	0.28	0.39	-0.07	-0.04	0.03	-0.40	0.70	-0.31	0.17	0.42	-0.20	-0.07
Secondary industries	0.63	0.97	-0.26	-0.11	-0.03	0.19	-0.18	-0.05	-0.01	0.15	-0.11	-0.06
Tertiary industries	0.93	0.70	0.27	-0.02	0.86	0.76	0.11	0.00	0.82	0.88	-0.05	-0.02

Note: Primary industries include agriculture, forestry, fishing and hunting and mining and gas and oil extraction. Secondary industries include utilities, construction and manufacturing. Remaining industries are tertiary.

Source: CANSIM table 383-0021.

III. Structural Break Tests

We identify and dates structural changes of labour productivity and total factor productivity in Canada statistically. First, we discuss the importance of identifying structural breaks statistically. Then, we explain the econometric model and procedure we use to identify structural changes. We next discuss results of the test and dating structural breaks.

A. Importance of Identifying Structural Changes

Identifying structural changes in labour productivity and total factor productivity has two empirical implications. First, dating structural changes in labour productivity and total factor productivity in Canada helps us narrow down the timeframe for investigating their provincial and industrial counterparts in order to find stylized factors about productivity slowdown in Canada. Second, structural breaks of time-series adversely affect the performance of economic models. For example, failing to recognize structural breaks can lead to forecasting errors for econometric forecasting.

B. Structural Break Identification and Procedures to Date Structural Breaks

We use the following models to detect structural changes of productivity indices in Canada. For each productivity index y_t at time t ,

$$y_t = \alpha + \epsilon_t,$$

where α is the intercept and ϵ_t is the error terms with $E[\epsilon_t] = 0$. Therefore, a structural change occurs if the mean of the time-series changes. We test labour productivity and total factor productivity for each sector at the national level.¹

Our exploratory analysis in suggests that there should be more than one structural change in these time-series. Because we do not know the time when each structural change takes place, we should use a test that can detect multiple structural changes of unknown timing.

Consequently, we first use the supremum Wald test (H_0 : No structural break Vs. H_1 : at least one structural change) with trimming rate of 15% to check against our findings from inspection. Then we use methods developed by Bai and Perron (2003) to date the breaks. Intuitively, we first set the minimal size of each segment h . Then we divide the time-series into m -partitions where $m = 1, 2, \dots, \lfloor T/h \rfloor$. Then we find the partition (T_s, \dots, T_m) with the minimum squared sum of residuals. Then we conduct an F-test to test the break points. In this paper, we use package *strucchange* from R to implement this method.

¹ We do not test provincial data for structural break because the sample size is very small (20 observations from 1997 to 2016).

The supremum Wald tests show that there is very strong evidence for structural changes in TFP and labour productivity in Canada between 1961 to 2016, 1961 to 1999 and 2000 onwards. For TFP in Canada, p-values of the test for most industries are 0.00 for the period from 1961 to 2016, 1961 to 1999 and 2000 to 2016. All exceptions are manufacturing (0.01), professional, scientific and technical services (0.01) and other private sector (0.57) between 2000 and 2016. Moreover, for labour productivity in Canada, p-values of the supremum Wald tests for all industries are 0.00 in the above three periods.

We date structural changes in the business sector for labour productivity and total factor productivity from 1961 to 2016. By varying minimal segment sizes (h), years around 2000 or the year of 2000 constantly appears on all sets of breakpoints in business sectors. Therefore, labour productivity and total factor productivity changed structurally around 2000. Chart 5 and Chart 10 show labour productivity indices and total factor productivity indices in Canada with $h = 7$ in dashed vertical lines and red intervals on the horizontal axis being the corresponding 95% confidence interval of each breakpoint.