



Explaining Slower Productivity Growth in Canada: The Role of Falling R&D Intensity

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Presented at the IRPP Symposium “A New Take on Innovation in
Canada: Boosting the Demand Side”

Session on Linkages between Productivity, Trade, and Innovation

Thursday, May 17
10:15am-12:00pm

Outline of Presentation

- I. Introduction
- II. Productivity Trends in Canada: The Post-2000 Slowdown
- III. Factors Explaining Slower Productivity Growth
- IV. Links between Productivity and R&D Spending
- V. Conclusion

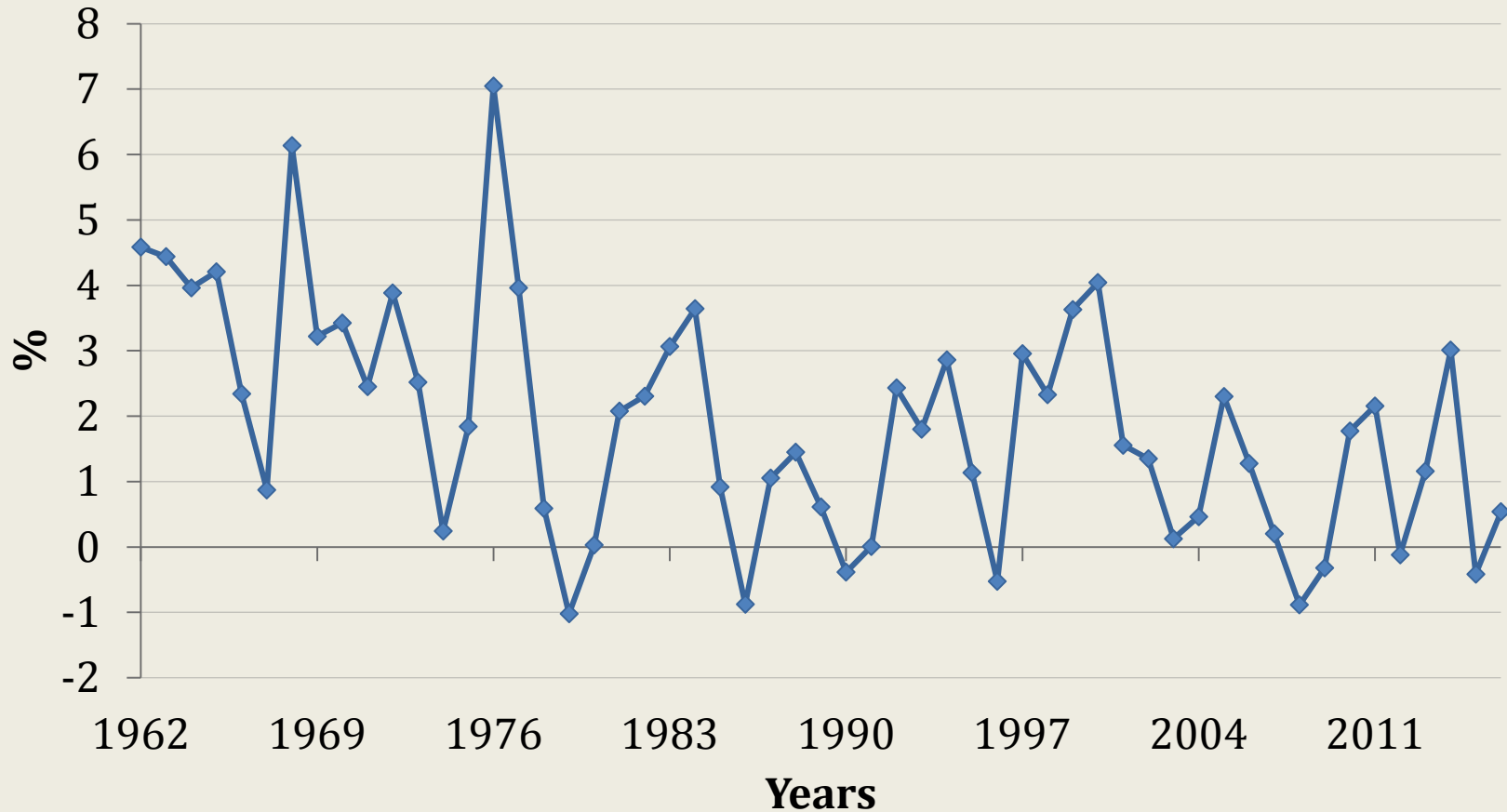
I. Introduction

- Motivation for presentation
- Importance of productivity for economic growth and living standards
- Definitions of productivity (labour productivity, total factor productivity (TFP))
- Focus on business sector
- Long-term versus cyclical productivity developments

II. Productivity Trends in Canada: The Post-2000 Slowdown

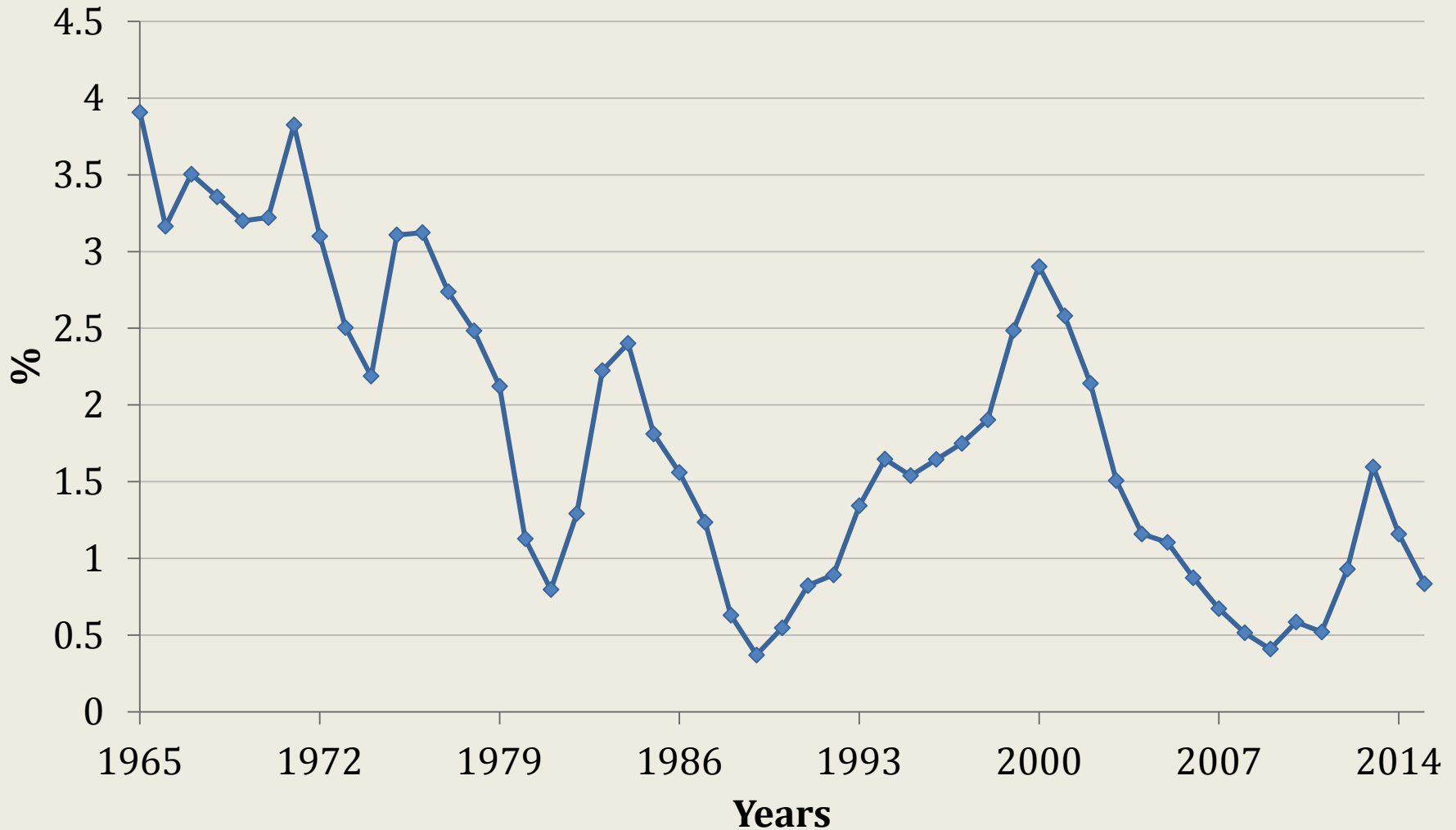
- Business sector trends
- International comparisons
- Trends by industry
- Industry contributions to the slowdown
- Sharing of productivity gains

Business Sector Labour Productivity Growth in Canada, 1962 - 2016

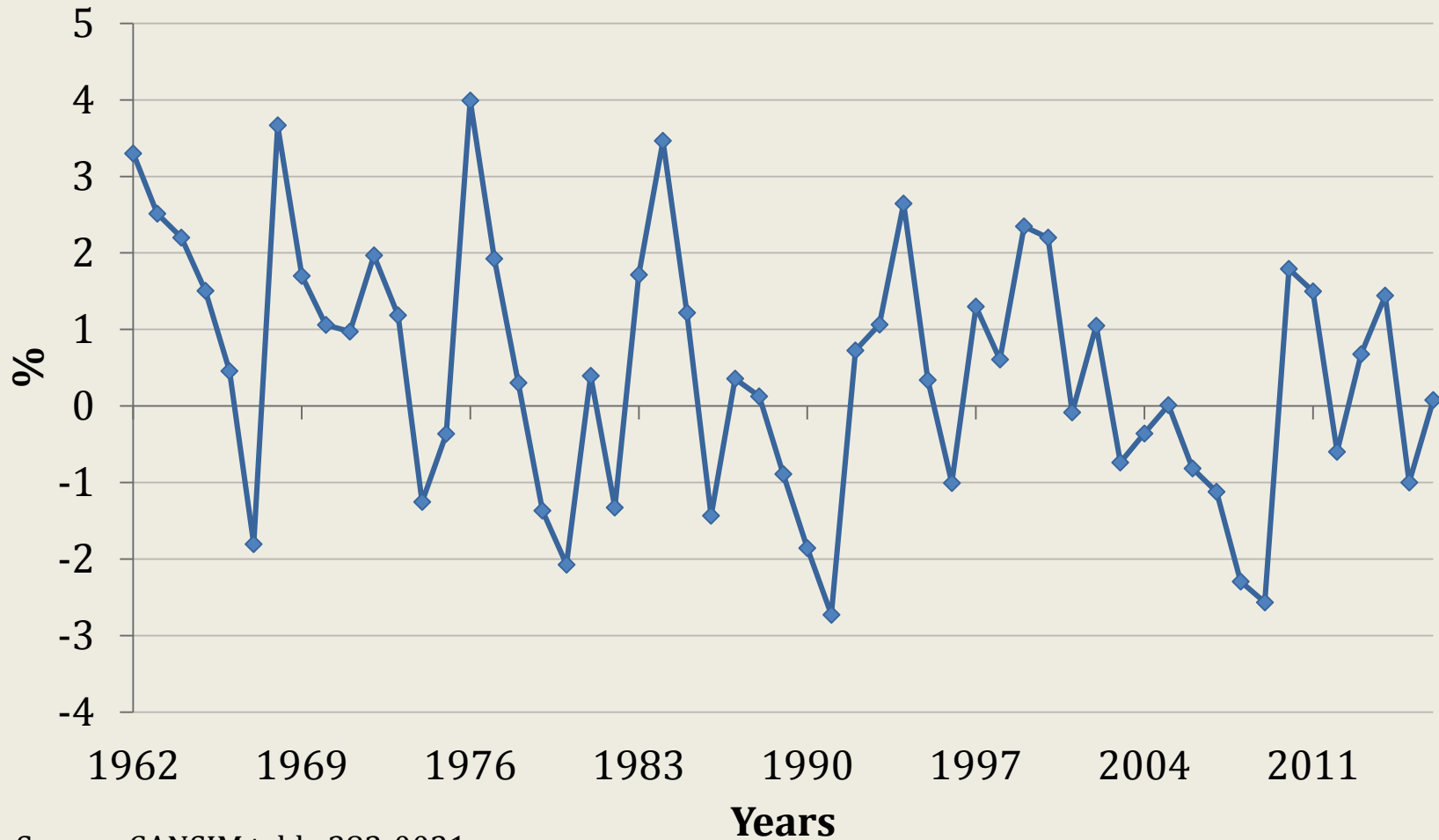


Source: CANSIM table 383-0021

5-Year Moving Average of Business Sector Labour Productivity Growth in Canada, 1965 - 2016

