

Productivity Growth in Canadian and U.S. Regulated Industries

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ABSTRACT

This article compares the productivity growth of a set of Canadian and U.S. regulated industries. Using data from Statistics Canada's KLEMS database and the U.S. Bureau of Economic Analysis, the article examines productivity growth in transportation services (which includes air, rail, and other transportation services), broadcasting and telecommunications, cultural industries (which include publishing and information services, and motion pictures and sound recording), and financial services (which includes financial intermediation and insurance) over the period from 1977 to 2006. These industries provide the foundational networks on which other industries rely. In 1977, they were quite heavily regulated in Canada. They experienced deregulation after 1977, but still faced various types of regulation in 2006. Deregulation also occurred in the United States, but regulation has generally been less restrictive in that country over the period.

THE EVIDENCE SHOWS THAT many of the Canadian industries that underwent deregulation experienced faster labour productivity growth and multifactor productivity growth than did the aggregate Canadian business sector and had similar or higher productivity growth than did their counterparts in the United States over the 1977-2006 period. These industries include rail transportation, motion pictures and sound recording, financial intermediation and insurance carriers. The broadcasting and telecommunications industry had similar productivity growth in the two countries before 2001, and after 2001 it had much slower productivity growth in Canada. The airline industry and the publishing and information services industries had slower pro-

ductivity growth in Canada than in the United States over the 1977-to-2006 period.

Recent research for OECD countries suggests that productivity growth is boosted by reforms that promote better corporate governance and competition (Nicoletti and Scarpetta, 2003). Regulation is seen to create barriers to entry, reduce the incentives to innovate and invest, all of which lead to slower technological progress and slower productivity growth (Crafts, 2006; Conway and Nicoletti, 2007).

Similarly, in a series of cross country case studies, the McKinsey Institute identified regulation and a lack of competition as factors behind low productivity growth in many countries (Kellison, 2004). Many of the McKinsey studies focused on restrictions on foreign invest-

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ment, traditional utility type regulation, and urban planning restrictions that reduced retail and wholesale competition.

Since a number of studies have found that regulation and barriers to competition hinder productivity growth (though they may have beneficial effects in other areas), the focus of this article is the productivity performance of the 'regulated' infrastructure sector in Canada.

The industries that are examined encompass transportation services, including rail and air; broadcasting and telecommunications; and financial services, including financial intermediation and insurance. These industries provide the foundational networks on which other industries rely. They are also industries that have traditionally faced regulation in terms of the pricing of products, the supply of industry outputs, and restrictions on foreign ownership. In recent years, they have undergone varying degrees of deregulation and experienced increases in competition.

Productivity is important but it is just one of many indicators that analysts use to judge the performance of an economy. Productivity is a measure of the efficiency with which resources are turned into output. Growth in labour productivity is closely associated with growth in GDP per capita and with increases in real wages (Baldwin and Gu, 2007c). Other aspects of an economy—the safety of the products produced, the volatility of the economic system, and the fairness of the distribution of income—require other indicators if one is to fully assess the many factors, in addition to productivity, that together affect an economy's overall health.²

Canada has sector-specific legislation and/or policies on foreign investment in telecommunications, broadcasting, cultural industries, and transportation services. The financial services sector is subject to owner-

ship restrictions, but not specific foreign-ownership restrictions. According to the Organisation for Economic Co-operation and Development (OECD), Canada has the second greatest restrictions on foreign direct investment in the OECD countries (Maher and Shaffer, 2005). The regulations are generally more restrictive in Canada than in the United States in non-manufacturing industries, including air transportation and telecommunications (Conway and Nicoletti, 2006).

These sectors were quite heavily regulated in Canada at the beginning of the period of study (1977), experienced deregulation at different times during the period, but still faced various types of regulation at the end (2006). Deregulation also occurred in the United States, but regulation has generally been less restrictive there over the period.

Regulation is expected to affect the *level* of an industry's productivity. That is, heavily regulated industries are likely to be behind less regulated industries in other countries in terms of the level of their productivity, everything else being equal. Deregulation is posited to give the regulated industries a boost, that is, their productivity *growth* is expected to increase the relative productivity level towards that of their less regulated counterparts as they partially or fully "catch up" to them. During periods of deregulation productivity growth rates are expected to be particularly robust - both relative to other industries in the same country and relative to the same industries in other countries that have already experienced more deregulation.

This article investigates this hypothesis by asking whether productivity growth in the Canadian regulated industries has been especially robust relative to other Canadian industries and to their U.S. counterparts.³

2 Gray (1987), for example, demonstrates that environmental regulations in the United States negatively affected productivity growth, though presumably benefiting the environment.

Table 1
The Share of Regulated Industries in Business Sector
Nominal GDP in Canada, 1977 and 2006

	1977	2006	Absolute Change
Air transportation	0.7	0.4	-0.3
Rail transportation	1.5	0.6	-0.9
Other transportation	3.6	3.8	0.3
Publishing, data processing and information services	0.8	1.3	0.5
Motion picture and sound recording industries	0.1	0.3	0.2
Broadcasting and telecommunications	2.8	2.8	0.0
Financial intermediation	2.7	4.0	1.3
Insurance carriers and related activities	1.6	1.6	0.0
Total regulated industries	13.9	14.9	1.0

Source: Statistics Canada, KLEMS database and CANSIM table 383-0021.

Note: Figures for 'total regulated industries' are simply the sum of the figures for the eight specific industries.