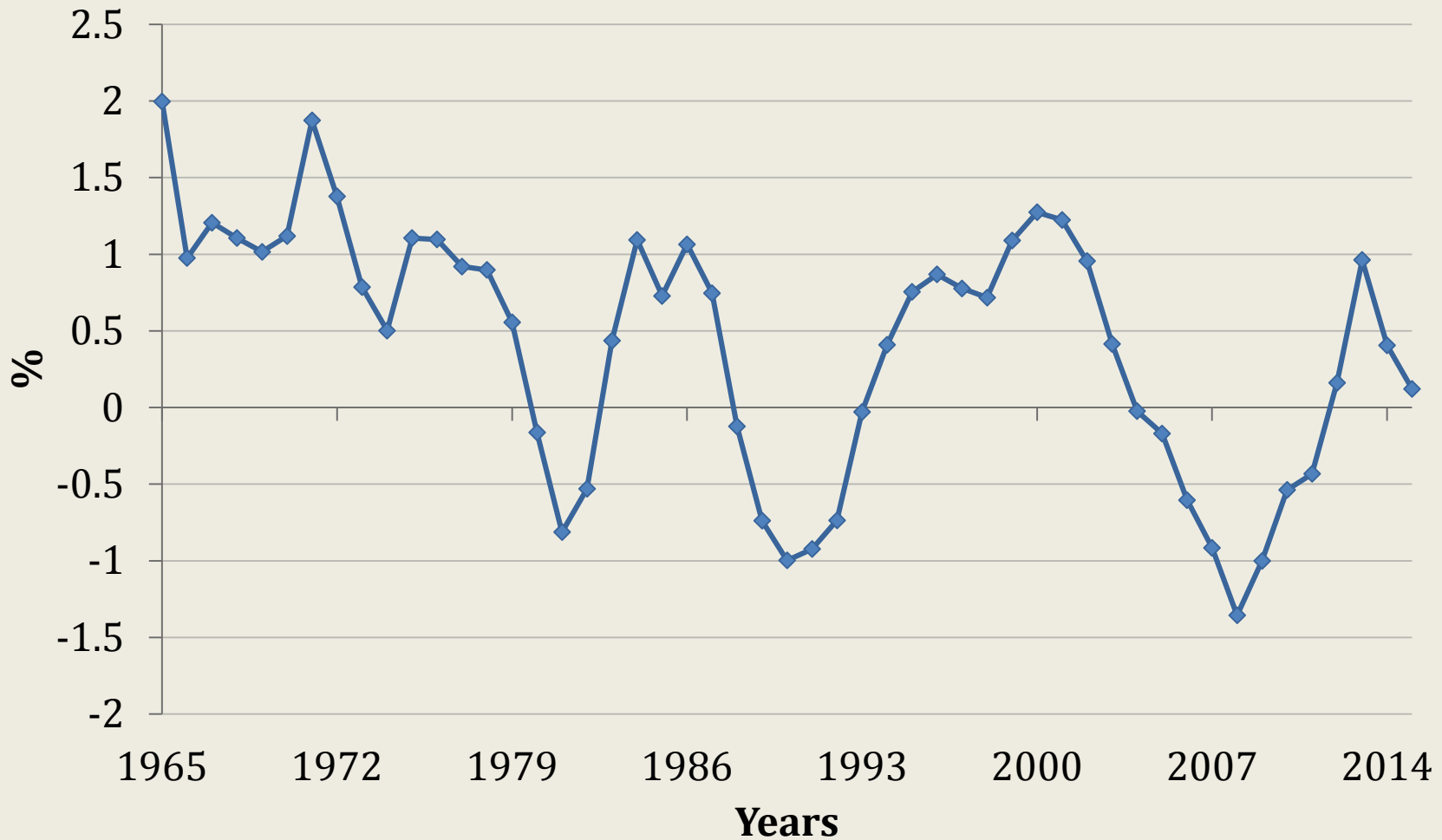


Business Sector Total Factor Productivity Growth in Canada, 1962 - 2016



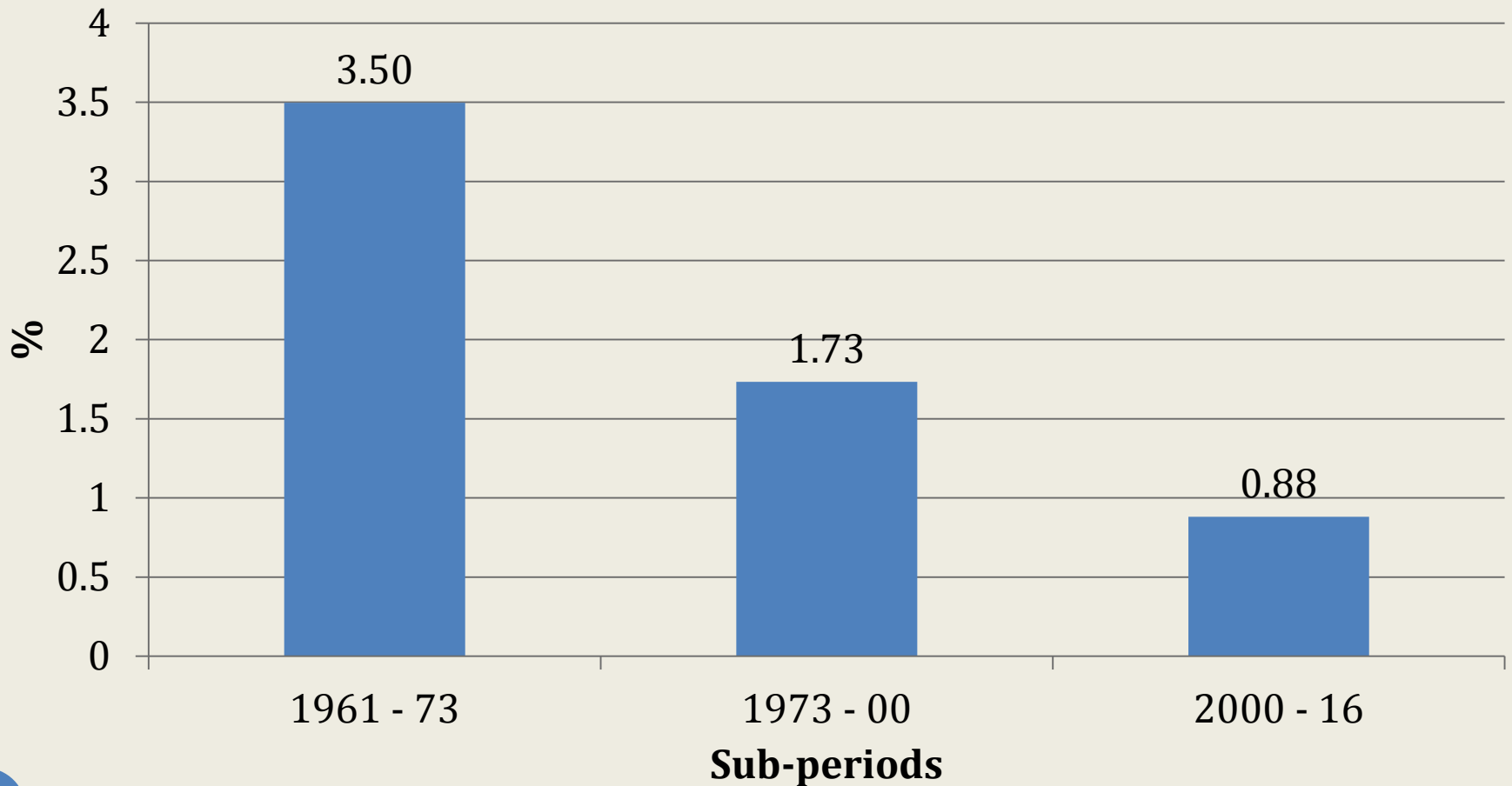
Source: CANSIM table 383-0021

5-Year Moving Average of Business Sector Total Factor Productivity Growth in Canada, 1965 - 2016

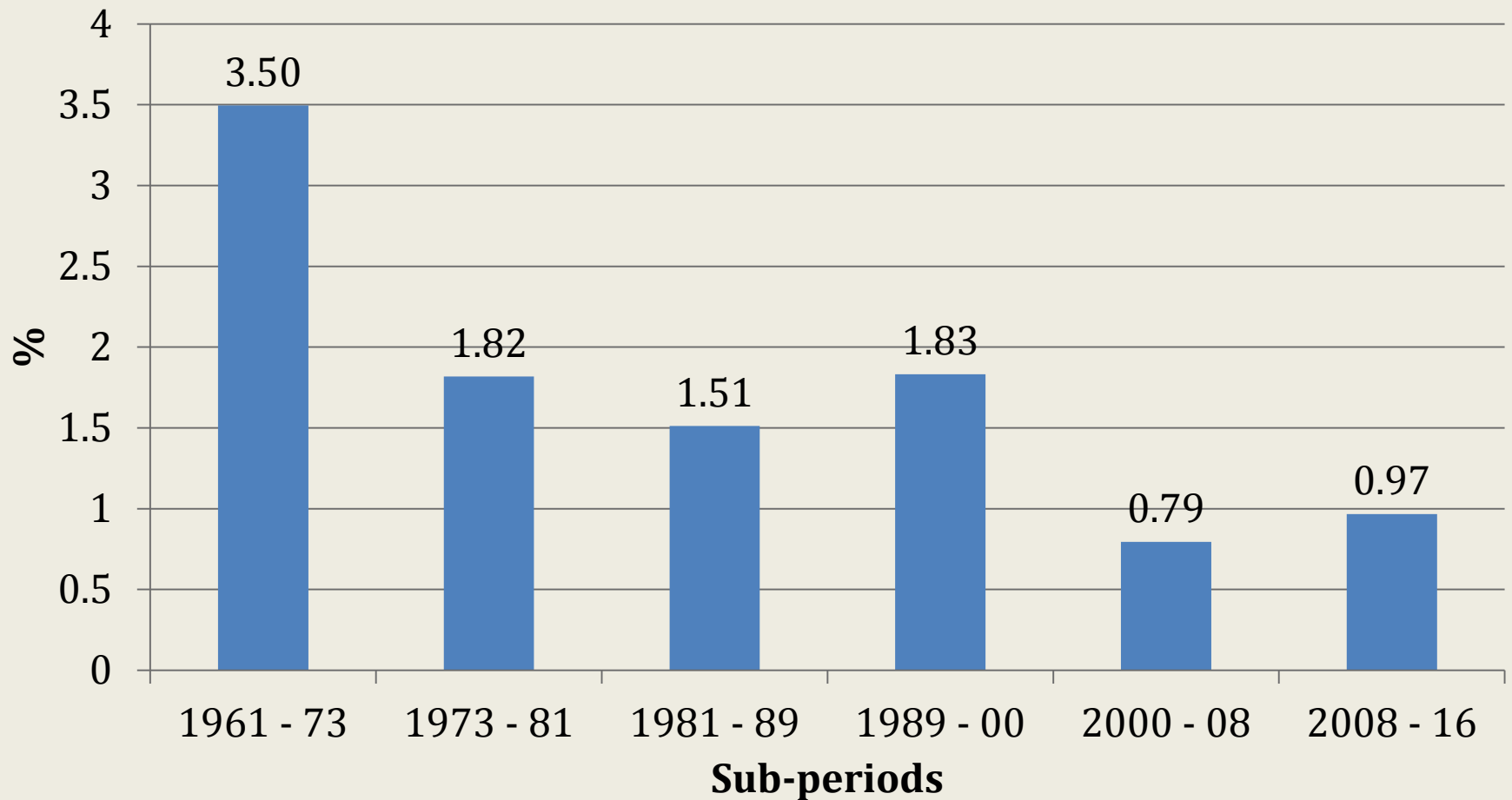


Source: CANSIM table 383-0021

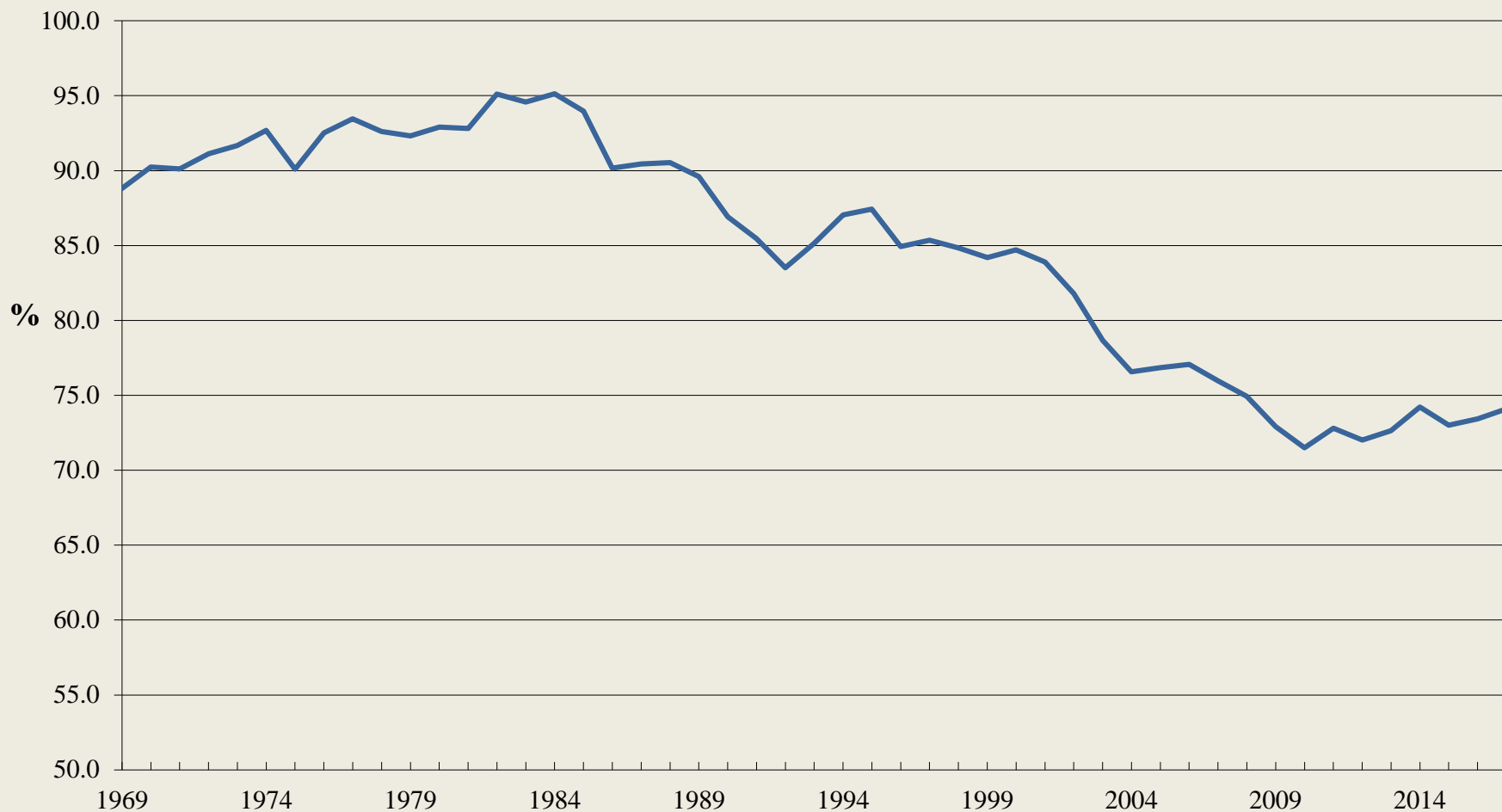
Labour Productivity Growth in the Business Sector in Canada (Compound Annual Growth Rates) , 1961 - 2016



Labour Productivity Growth in the Business Sector in Canada (Compound Annual Growth Rates) , 1961 - 2016

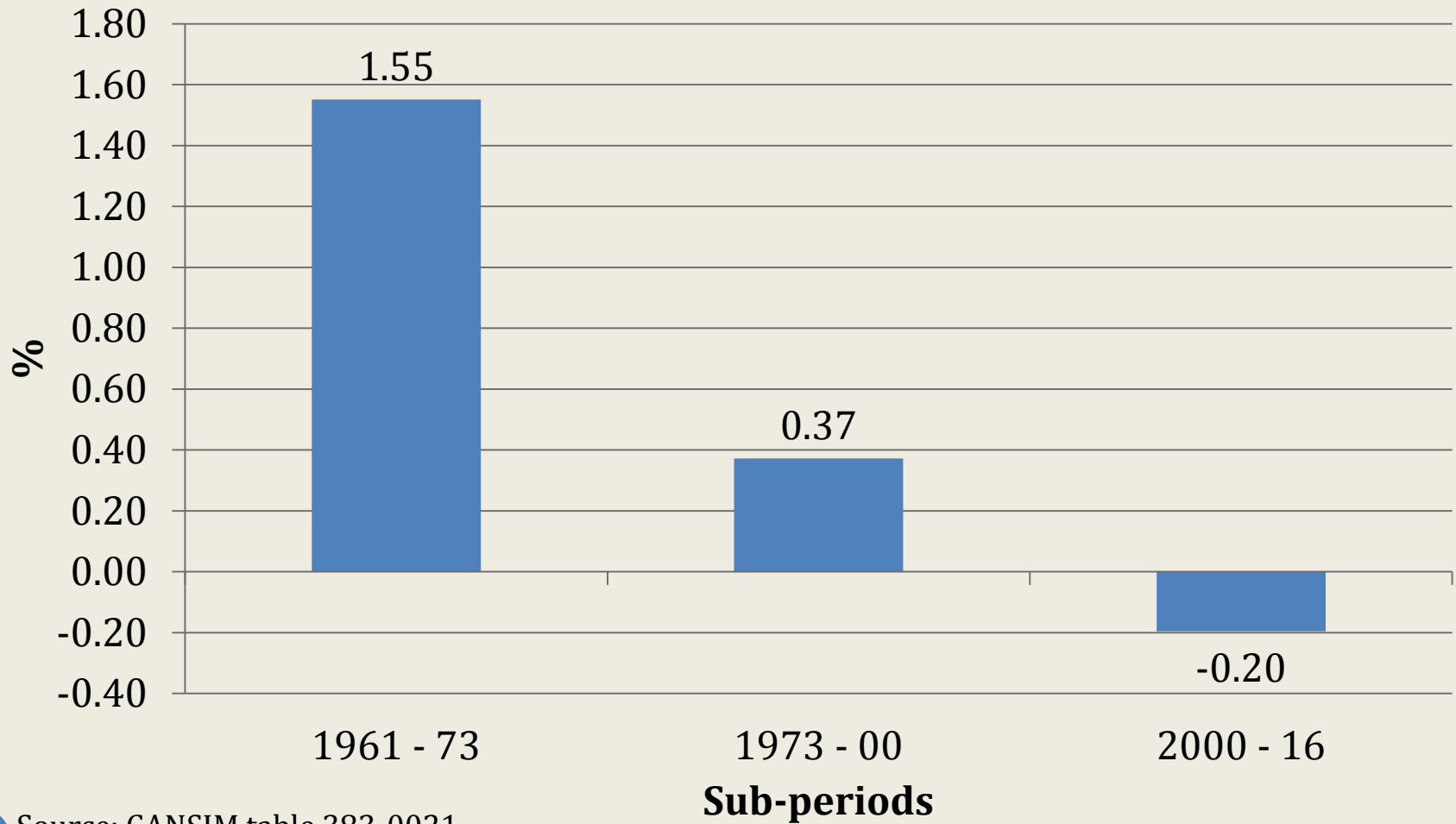


Relative Labour Productivity Levels (GDP per hour) in the Business Sector in Canada, 1969-2017 (Canada as % of the United States)



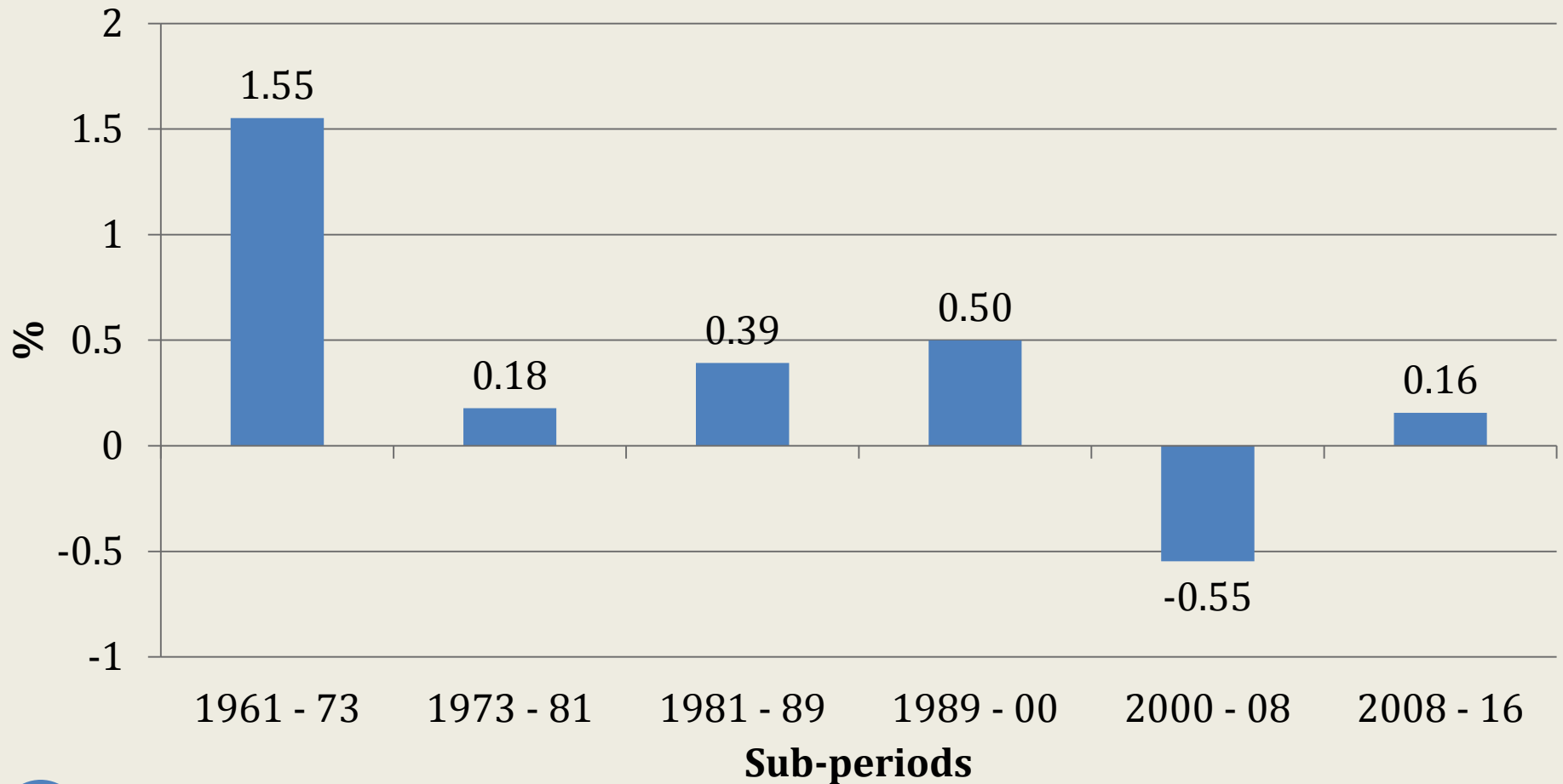
Source: CSLS estimates

Total Factor Productivity Growth in the Business Sector in Canada, (Compound Annual Growth Rates), 1961 - 2016

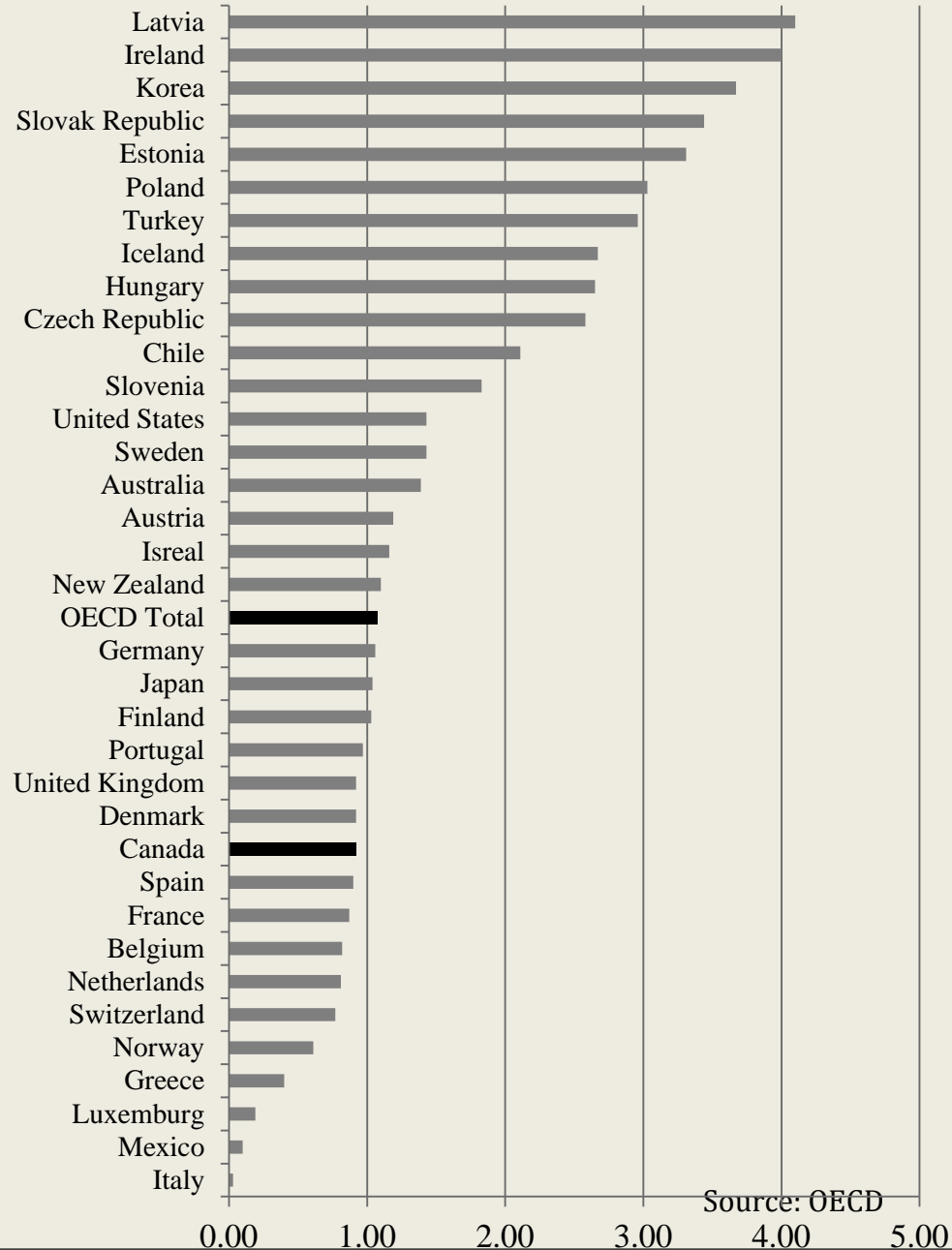


Source: CANSIM table 383-0021

Total Factor Productivity Growth in the Business Sector in Canada, (Compound Annual Growth Rates), 1961 - 2016