The paper is organized as follows. The second section outlines the data used for the international comparison. Section three examines labour productivity growth in regulated industries in Canada while section four compares labour productivity growth in Canadian and U.S. regulated industries. Section five examines multifactor productivity growth and capital deepening in the regulated industries in both countries. Section six concludes.

The Data

This article examines the growth in output and labour productivity in regulated industries in Canada and in the United States over the 1977-2006 period. The industry definitions for the regulated industries are based on the 1997 North American Industry Classification System (NAICS). The industries that will be examined are transportation services industries (rail, air,

and other transportation services including truck, transit and ground passenger transportation and pipeline transportation); two cultural industries (publishing, data processing and information services; and motion pictures and sound recording industries); broadcasting and telecommunications; and two financial services industries (financial intermediation including monetary authorities and credit intermediation, and insurance carriers).⁴ All of these industries, with the possible exception of the cultural sector, play a foundational network role for industries in the rest of the economy.⁵

Regulated industries accounted for 14.9 per cent of business sector nominal GDP in 2006 (Table 1). This was up from 13.9 per cent in 1977. The share of air transportation and rail transportation in business sector GDP declined over the period. The share of the two cultural industries, financial intermediation, and other transportation increased, while the share of broadcasting and telecommunications and insurance carriers was unchanged over the period.

Canadian Data

The data for Canada are taken from the Canadian KLEMS database. This database provides time series data for multifactor productivity, output and inputs including capital, labour, energy, materials and purchased services for industries on a NAICS basis back to 1961 (Baldwin, Gu and Yan, 2007). For the purpose of this article, we use GDP as the measure of output and hours worked and net capital stock as measures of labour and capital. This is consistent with the data used for the U.S. industries. The

3 Additional studies of the impact of regulation might try to capture whether turning points in productivity growth could be identified with specific regulatory events and whether other factors in the underlying technology also favoured the regulated sector in Canada that might have had a greater stimulating effect on them than on their counterpart U.S. industries. But these issues were beyond the scope of this study.

4 The insurance carriers for the United States include related activities that make up a small portion of the insurance industry.

5 Another important regulated industry is the utilities industry (i.e. electricity generation and distribution). Utilities are not addressed in this study.

data for the Canadian business sector are taken from CANSIM Table 383-0021.

U.S. Data

The data for the regulated industries in the United States are obtained from the U.S. Bureau of Economic Analysis (BEA). For the output measure, BEA publishes chain-type volume indexes for value added. For the labour measure, BEA publishes data on persons engaged in production that include paid workers and self-employed workers for the 1998-2006 period; it also publishes data on full-time and part-time paid workers for the period prior to 1998. The two measures are linked to form a time series of persons engaged in production for the 1977-2006 period. This is appropriate, as there is very little self-employment in these industries and the trend between persons engaged in production and the number of full-time and part-time workers is very similar for the industries examined over the 1998-to-2006 period. Finally, the number of persons engaged in production in an industry is multiplied by hours worked per person engaged in production in the same industry from the EU KLEMS database to obtain the number of hours worked (Timmer, O'Mahony and van Ark, 2007). The data on GDP and hours worked for the U.S. business sector are obtained from the Bureau of Labor Statistics.

The investment data by industry are obtained from the BEA (Lally, 2004). The data are based on NAICS and contain investment for 47 asset categories. The capital stock of each asset category for U.S. industries is then estimated using the perpetual inventory method by assuming a geometric depreciation pattern. To ensure the measures of capital stock in the United States are comparable with those in Canada, we have used the depreciation rates that are used in the Canadian KLEMS database (for details, see Baldwin *et al.*, 2008).

Labour Productivity Trends in Regulated Industries in Canada

In this section, we examine the output and productivity growth of the regulated industries over the 1977-to-2006 period. We begin by discussing the regulatory framework in each industry.

Structural Reforms and Deregulation in Regulated Industries in Canada

Throughout the period since the 1970s, there has been a trend toward deregulation within Canadian regulated industries. A number of structural reforms were implemented in the late 1980s across a range of the regulated industries (Conway and Nicoletti, 2006). The OECD publishes regulation indicators in energy, transport and communications that measure restrictions to competition. These indicators capture factors such as barriers to entry, state ownership and market structures in the industry, although they do not reflect restrictions to foreign ownership.⁶ For example, in telecommunications, the indicator is based on the market share of new entrants to gauge the extent to which regulators succeeded in promoting competition (Conway and Nicoletti, 2006). Chart 1 illustrates these indicators for air transportation, telecommunications and rail transportation over the 1977-2006 period. Restrictions to competition are based on a 0 to 6 scale where 6 signifies that there are heavy restrictions to competition in the industry and 0 indicates no restrictions.

Both the airline and the rail industries were largely deregulated in 1988 with the emergence of the *Canada Transportation Act*. This Act entitled all licensed domestic air carriers to operate freely in southern Canada, and this right was then extended throughout the country in 1996. However, there are restrictions on foreign ownership in the airline industry, and

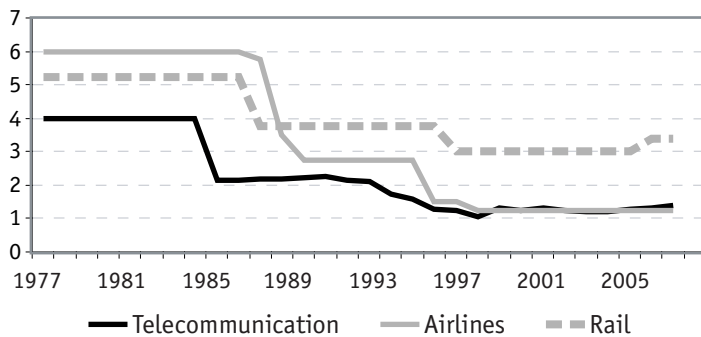
⁶ For further explanation of these indicators, see Conway and Nicoletti (2006).