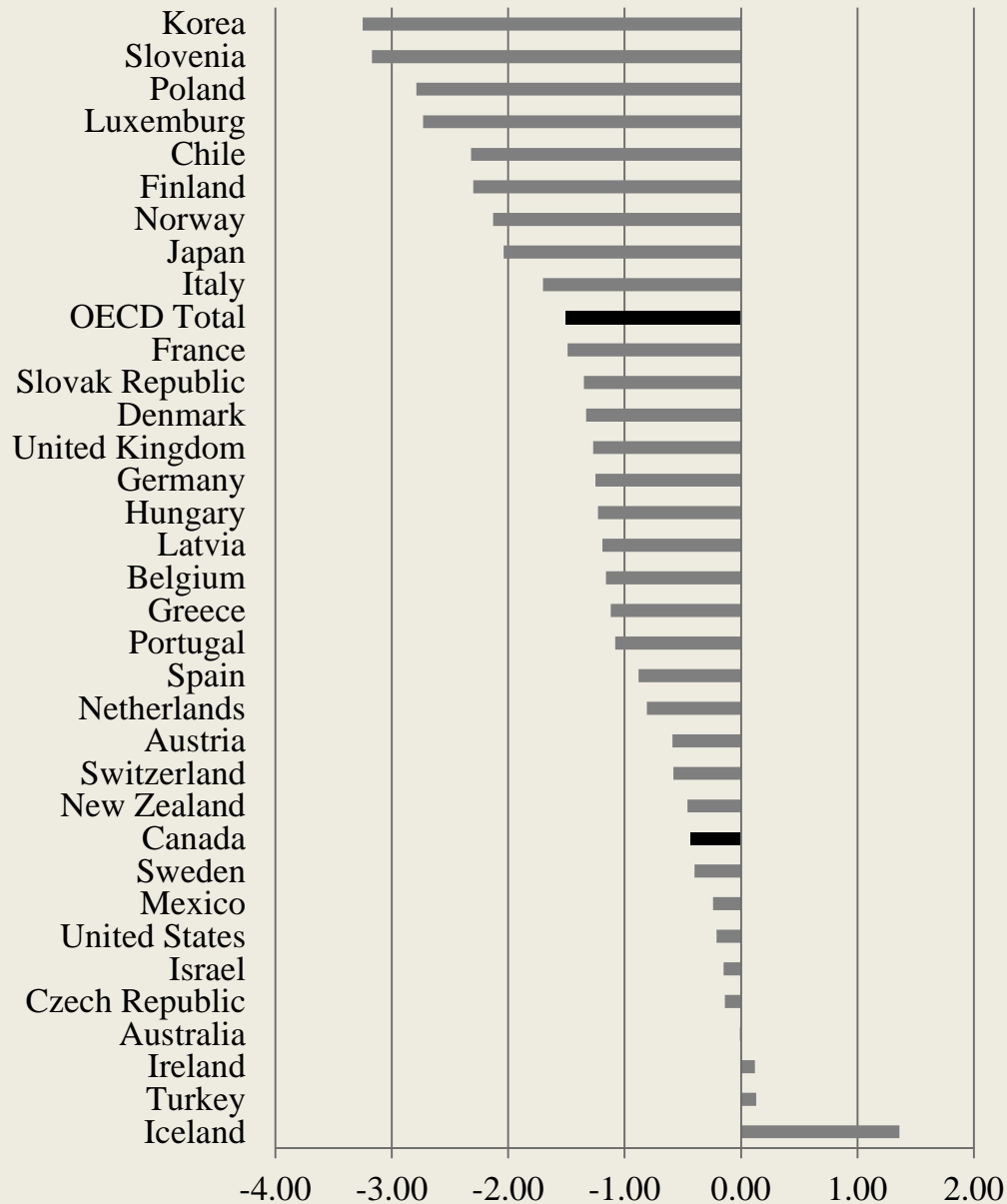


**GDP per hour, annual compound growth rate,
OECD countries, 2000-2016, per cent**

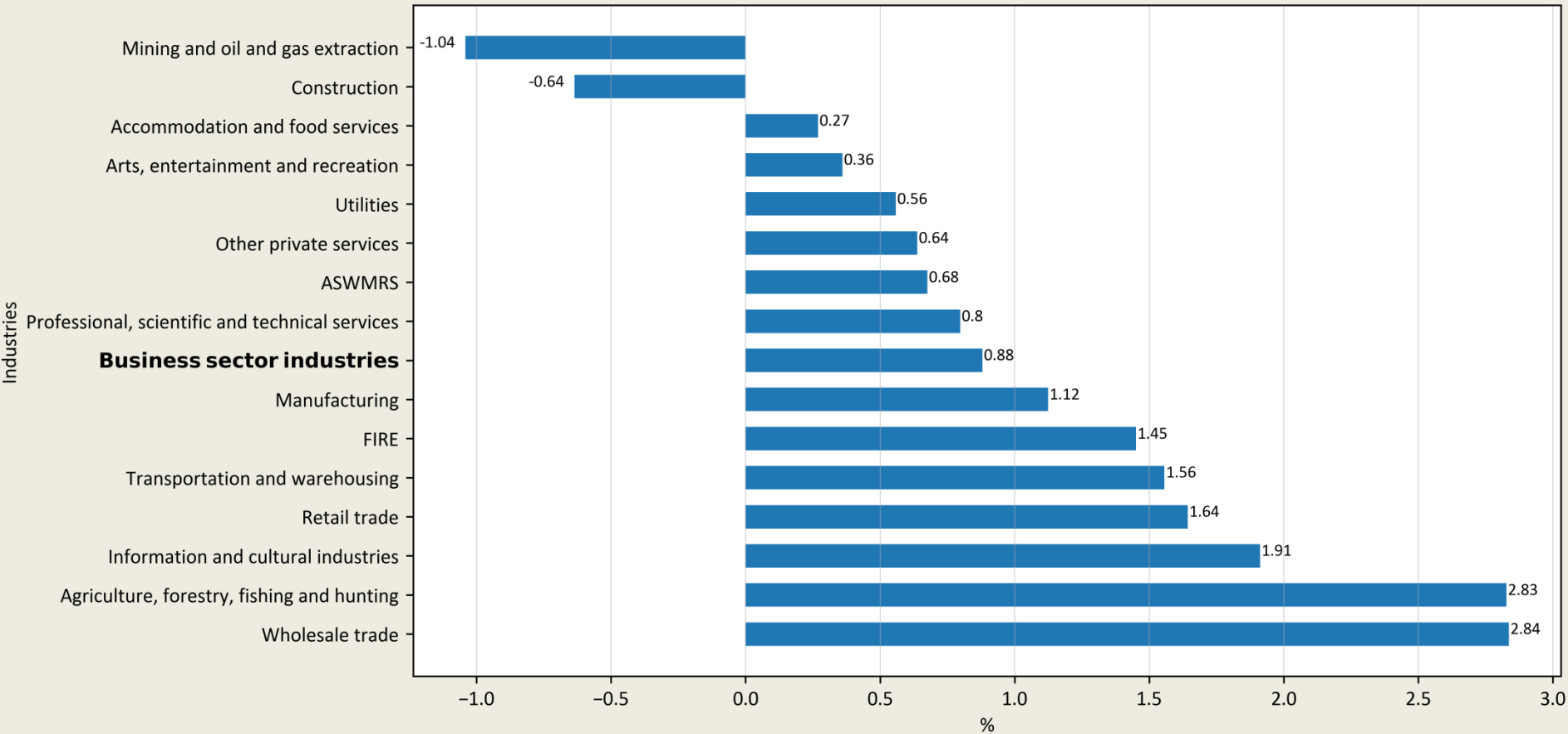


Source: OECD

**Change in annual compound growth rates in GDP
per hour, between 1981-2000 and 2000-2016, per cent**



Labour Productivity Compound Annual Growth Rates by Industry,
2000 - 2016

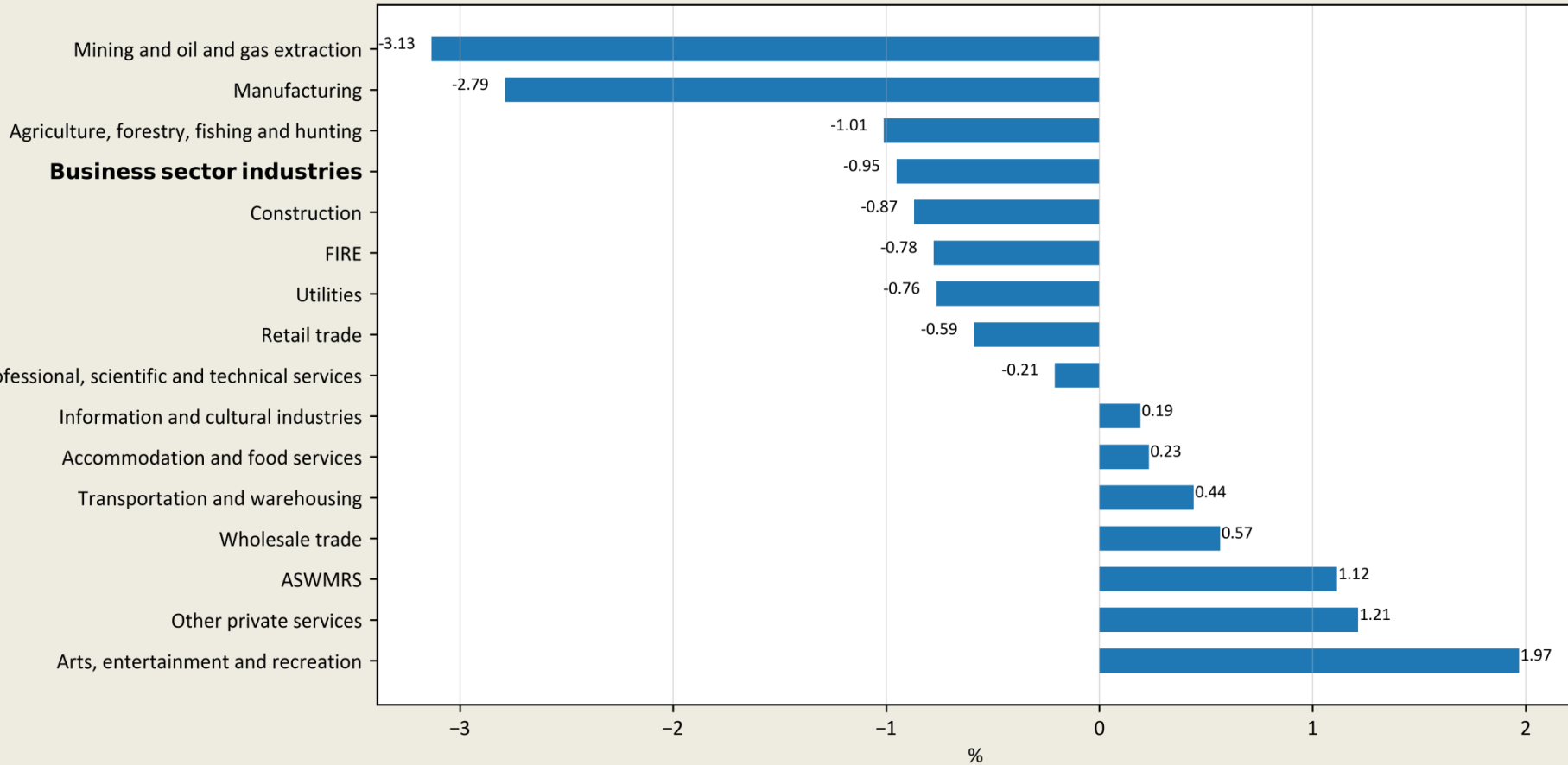


Source: CANSIM Table 383-0021

Note: FIRE stands for Finance, insurance, real estate, rental and leasing.

ASWMRS stands for Administrative and support, waste management and remediation services.

Absolute Difference in Labour Productivity Compound Annual Growth Rates by Industry,
1989 - 2000 and 2000 - 2016



Source: CANSIM Table 383-0021

Note: FIRE stands for Finance, insurance, real estate, rental and leasing.

ASWMRS stands for Administrative and support, waste management and remediation services.

Labour Productivity Compound Annual Growth in Canada, 1989 - 2000 and 2000 - 2016

	Compound Annual Growth Rates			Absolute Percentage Contribution to Growth			Percentage Point Contribution to Growth		
	1989 - 2000	2000 - 2016	Absolute Difference	1989 - 2000	2000 - 2016	Absolute Difference	1989 - 2000	2000 - 2016	Absolute Difference
Business sector industries	1.83	0.88	-0.95	1.83	0.88	-0.95	100.0	100.0	100.0
Agriculture, forestry, fishing and hunting	3.84	2.83	-1.01	0.21	0.08	-0.13	11.4	9.2	13.4
Mining and oil and gas extraction	2.09	-1.04	-3.13	0.17	0.02	-0.15	9.2	2.3	15.7
Utilities	1.32	0.56	-0.76	0.01	0.00	-0.01	0.7	0.4	1.0
Construction	0.23	-0.64	-0.87	0.05	-0.13	-0.17	2.5	-14.5	18.2
Manufacturing	3.91	1.12	-2.79	0.83	0.21	-0.62	45.5	24.0	65.4
Wholesale trade	2.27	2.84	0.57	0.09	0.16	0.07	5.1	18.7	-7.5
Retail trade	2.23	1.64	-0.59	0.16	0.05	-0.11	8.8	5.3	12.0
Transportation and warehousing	1.11	1.56	0.44	0.05	0.08	0.03	2.8	8.7	-2.6
Information and cultural industries	1.72	1.91	0.19	0.07	0.06	-0.01	3.7	6.4	1.2
FIRE	2.23	1.45	-0.78	0.48	0.31	-0.17	26.1	34.9	18.1
Professional, scientific and technical services	1.01	0.80	-0.21	-0.01	0.02	0.04	-0.7	2.6	-3.7
ASWMRS	-0.44	0.68	1.12	-0.11	-0.02	0.09	-5.9	-1.9	-9.5
Arts, entertainment and recreation	-1.61	0.36	1.97	-0.04	0.00	0.04	-2.3	0.2	-4.7
Accommodation and food services	0.04	0.27	0.23	0.00	-0.02	-0.02	0.0	-2.4	2.2
Other private services	-0.58	0.64	1.21	-0.01	0.10	0.12	-0.8	11.7	-12.4

Decomposition of the Growth Gap between Labour Productivity and Median Real Hourly Earnings into Four Components, Canada, 1976-2014

	Labour Productivity	Median Real Hourly Earnings	Gap	Inequality	Employer Social Contributions	Labour's Terms of Trade	Labour Share
	Growth (per cent per year)			Percentage Point Contributions to the Gap			
1976-2014	1.12	0.09	1.03	0.53	0.00	0.20	0.31
1976-1981	0.90	-0.32	1.21	-0.41	0.03	0.92	0.76
1981-1989	0.94	0.16	0.78	0.15	-0.03	0.48	0.19
1989-2000	1.51	-0.28	1.79	0.92	0.14	0.24	0.48
2000-2008	0.89	0.94	-0.05	0.20	0.01	-0.55	0.29
2008-2014	1.12	-0.14	1.26	1.52	-0.24	0.18	-0.20
	Per Cent Contributions to the Gap						
1976-2014	--	--	--	51.0	0.2	19.1	29.7
1976-1981	--	--	--	-33.9	2.5	75.8	62.3
1981-1989	--	--	--	19.5	-4.0	61.9	24.0
1989-2000	--	--	--	51.7	7.8	13.3	26.6
2000-2008	--	--	--	--	--	--	--
2008-2014	--	--	--	120.5	-19.0	14.4	-15.9