Chart 1

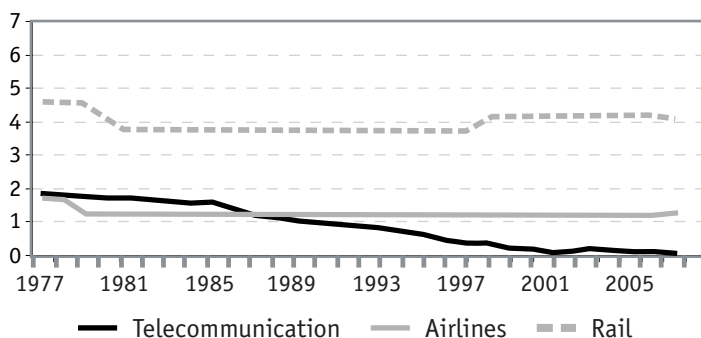
Regulation Index by Industry in Canada

(based on a scale from 0-6, from the least to the most restrictions to competition)

Canada



United States



Source: Conway and Nicoletti (2006).

there remain controls preventing foreign carriers from competing on domestic routes. Under the *Canada Transportation Act*, ownership and control of voting interests held in a Canadian air carrier by non-Canadians may not exceed 25 per cent.

The telecommunications industry consists of wired or wireline and wireless telecommunications carriers as well as satellite telecommunications, while the broadcasting industry comprises radio and television broadcasting, as well as pay and specialty television. With the introduction of technological advances, both telecommunications and broadcasting have experienced dramatic changes in the last decade. Changes in the telecommunications services sector include the

liberalization of the terminal equipment market (1980 to 1982), the launch of cellular service (1985), facilities-based long distance (1992), and fixed satellite services (2000). Changes to the broadcasting industry include the introduction of pay TV and specialty services (1983) and the launch of digital networks (2002).

According to the OECD, Canada started early, relative to most OECD countries, in implementing competitive reforms to its telecommunications policy and regulatory regime. The *Telecommunications Act* of 1993 installed a more flexible regulatory framework to foster competition. Canada has had open-market entry in all telecommunications services since the end of 1998 (although a licence is required for wireless operators and international service providers), and its telecommunications industry is considered to be one of the most pro-competitive in OECD countries (Maher and Shaffer, 2005). However, Canada is one of six OECD countries that have restrictions on foreign ownership in public telecommunications operators.

The rules regarding foreign ownership require majority ownership and control of Canadian broadcasting entities by Canadians; however, at least 40 per cent of television content is not produced in Canada. Broadcast program distribution was opened to competition in 1997, which allows cable firms to face competition from direct-broadcast satellites. Since then, cable operators have been able to change their basic cable rates without seeking approval from the Canadian Radio-Television and Telecommunications Commission.

In cultural industries, policies generally prohibit the acquisition of an existing Canadian-owned business and they prohibit or set conditions for the establishment of new businesses, particularly in most types of publishing. Canada has sought to restrict access to U.S. press, television and radio with cultural

trade restrictions, although this policy is not unique to Canada. Although restrictions exist, in many cases, foreign-owned companies dominate the culture industries in terms of sales.

The financial intermediation industry consists of activities related to the central bank and depository institutions such as commercial banks and credit unions. This industry has experienced many changes in its regulatory regime since the early 1980s, particularly because of changes made to the *Bank Act*, which is subject to review every five years. In 1987, amendments were made to federal legislation to permit Canadian banks to invest in corporate security dealers. In 1999, federal legislation allowed foreign banks to establish specialized, commercially focused branches in Canada, although foreign-bank branches were restricted in accepting deposits of at least \$150,000. Previously, they were required to establish separate Canadian subsidiaries. Following this change, many foreign-bank subsidiaries converted into foreign-bank branches. In 2001, reforms were made to the *Bank Act* to encourage increased competition and accountability, such as allowing banks to own finance companies.

The insurance carriers industry consists of the markets for life insurance and pensions, health and accident insurance and property and casualty (P&C) insurance. Both federal and provincial levels of government regulate the insurance industry. Over 90 per cent of firms in the life and health insurance sector and over two thirds of firms in the P&C sector are regulated by the Government of Canada under the *Insurance Companies Act*. All insurers are subject to market conduct regulation by the province in which they carry on business. In 2001, federal legislation allowed insurers to set up holding companies and gain access to Canada's national payments system.

Table 2
Labour Productivity Growth in Regulated Industries in Canada
(average annual rate of change)

	1961-1977	1977-1990	1990-2006	1977-2006
Air transportation	4.6	3.1	0.8	1.8
Rail transportation	7.0	5.7	6.9	6.3
Other transportation	2.6	1.1	0.3	0.7
Publishing, data processing and information services	2.4	0.4	1.2	0.9
Motion picture and sound recording industries	-1.1	1.8	2.4	2.1
Broadcasting and telecommunications	6.3	5.1	3.9	4.5
Financial intermediation	1.5	2.2	3.0	2.6
Insurance carriers and related activities	2.5	5.6	2.7	4.0
Total regulated industries	4.2	3.0	2.0	2.4
Business sector	3.5	1.1	1.7	1.4

Source: Statistics Canada, KLEMS database and CANSIM table 383-0021.