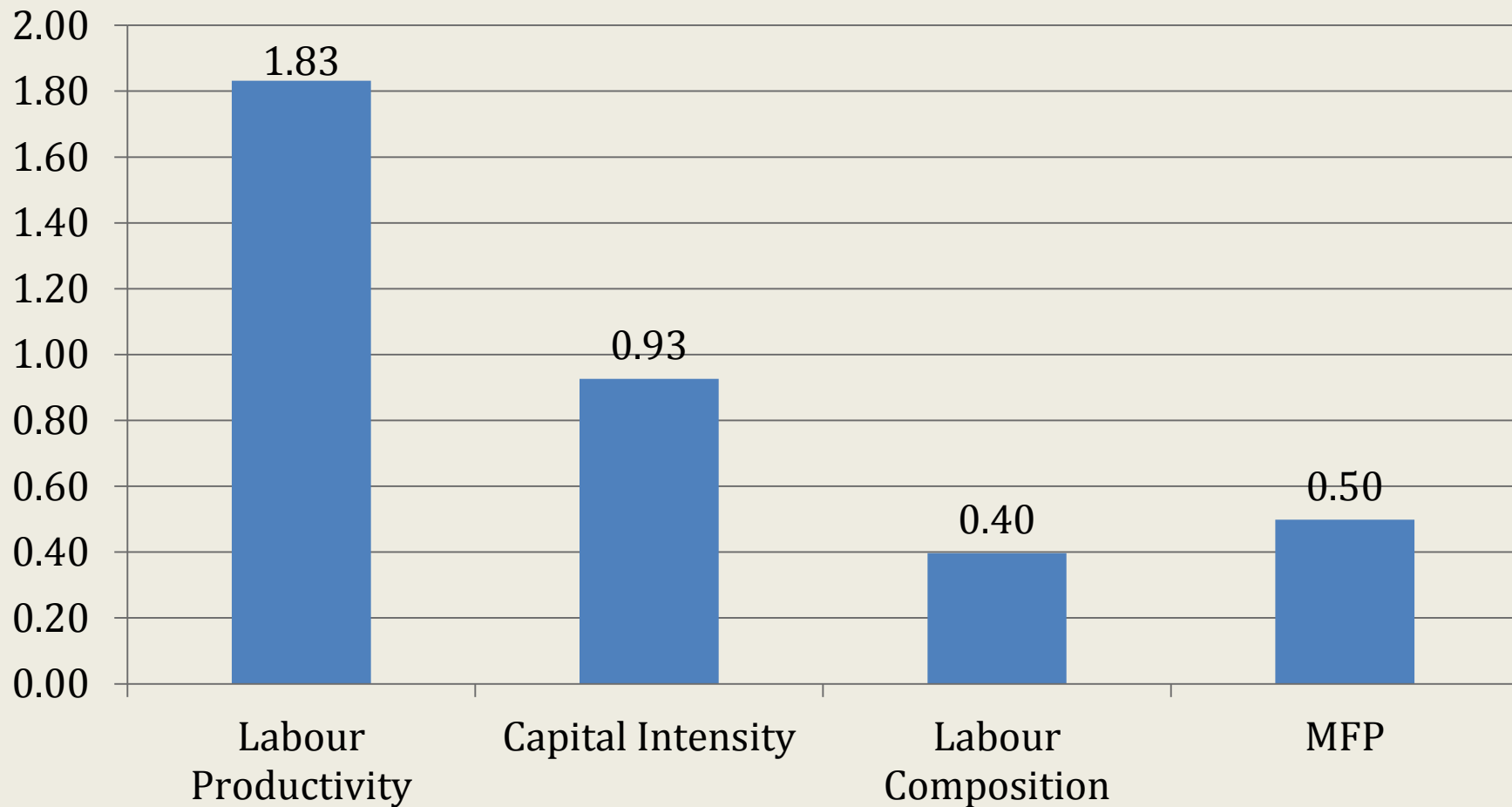
Note: Per cent contributions to the gap are not computed for the 2000-2008 period because the total gap was close to zero over that period.

Source: CSLS calculations, based on Statistics Canada data

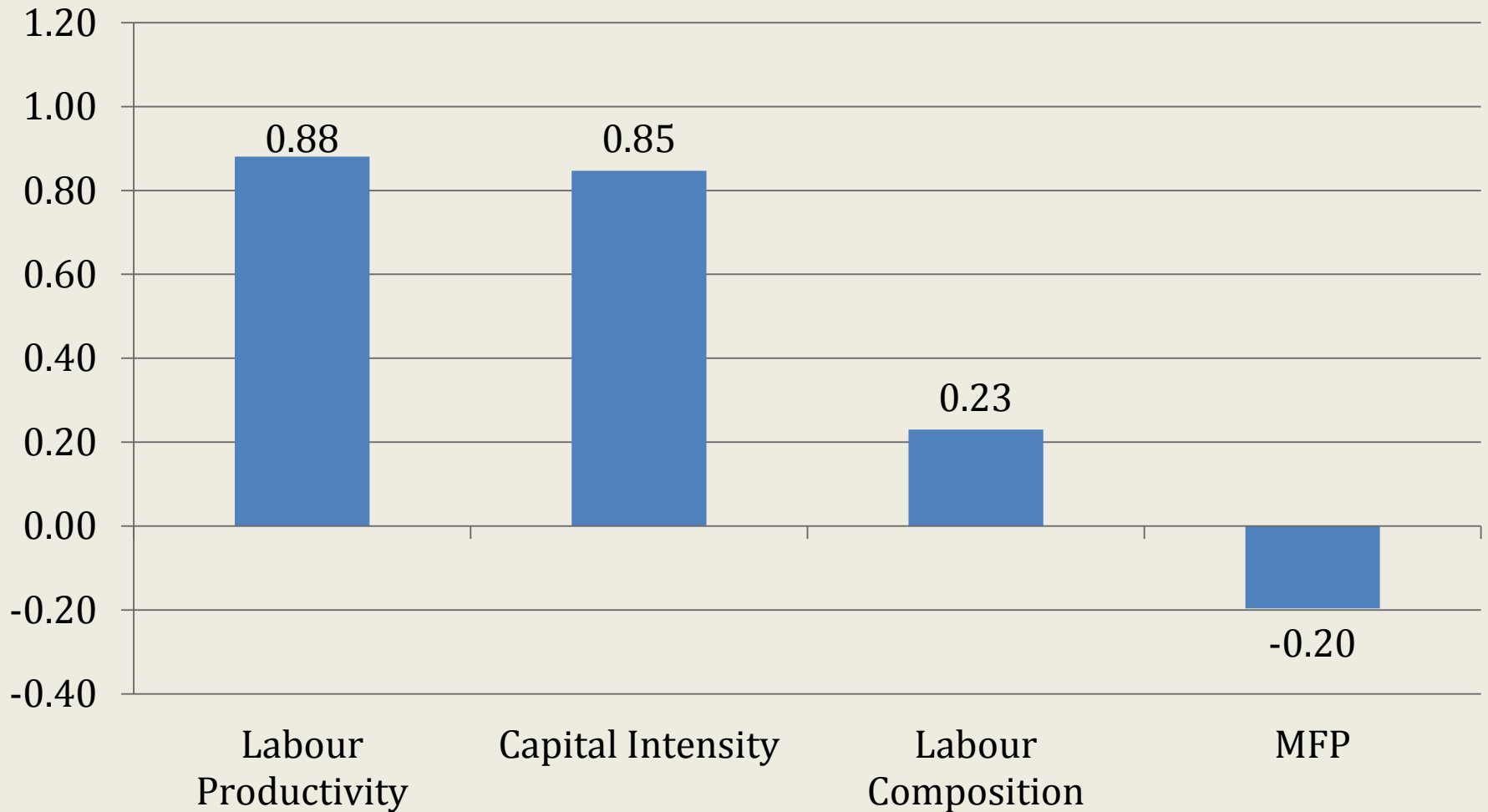
III. Factors Explaining Slower Productivity Growth

- Growth accounting results (TFP, labour quality, and capital intensity)
- Measurement issues
- Resource reallocations
- Demand-side secular stagnation
- Supply-side slower rate of technological progress

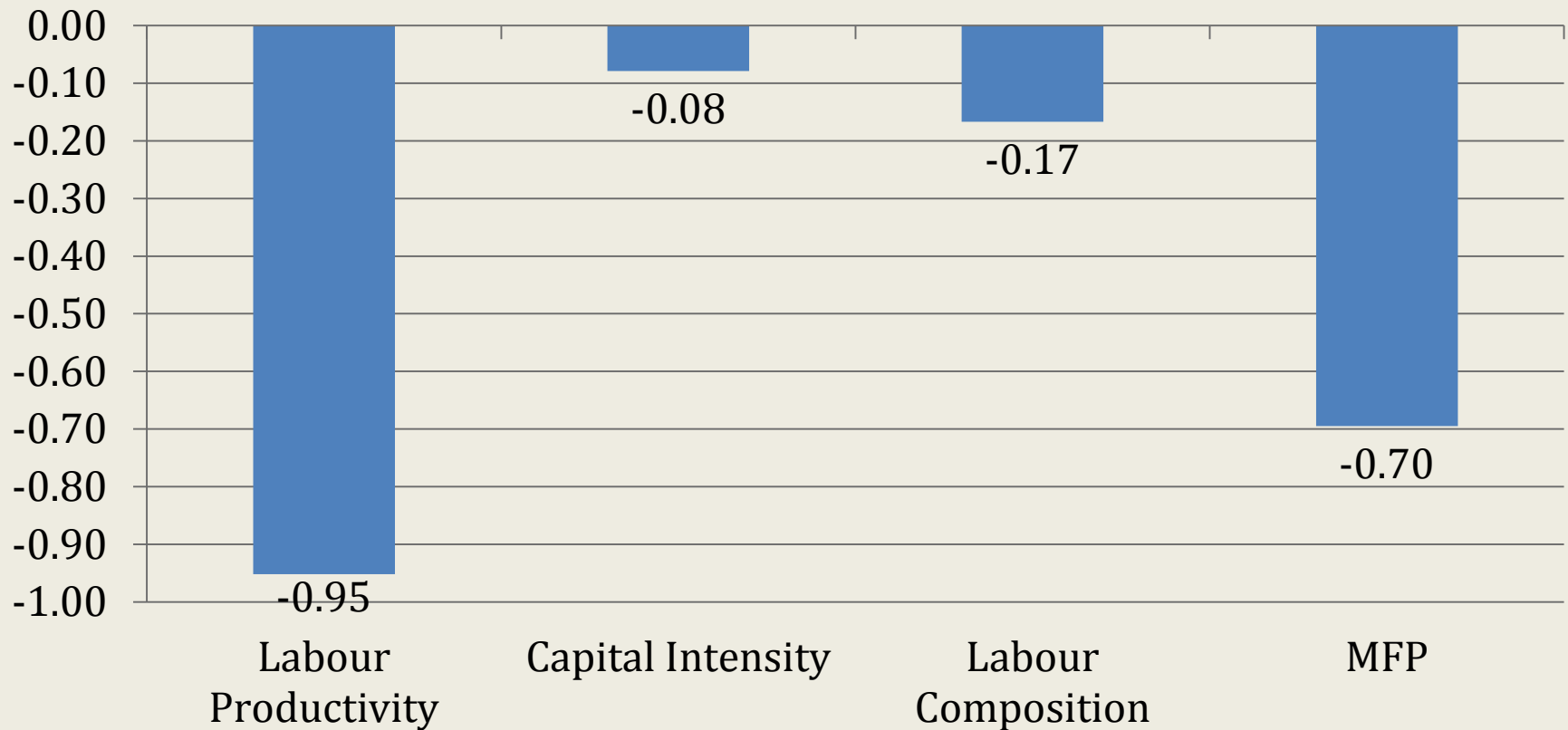
Percentage Point Contributions of Capital Intensity, Labour Composition, and MFP to Labour Productivity Growth, Business Sector, Canada, 1989 - 2000