Output and Labour Productivity Growth in Regulated Industries in Canada

Table 2 presents estimates of labour productivity (output per hour) growth in regulated industries and the business sector in Canada over 1977-2006. Business sector labour productivity growth was 1.4 per cent per year. Labour productivity growth was higher in seven of the nine regulated industries. The exceptions were publishing and information services, and other transportation services. Over the 1977-2006 period, labour productivity growth was strongest in rail transportation (6.3 per cent per year), broadcasting and telecommunications (4.5 per cent) and financial intermediation (4.0 per cent).

The deregulation was associated with increased productivity growth in the regulated industries in Canada. During the period 1961 to 1977, the labour productivity growth of the total regulated industries was 0.7 percentage point faster than that of the total business sector. During the period 1977 to 1990 when the industries were being deregulated,

Table 3
Real GDP Growth in Regulated industries in Canada
 (average annual rate of change)

	1961-1977	1977-1990	1990-2006	1977-2006
Air transportation	10.1	6.6	-0.5	2.6
Rail transportation	5.1	1.5	4.2	3.0
Other transportation	4.4	4.1	3.4	3.7
Publishing, data processing and information services	4.5	4.9	4.3	4.6
Motion picture and sound recording industries	-0.9	6.2	5.3	5.7
Broadcasting and telecommunications	9.9	6.8	5.0	5.8
Financial intermediation	7.4	4.7	4.1	4.4
Insurance carriers and related activities	3.7	5.8	2.1	3.8
Total regulated industries	6.2	4.9	3.7	4.2
Business sector	5.2	3.3	3.2	3.2

Source: Statistics Canada, KLEMS database and CANSIM table 383-0021.

Table 4
Hours Worked Growth in Regulated Industries in Canada
 (average annual rate of change)

	1961-1977	1977-1990	1990-2006	1977-2006
Air transportation	5.2	3.4	-1.3	0.8
Rail transportation	-1.8	-4.0	-2.5	-3.2
Other transportation	1.7	3.0	3.0	3.0
Publishing, data processing and information services	2.1	4.5	3.0	3.7
Motion picture and sound recording industries	0.2	4.4	2.8	3.5
Broadcasting and telecommunications	3.3	1.7	1.0	1.3
Financial intermediation	5.7	2.5	1.1	1.8
Insurance carriers and related activities	1.2	0.2	-0.6	-0.2
Total regulated industries	1.9	1.9	1.7	1.8
Business sector	1.7	2.2	1.4	1.8

Source: Statistics Canada, KLEMS database and CANSIM table 383-0021.

lated, the productivity growth difference favouring the total regulated industries almost tripled. Over that period, the productivity growth in the total regulated industries was 1.9 percentage point higher than in the total business sector.

The strong productivity performance in the industries that have been deregulated supports the empirical evidence from the OECD, European Union and the United Kingdom that deregulation is associated with higher productivity growth, possibly through the reduction in barriers to entry, and increases in incentives to innovation and adoption of advanced technologies (Copenhagen Economics, 2007; European Commission, 2004).

As noted above, publishing and information services and other transportation industries have had slower productivity growth than the business sector. The Canadian publishing industry experienced less deregulation than most of the other industries studied here.⁷ The slower productivity growth in other transportation occurred during a time when Canada experienced a recession in the early 1990s and a surge in oil prices.

Tables 3 and 4 present estimates of growth in real gross domestic product (GDP) and hours worked in regulated industries and the business sector in Canada over the 1977-2006 period. Output growth was higher than the business sector average of 3.2 per cent per year in all regulated industries except air and rail transportation. Growth in hours worked in the two cultural industries was higher than all other regulated industries and the business sector.

The rest of this section presents a more detailed examination of output and labour productivity growth in the regulated industries over the 1977-2006 period. The airline industry experienced strong output, hours, and labour productivity growth in the 1977-1990 period. Since then it has performed well below average on all three variables. The industry was greatly affected by the recession of early 1990s. Following this recession, output growth rebounded, outpacing the business sector until 1998. Thereafter, the trends

⁷ These industries may also be subject to greater measurement problems when it comes to the price data that are used to generate output growth from revenue data.

reversed as the industry experienced a number of disruptions, including 9/11 and surges in oil prices.

GDP in the rail industry, consisting of freight and passenger railways, grew at less than one half the rate of business sector output (1.5 per cent versus 3.3 per cent per year) in the 1977-1990 period. However, since the privatization of Canadian National Railways (CN) in 1995, and further deregulation in 1996, the industry's output growth has doubled. Moreover, in 1998, CN purchased U.S. rail company Illinois Central Corp., which allowed the Canadian railway to connect its Canadian lines to a line running from Chicago to New Orleans. This has led CN to increase its customer base and gain significant economies of scale. Labour productivity growth in the rail industry has been the highest of any regulated industry since 1977.

Other transportation services, which include truck, transit and ground passenger transportation and pipeline transportation, had higher growth in output and hours worked than the business sector in 1977-2006 period. But its labour productivity growth was below that of the business sector (0.7 per cent versus 1.4 per cent per year).

The broadcasting and telecommunications industry's performance has proven to be quite robust in terms of output and productivity growth over the 1977-2006 period. Hours worked grew by 1.3 per cent per year over the period while output grew much faster, so most of the output growth translated into productivity growth.