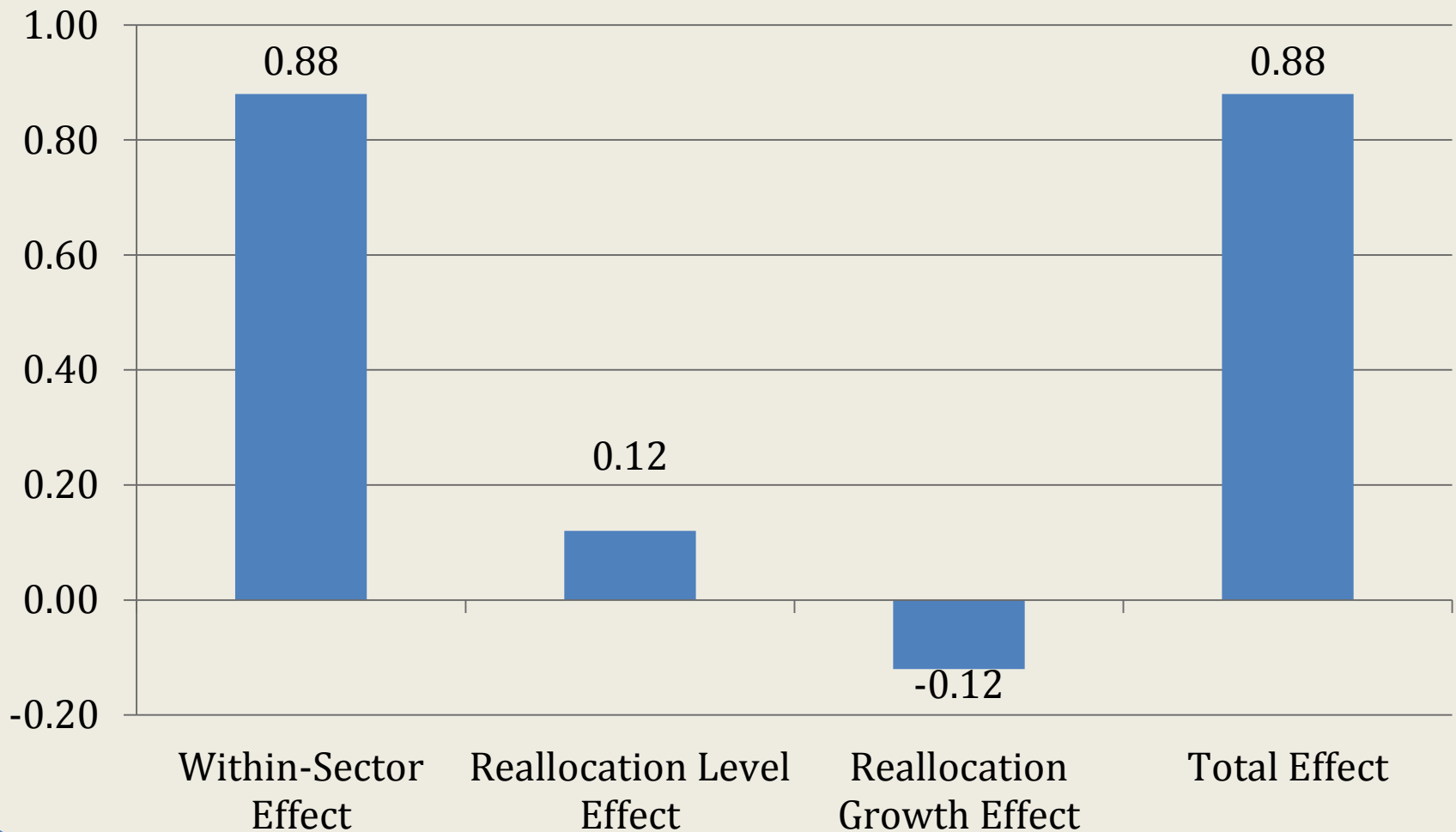
Percentage Point Contributions of Capital Intensity, Labour Composition, and MFP to Labour Productivity Growth, Business Sector, Canada, 2000-2016



Differences in Percentage Point Contributions of Capital Intensity, Labour Composition, and MFP to Labour Productivity Growth, Business Sector, Canada between 1989 - 2000 and 2000 - 2016



CSLS Labour Productivity Decomposition, Business Sector, Compound Average Annual Growth Rates, Per Cent, Canada, 2000-2016

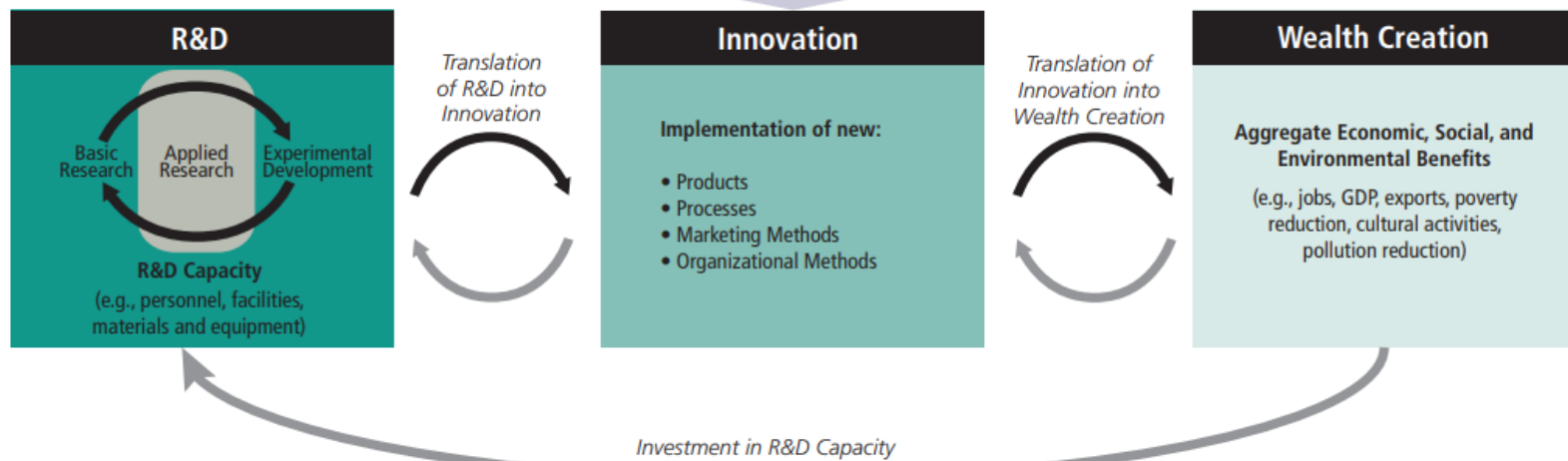


IV. Links between Productivity and R&D Spending

- Importance of R&D for productivity growth
- Trends in BERD and BERD intensity
- International comparisons
- Trends in BERD by industry and province
- Explanations for falling BERD
- Contributions of R&D trends to productivity growth

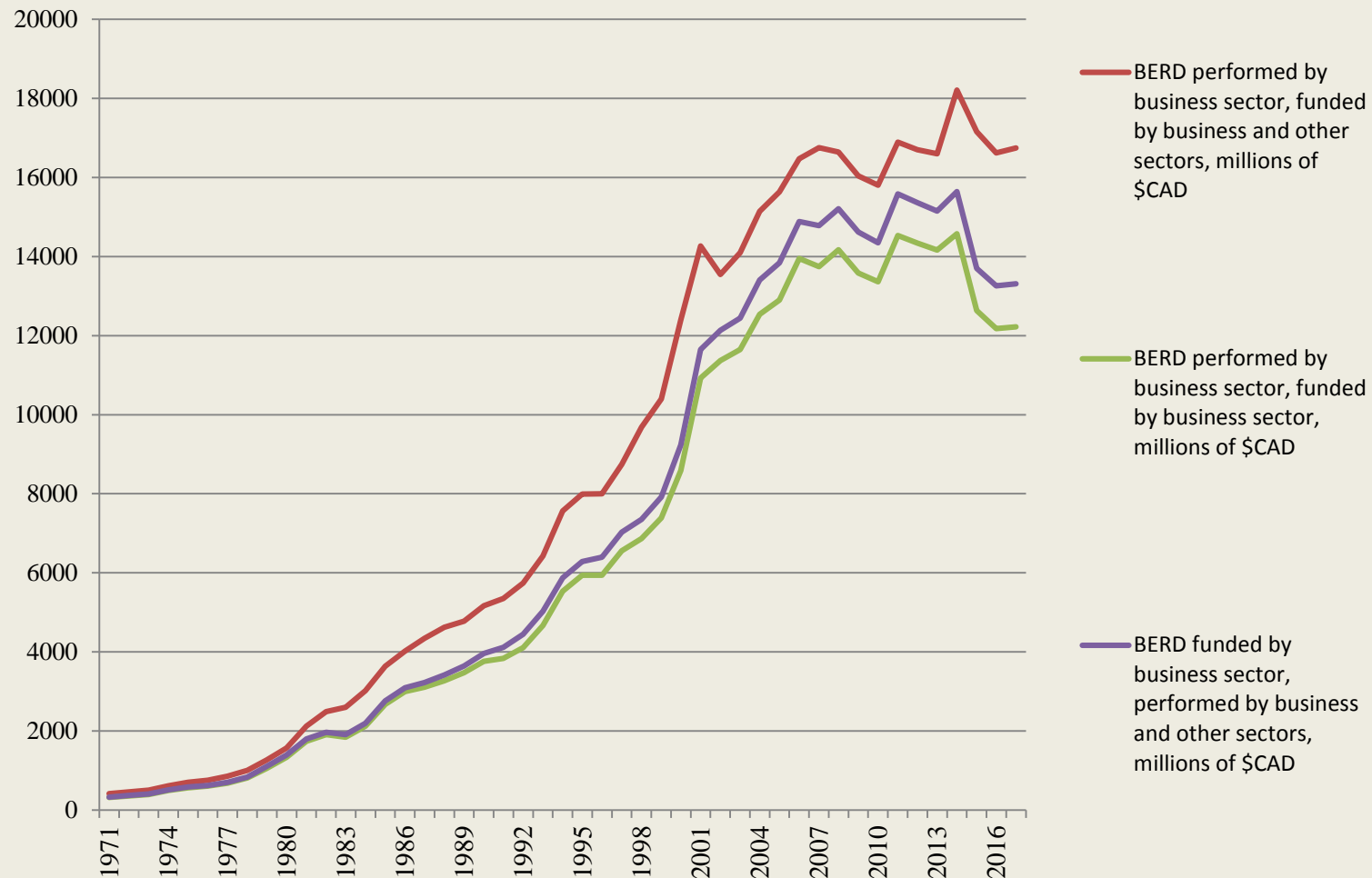
External Drivers of Innovation

(e.g., macroeconomic context, policy and regulatory environment, financing, networks and collaborations, market conditions, social environment)



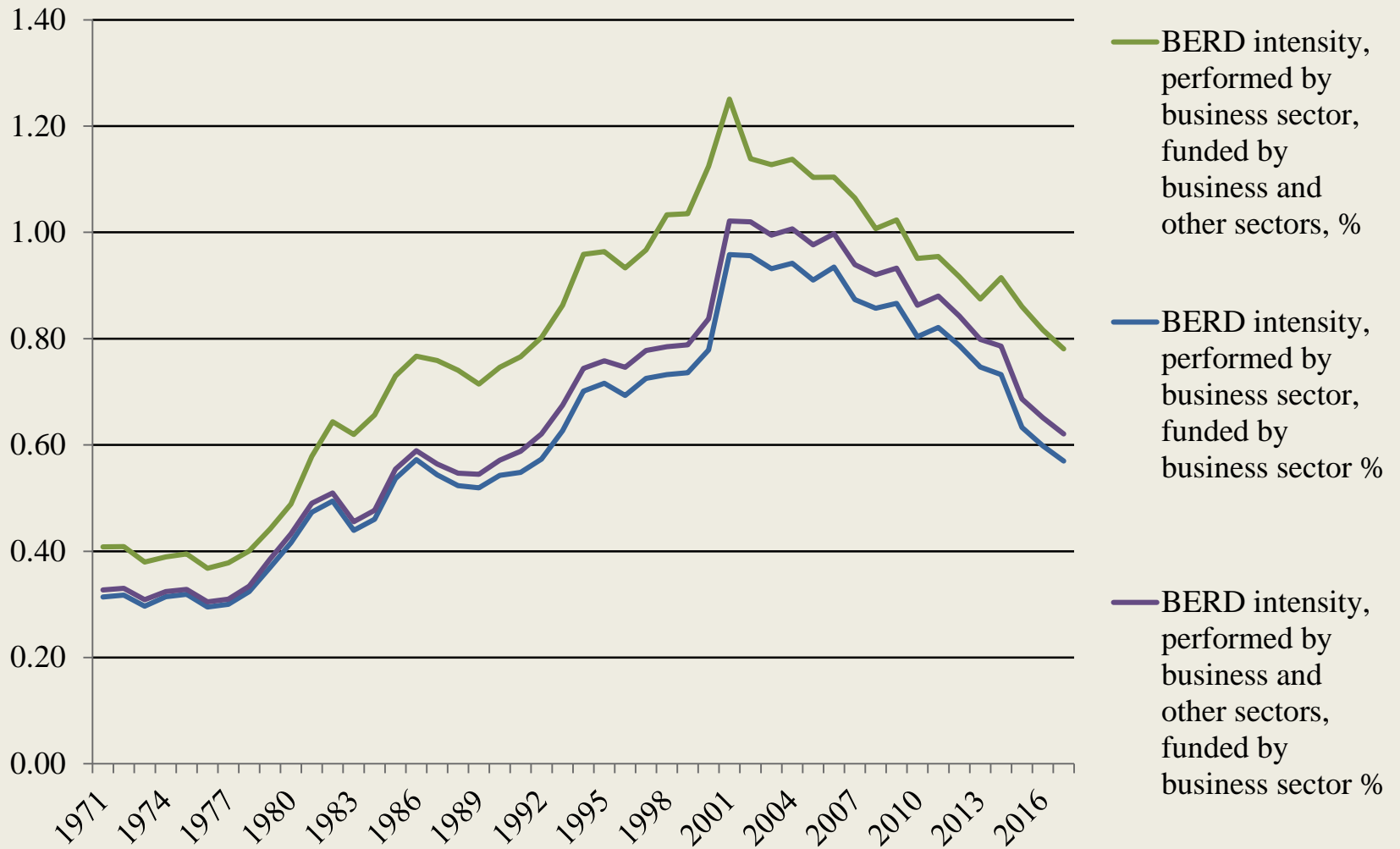
Source: “Competing in a Global Innovation Economy: The Current State of R&D in Canada,” Council of Canadian Academies (2018),

Total business enterprise research and development intramural expenditures, Canada 1971-2017