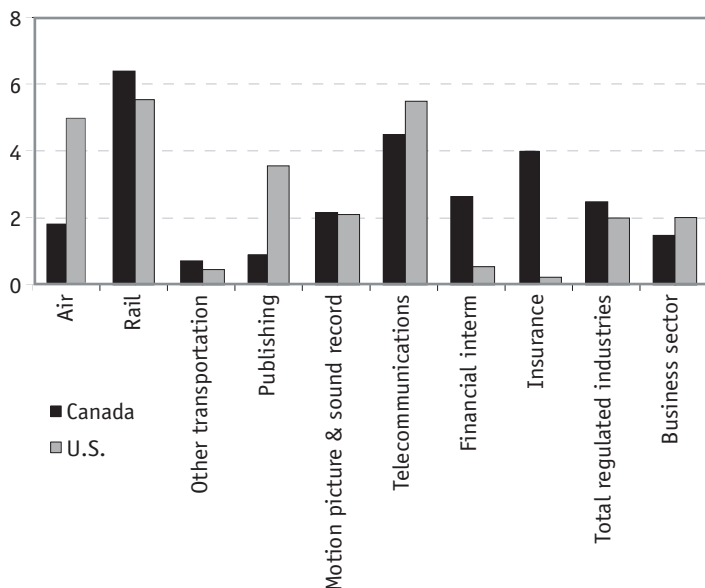
The wireless telecommunications component has been growing quickly, particularly since the launch of cellular service. The number of wireless phones has been increasing rapidly. The number of mobile communication subscribers in 2003 was more than 10 times the number of subscribers in 1993. Moreover, the rate of Internet subscriptions

in Canada is one of the highest in the world, with 56 subscribers per 100 households in 2003. In broadcasting, the FM-radio segment is one of the most profitable in broadcasting. Much of the growth in television broadcasting over the last decade can be attributed to the rapid rise of pay and specialty television.

The publishing, data processing and information services industry consists of the publishers of newspapers, periodicals, books, databases and software, data processing services, and information services such as news syndicates, libraries and archives. Its GDP accounted for 0.8 per cent of the business sector's GDP in 1977. This ratio jumped to 1.3 per cent in 2006 because of above average output growth (Table 1). However, labour productivity growth in this industry over the 1977-2006 period was below that of the business sector (0.9 per cent versus 1.4 per cent per year).

The motion picture and sound recording industries include motion picture and video production, distribution and exhibition, and record production, integrated record production, music publishers and sound recording studios. The sector is small, but it has expanded rapidly, from 0.1 per cent of nominal business sector GDP in 1997 to 0.3 per cent in 2006. Since 1997, there have been increases in service production for Hollywood films in the motion picture industry. The creation of the Canadian Film or Video Tax Credit in 1994, the Canadian Television Fund in 1996 and the expansion of the broadcasting industry generated the need for more Canadian programming. Moreover, many new and large movie theatres have been built in recent years. On the other hand, the Canadian film market is fragmented into the markets for French-language and English-language Canadian productions. The industry in Quebec is largely subsidized, and there are barriers to entry in the French-language market in

Chart 2
Labour Productivity Growth in Canadian and U.S. regulated industries, 1977-2006
 (average annual rate of change)



Source: Canada KLEMS and CANSIM Table 383-0021, Bureau of Economic Analysis.

the form of laws stipulating that distributors interested in distributing films in Quebec must be based in the province, along with mandatory translation of foreign films. In terms of the sound-recording industries, according to the International Federation of the Phonographic Industry, Canada ranked sixth in terms of recorded-music sales in 2003. Labour productivity in motion pictures and sound-recording industry grew more quickly than that of the business sector over the 1977-2006 period (2.1 per cent per year versus 1.4 per cent).

Labour productivity grew much more quickly in financial intermediation and insurance carriers than in the business sector over the 1977-2006 period. While domestic banks and trust companies dominate the industry, the real value of services produced by foreign bank subsidiaries and branches has been growing quickly (Hinchley, 2006). This has contributed to the industry's output growth.

Canada–U.S. Comparison of Labour Productivity Growth in Regulated Industries

In this section, we compare output and labour productivity growth in Canadian and U.S. regulated industries over time. In the 1970s, the regulated sector in Canada was, in general, more heavily regulated than in the United States (Conway and Nicoletti, 2006). Since the 1970s, there has been deregulation and open-market entry in both Canada and the United States, but at a faster pace in Canada. By the early 2000s, the gap between the severity of regulation in Canada as compared to the United States had been considerably reduced; the possible exception would be that of the cultural industries in Canada. The book publishing, distribution and retail sectors, the periodical publishing and newspaper sectors, and the film distribution sectors all have policy measures that generally prohibit the acquisition of an existing Canadian-owned business and prohibit or set conditions for the establishment of new businesses. In the United States, there are no rules preventing foreign ownership in the publishing industry, with the exception of newspapers (Price, 2001).

Over the 1977-2006 period, labour productivity growth in the business sector was slower in Canada (1.4 per cent per year) than in the United States (2.0 per cent) as shown in Chart 2. However, six of nine regulated industries in Canada had higher (or comparable) labour productivity growth than their U.S. counterparts. The three exceptions were air transportation, publishing and information services, and broadcasting and telecommunications. Overall, labour productivity growth in the regulated industries was higher in Canada than in the United States: 2.4 per cent per year versus 2.0 per cent.