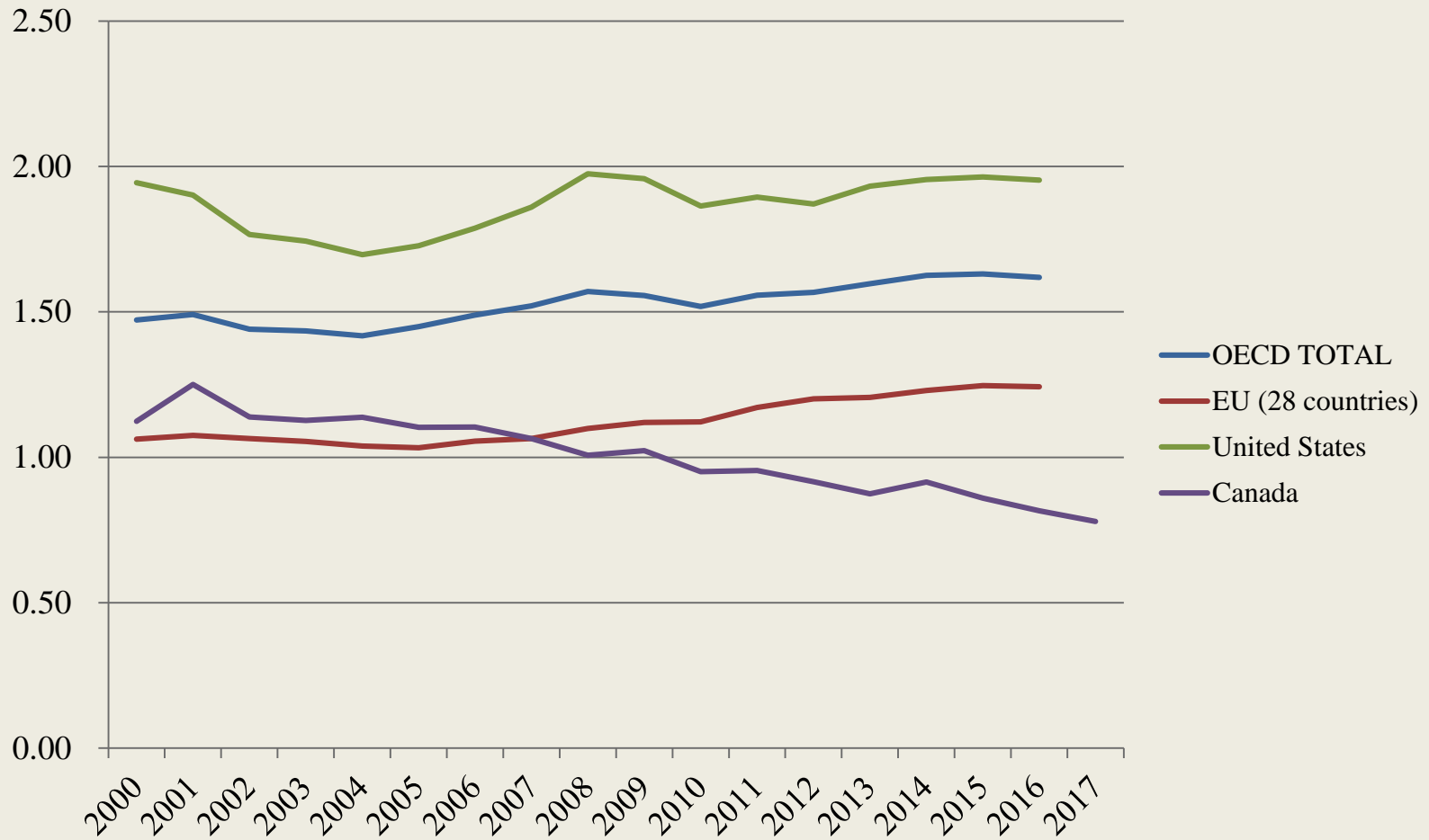
Source: Statistics Canada CANSIM table 358-001.

BERD intensity (R&D expenditure/GDP), Canada 1971-2017, %



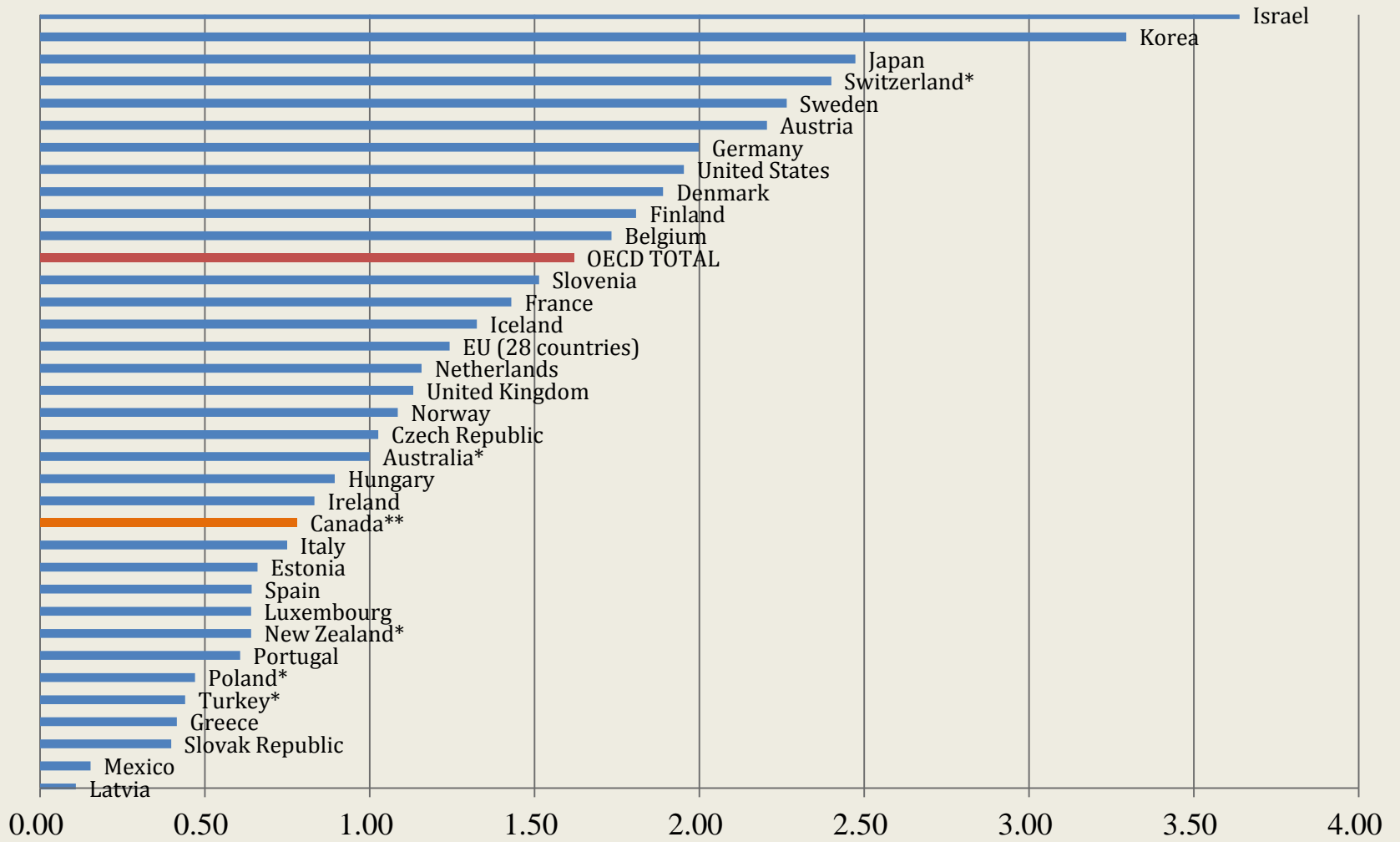
Source: BERD: Statistics Canada CANSIM table 358-001; GDP: CANSIM table 358-064.

BERD intensity, Canada, United States, EU and OECD average, 2000-2017, percentage



Source: OECD, Main Science and Technology Database

BERD intensity 2016, percentage

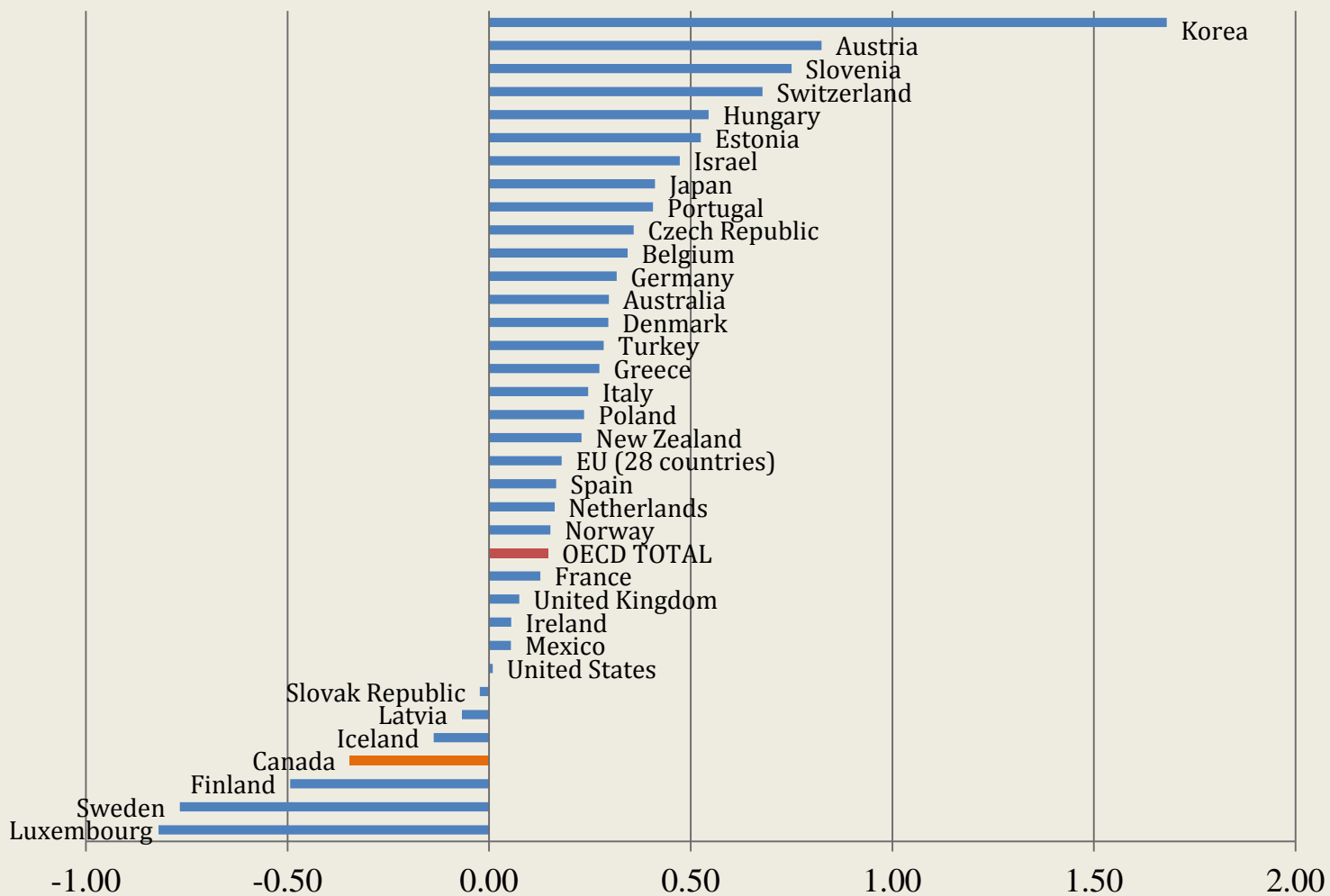


Source: OECD, Main Science and Technology Database

* Data from 2015

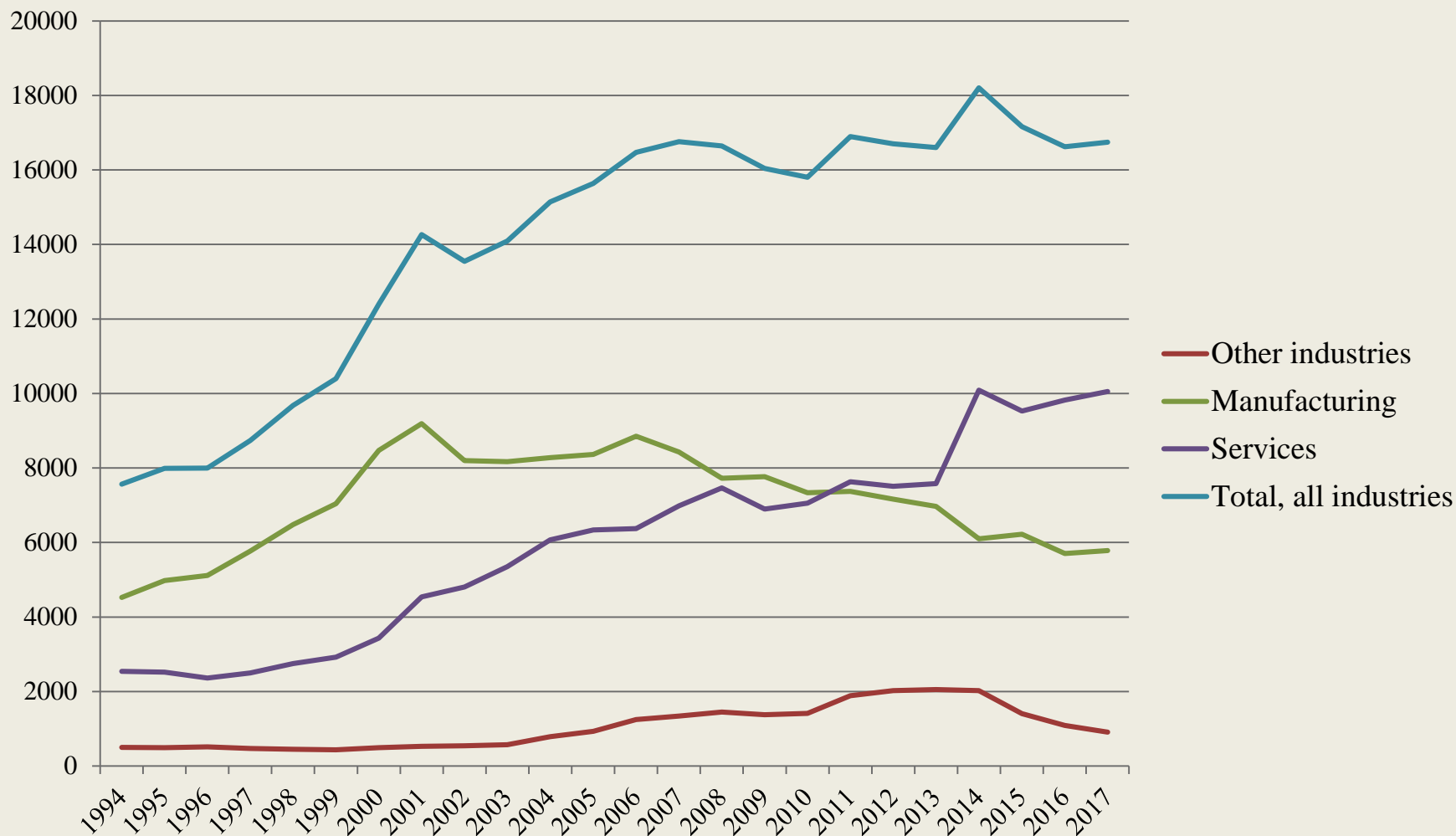
**Data from 2017

Percentage points change in BERD intensity between 2000 and 2016 (or most recent year available)