The regulated industries in Canada that had a higher or comparable productivity growth relative to the United States are those industries which experienced deregulation. The slow pro-

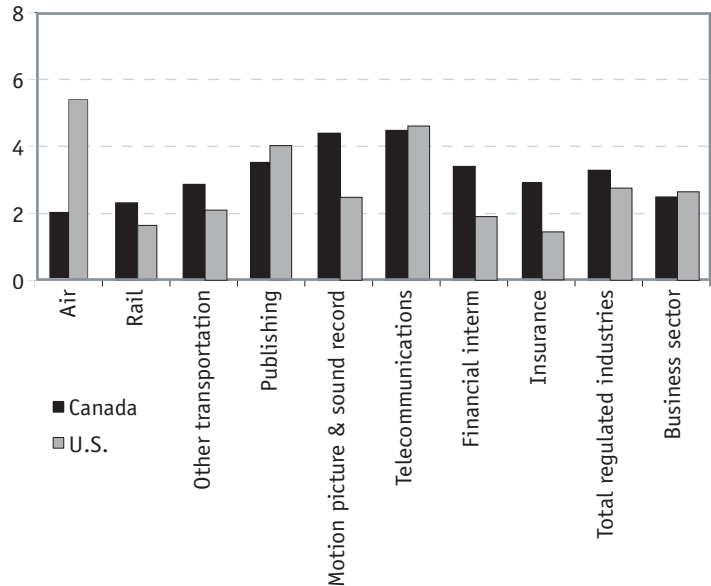
ductivity growth in Canadian publishing and information services, which experienced less deregulation, stands in contrast to those industries where there was more deregulation.

Chart 3 presents the real GDP growth in regulated industries in Canada and the United States over the 1977-2006 period. Output growth in Canada was higher or comparable to that in the United States in six of the nine regulated industries. Again the exceptions are air transportation, publishing and information services, and telecommunications and broadcasting. Air transportation in Canada had much slower output growth than in the United States over the 1977-to-2006 period, which was due to slow growth in Canadian air transportation after the early 1990s.

In the rest of the section, we provide a Canada-U.S. comparison of labour productivity growth in individual industries over time, as shown in Charts 4 to 7. These charts show trends in the ratio of labour productivity in Canada to that in the United States (1977=100 for both countries). An index above 100 implies that the relative Canada-United States productivity level has increased relative to the base period. A decrease in the relative index implies that productivity growth in Canada has been slower than productivity growth in the United States. The slope of each line at a given year indicates the relative growth rates of labour productivity in the two countries.

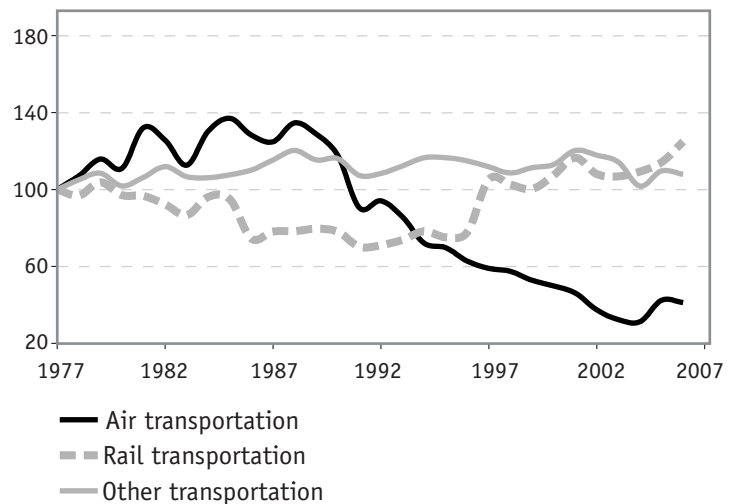
From 1977 to 1990, labour productivity growth was higher in Canada than in the United States in air transportation (Chart 4). After 1990, this situation reversed, with the United States leading in terms of labour productivity growth. Productivity growth has been particularly poor in the Canadian air transportation industry after 1990. On the other hand, the rail industry in Canada did not perform in the same manner as air transportation. There was a downward trend in the relative Canada-United States

Chart 3
Real GDP growth in Canadian and U.S. Regulated Industries, 1977-2006
(average annual rate of change)



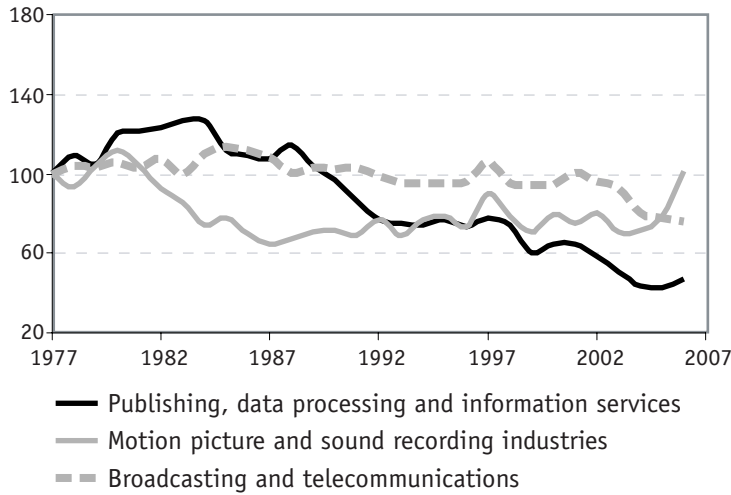
Source: Canada KLEMS and CANSIM Table 383-0021, Bureau of Economic Analysis.

Chart 4
Relative Canada/United States Labour Productivity in Transportation, 1977-2006
Index (1977=100)



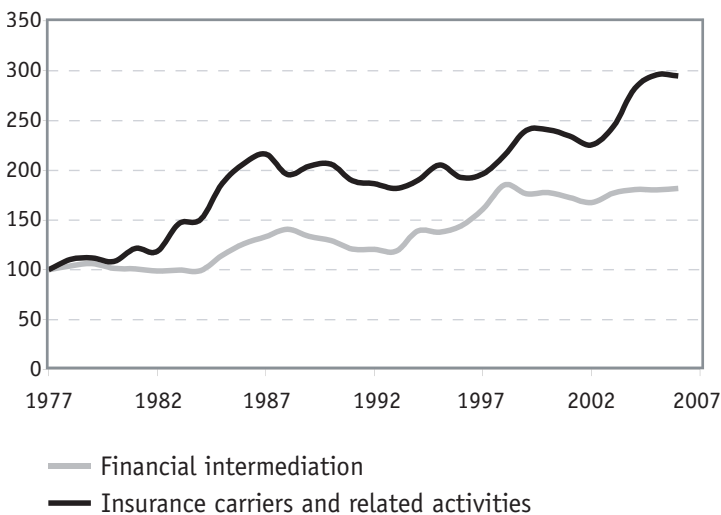
Source: Canada KLEMS, Bureau of Economic Analysis.

Chart 5
Relative Canada/United States Labour Productivity
in Information and Cultural Industries, 1977-2006
 Index (1977=100)



Source: Canada KLEMS, Bureau of Economic Analysis.

Chart 6
Relative Canada/United States Labour Productivity
in Financial Services, 1977-2006
 Index (1977=100)



Source: Canada KLEMS, Bureau of Economic Analysis.

labour productivity ratio until 1990. Thereafter, the ratio increased, with the rail transportation industry in Canada growing more quickly than in the United States. The other transportation services had slightly higher labour productivity growth in Canada than in the United States throughout the period.

Labour productivity growth in broadcasting and telecommunications was similar in the two countries before 2001, and after 2001 it was slower in Canada (Chart 5). In the publishing, data processing and information services industry, Canada outperformed the United States until the mid-1980s, as shown in Chart 5. Since then, labour productivity in the United States grew faster than in Canada. For the motion picture and sound recording industries, labour productivity growth was slower in Canada until the mid-1980s. Thereafter, labour productivity growth was similar in the two countries for most of the period.

Labour productivity growth in financial intermediation and insurance carriers was higher in Canada than in the United States in the 1977-2006 period (Chart 6). The ratio of Canadian to U.S. labour productivity showed a steady increase over the period for the two financial services industries. Alternative output measures using other data sources have shown that productivity growth of Canadian banks has been higher than that of American banks in recent years (Allen and Engert, 2007).

The overall labour productivity growth in the regulated industries was higher in Canada than in the United States over the period 1977 to 2006 (Chart 7). But there was some decline in Canada's relative productivity in the regulated industries after 2000, which was mostly due to the relatively slower productivity growth in the Canadian broadcasting and telecommunications services.

Canada–U.S. Comparison of Investment and Multifactor Productivity Growth in Regulated Industries

Labour productivity growth can be broken into two main components: gains that originate from changes in capital intensity (the amount of capital per hour worked); and growth in multifactor productivity (MFP), which is generally everything that cannot be accounted for by capital intensity growth. Growth in MFP is often associated with technological change, organizational change or economies of scale. In this section, we examine the sources of labour productivity growth in the regulated sector in Canada and the United States, and compare them in both countries over time. We will use a standard growth accounting technique:

$$\Delta \ln(LP_t) = \Delta \ln(MFP_t) + \bar{S}_K \Delta \ln\left(\frac{K_t}{L_t}\right),$$

where Δ denotes the change between periods $t-1$ and t . LP is labour productivity defined as real gross domestic product (GDP) per hour worked, K/L is capital stock per hour worked, and \bar{S}_K is the average share of capital income in nominal GDP in the periods $t-1$ and t .

The equation shows the two main sources of labour productivity growth. The first term is MFP growth, which increases labour productivity growth on a point-for-point basis. The second term on the right-hand side is the contribution of capital deepening (or capital deepening effect), whereby more capital services make workers more productive.⁸

Table 5 presents labour productivity growth, the capital deepening effect and MFP growth in regulated industries in Canada and the United States over the 1977-2006 period. For the business sector, labour productivity growth and MFP growth were slower in Canada than in the

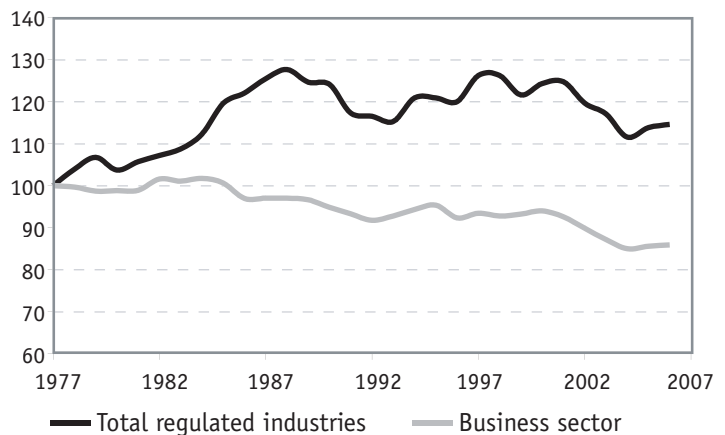
Table 5
Sources of Labour Productivity Growth in Regulated Industries in Canada and the United States, 1977-2006 (average annual rate of change)

	Canada			United States		
	LP	K/L	MFP	LP	K/L	MFP
Air transportation	1.8	0.9	0.9	5.0	0.6	4.3
Rail transportation	6.3	1.1	5.2	5.5	0.9	4.6
Other transportation	0.7	-0.1	0.7	0.4	-0.4	0.8
Publishing, data processing and information services	0.9	2.1	-1.3	3.5	1.3	2.2
Motion picture and sound recording industries	2.1	0.6	1.5	2.1	1.0	1.0
Broadcasting and telecommunications	4.5	1.3	3.1	5.4	2.4	3.0
Financial intermediation	2.6	2.8	-0.2	0.5	2.6	-2.0
Insurance carriers and related activities	4.0	3.8	0.2	0.2	1.8	-1.6
Total regulated industries	2.4	0.9	1.5	2.0	1.1	0.9
Business sector	1.4	0.5	1.0	2.0	0.7	1.2

Notes: LP denotes Labour productivity; K/L denotes contribution of capital intensity to labour productivity growth; MFP denotes multifactor productivity.