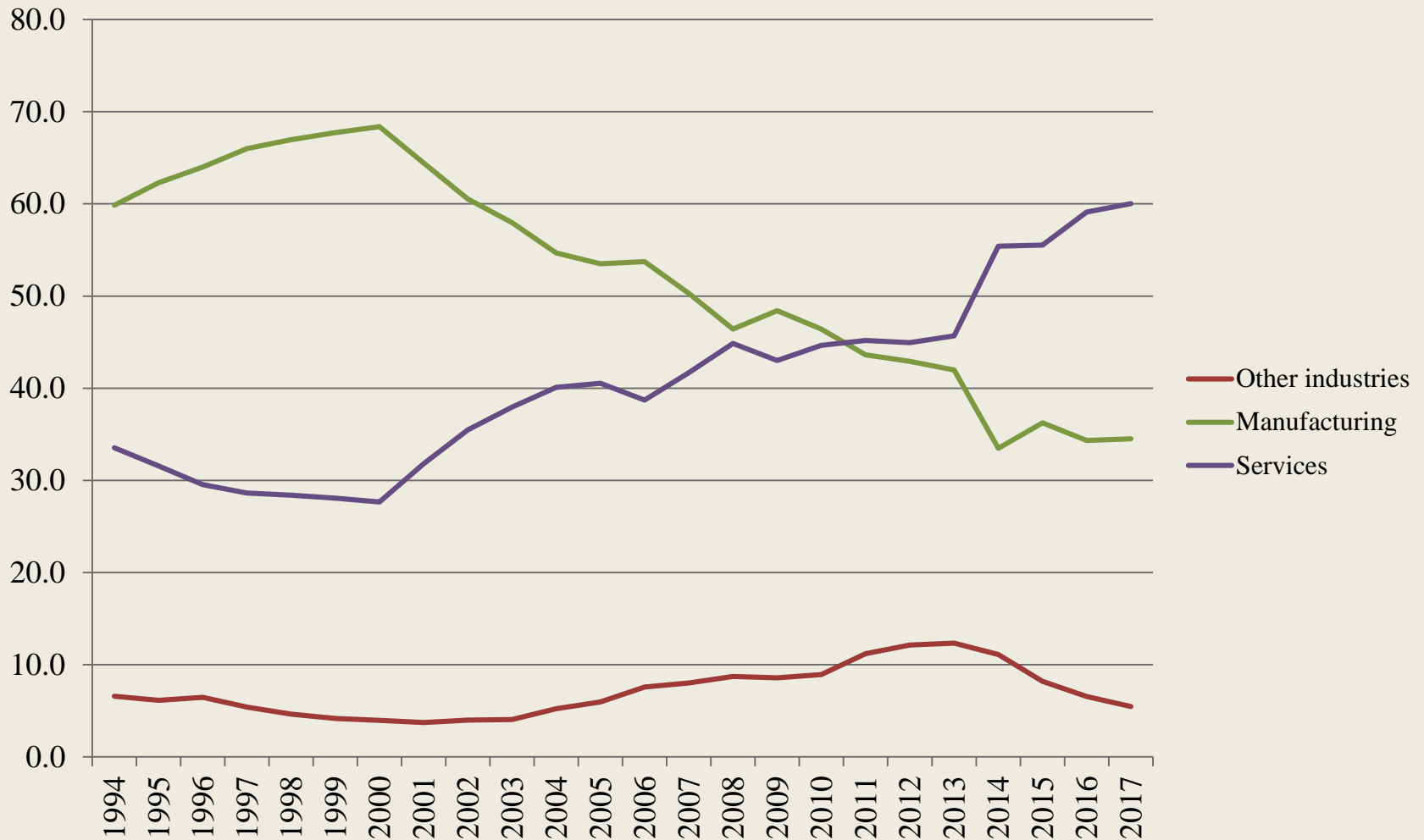
Source: OECD, Main Science and Technology Database

Total business enterprise research and development intramural expenditures, by NAICS, Canada 1994-2017, millions of \$CAD



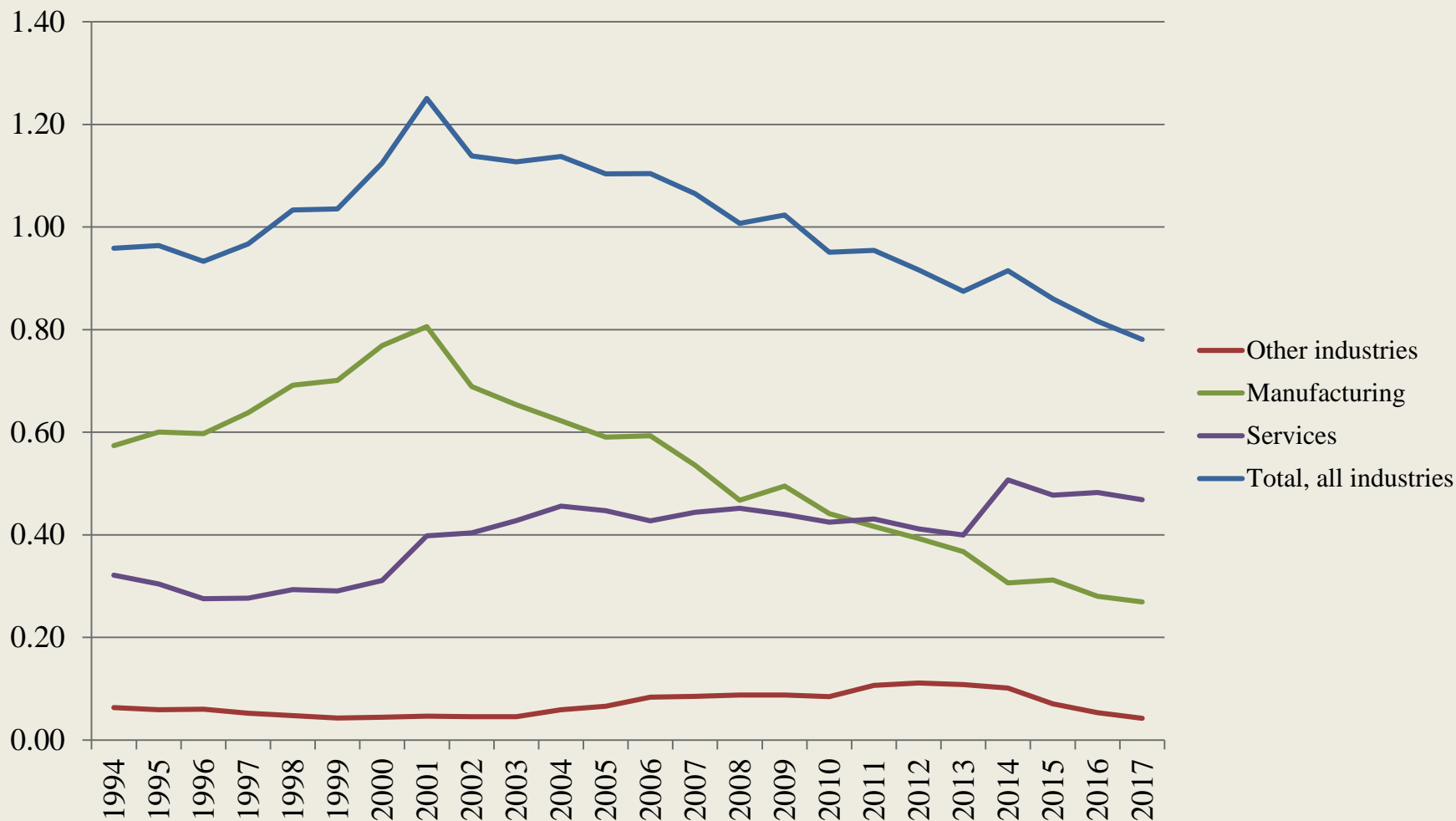
Source: 1994-2013: CANSIM 358-0024 This CANSIM table has been archived and replaced by the new series of Research and Development in Canadian Industry tables, 358-0510 to 358-0526, which begin as of reference year 2014. 2014-2017: CANSIM 358-0510
 "Other" includes agriculture, forestry, fishing and hunting [11], mining, quarrying, and oil and gas extraction [21], utilities [13], and construction [23]

Industry % of total business enterprise research and development intramural expenditures, by NAICS, Canada 1994-2017



Source: 1994-2013: CANSIM 358-0024 This CANSIM table has been archived and replaced by the new series of Research and Development in Canadian Industry tables, 358-0510 to 358-0526, which begin as of reference year 2014. 2014-2017: CANSIM 358-0510
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BERD intensity by industries, Canada 1994-2017, percentage



Source: 1994-2013: CANSIM 358-0024 This CANSIM table has been archived and replaced by the new series of Research and Development in Canadian Industry tables, 358-0510 to 358-0526, which begin as of reference year 2014. 2014-2017: CANSIM 358-0510
 "Other" includes agriculture, forestry, fishing and hunting [11], mining, quarrying, and oil and gas extraction [21], utilities [13], and construction [23]

Break down of BERD in manufacturing, Canada, 2001 & 2017

	2001	2017	Δ%	Δ	Contribution to industry decline, %
Manufacturing	9,194	5,780	-37.1	-3,414	
Food manufacturing [311]	71	140	97.2	69	-2.0
Paper manufacturing [322]	420	98	-76.7	-322	9.4
Chemical manufacturing	1114	884	-20.6	-230	6.7
Pharmaceutical and medicine manufacturing [3254]	889	556	-37.5	-333	9.8
Other chemicals manufacturing [16]	225	328	45.8	103	-3.0
Plastic product manufacturing [3261]	79	110	39.2	31	-0.9
Primary metal manufacturing [331]	216	165	-23.6	-51	1.5
Fabricated metal product manufacturing [332]	113	170	50.4	57	-1.7
Machinery manufacturing [333]	441	567	28.6	126	-3.7
Computer and electronic product manufacturing	4648	1,041	-77.6	-3,607	105.7
Electrical equipment, appliance and component manufacturing [335]	313	189	-39.6	-124	3.6
Transportation equipment manufacturing	1382	1,838	33.0	456	-13.4
Motor vehicle and parts manufacturing [20]	407	211	-48.2	-196	5.7
Aerospace products and parts manufacturing [3364]	949	1,405	48.1	456	-13.4
All other transportation equipment manufacturing [21]	26	223	757.7	197	-5.8
Other manufacturing industries [22]	143	215	50.3	72	-2.1

Break down of BERD in services, Canada, 2001 & 2017

	2001	2017	Δ%	Δ	Contribution to industry change, %
Services, millions of \$CAD	4,539	10,052	121.5	5,513	
Wholesale trade [41]	664	1,503	126.4	839	15.2
Retail trade [44-45]	44	191	334.1	147	2.7
Transportation and warehousing [48-49]	33	107	224.2	74	1.3
Information and cultural industries [51]	559	2,068	269.9	1,509	27.4
Finance, insurance and real estate [24]	173	303	75.1	130	2.4
Architectural, engineering and related services [5413]	547	549	0.4	2	0.0
Computer systems design and related services [5415]	1,111	2,073	86.6	962	17.4
Management, scientific and technical consulting services [5416]	83	118	42.2	35	0.6
Scientific research and development services [5417]	763	2,415	216.5	1,652	30.0
Health care and social assistance [62]	341	125	-63.3	-216	-3.9
All other services [25]	222	601	170.7	379	6.9

Source: 1994-2013: CANSIM 358-0024 2014-2017: CANSIM 358-0510

BERD by province, Canada 2001 & 2015, millions of \$CAD

	2001	2015	Δ%	Δ	Contribution to industry change, %
Canada	14,266	17,158	16.9	2,892	
Newfoundland and Labrador	21	115	81.7	94	3.3
Prince Edward Island	6	21	71.4	15	0.5
Nova Scotia	91	156	41.7	65	2.2
New Brunswick	41	82	50.0	41	1.4
Quebec	4,157	4,851	14.3	694	24.0
Ontario	7,899	7,661	-3.1	-238	-8.2
Manitoba	173	286	39.5	113	3.9
Saskatchewan	87	306	71.6	219	7.6
Alberta	712	1,801	60.5	1,089	37.7
British Columbia and Territories	1,080	1,866	42.1	786	27.2

Source: 1994-2013: CANSIM 358-0161, now archived and replaced by the new series of Research and Development in Canadian Industry tables, 358-0510 to 358-0526, which begin as of reference year 2014. 2014-2017: CANSIM 358-0510, 358-0518

**BERD intensity by province, Canada 2001 & 2015,
millions of \$CAD**

	2001	2015	Δ%	Δ
Canada	1.25	0.86	-31.2	-0.39
Newfoundland and Labrador	0.15	0.38	160.7	0.23
Prince Edward Island	0.17	0.35	98.6	0.17
Nova Scotia	0.34	0.38	12.9	0.04
New Brunswick	0.19	0.25	29.8	0.06
Quebec	1.74	1.26	-27.6	-0.48
Ontario	1.68	1.01	-40.3	-0.68
Manitoba	0.48	0.43	-10.1	-0.05
Saskatchewan	0.26	0.39	51.2	0.13
Alberta	0.46	0.54	17.8	0.08
British Columbia and Territories	0.76	0.71	-6.1	-0.05

Source: GDP: CANSIM table 384-0038; BERD: CANSIM 358-0161;
358-0510; and 358-0518