Sources: Statistics Canada, KLEMS database and CANSIM table 383-0021; Bureau of Economic Analysis.

Chart 7
Relative Canada/United States Labour Productivity in Regulated Industries and the Business Sector, 1977-2006 Index (1977=100)



Source: Canada KLEMS, Bureau of Economic Analysis.

⁸ For details on the growth accounting framework, see Jorgensen, Ho and Stiroh (2005) and Baldwin and Gu (2007a).

United States. The capital deepening effect was also smaller in Canada. However, for many of the Canadian regulated industries that underwent deregulation, labour productivity growth and MFP growth in Canada were higher or quite comparable with those in the United States. In addition, the investment and the capital deepening effect in those industries in Canada were also higher than in the United States or comparable to those of similar U.S. industries. Those industries include rail transportation, other transportation, motion pictures and sound recording, and financial services. For rail transportation, other transportation services, and motion pictures and sound recording, labour productivity growth and MFP growth were similar in Canada and in the United States. For the two financial services industries, labour productivity grew faster in Canada than in the United States. MFP showed little change in Canada but experienced a large decline in the United States.

The broadcasting and telecommunications industry experienced similar productivity growth in the two countries before 2001. After 2001, it had much slower productivity growth in Canada. Most of this slower labour productivity in the Canadian broadcasting and telecommunications industry was due to slower MFP growth in that industry after 2001. Baldwin and Gu (2009) found that the slower productivity growth in that industry was an important contributor to Canada's slower business sector labour productivity growth after 2000.

The publishing and information services and air transportation industries in Canada had slower labour productivity growth and MFP growth than in the United States in 1997-2006. But the capital deepening effect was similar in the two countries. This suggests that the slower labour productivity growth in Canada was due to slower MFP growth, and there was no deficiency in relative investment in those Canadian industries. The publishing and information ser-

vices and air transportation industries in Canada experienced slower technological progress and slower improvement in production efficiency than did those in the United States.

The slower MFP growth and labour productivity growth in the publishing and information services industries in Canada occurred in a sector that experienced the least deregulation of the industries examined here. Productivity growth in air transportation slowed down during the period when Canada experienced a recession in the early 1990s, the effects of 9/11 and a number of other negative shocks associated with fuel price increases.

The contributions of capital deepening and MFP growth to labour productivity growth differ across industries. But the main contributor to labour productivity growth is the same in most industries between Canada and the United States. For the financial services sector, capital deepening is more important than MFP growth for labour productivity growth. For rail transportation, and broadcasting and telecommunications, MFP growth and technological progress are more important for labour productivity growth. For the cultural industries and air transportation, the capital deepening effect and multifactor productivity growth are both important for growth in labour productivity.

Conclusion

This article has examined productivity growth in nine Canadian regulated industries and compared the results with those in comparable U.S. industries. The evidence shows that many of the Canadian industries that underwent deregulation and opened market entry to competition experienced faster labour productivity growth and multifactor productivity (MFP) growth than the business sector over the 1977-2006 period. While the business sector had slower productivity growth in Canada than in the United States, most Canadian regulated industries had similar

or higher productivity growth relative to their counterparts in the United States.

In Canada, the growth in labour productivity in regulated industries ranged from an annual average rate of 1.8 per cent in air transportation, to 4.5 per cent in broadcasting and telecommunications and 6.3 per cent in rail between 1997 and 2006. The overall growth in labour productivity in the regulated industries was 2.4 per cent per year, higher than the business sector average (1.4 per cent). Between 1977 and 2006, growth in labour productivity in the business sector as a whole was slower in Canada than in the United States, 1.4 per cent versus 2.0 per cent per year.

In contrast to the situation in the business sector, most regulated industries in Canada had higher, or comparable, growth in labour productivity than their American counterparts. These include rail transportation, other transportation, motion pictures and sound recording, financial intermediation, and insurance. For example, the 2.6 per cent average annual rate of labour productivity growth in financial intermediation in Canada was much higher than the 0.5 per cent in the United States. Labour productivity growth in insurance was 4.0 per cent in Canada but zero in the United States. Labour productivity growth in motion pictures and sound recording was about the same in the two countries.

The broadcasting and telecommunications industry had similar productivity growth in the two countries before 2001. After 2001 the industry had much slower productivity growth in Canada.

On the other hand, labour productivity increased 5.0 per cent per year in air transportation in the United States over the 1977-2006 period, well above the 1.8 per cent rate in Canada. Productivity growth in publishing and information services was 3.5 per cent in the United States, compared to 0.9 per cent in Canada.

Overall, labour productivity growth in the regulated industries in 1997-2006 was higher in Canada than in the United States, 2.4 per cent per year versus 2.0 per cent.

On balance, the evidence for Canada is consistent with the empirical evidence from the European Union, the United Kingdom and other OECD countries that suggest that deregulation is associated with higher productivity growth. This comes from reduced barriers to entry, increased competition, and increased incentives to innovation and adoption of advanced technologies such as information technologies.

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