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Structural Factors, Adjustment, and Productivity

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Cover

Leonard C. Wyon: Canada's Victorian Engraver

Paul Berry, Chief Curator, Currency Museum

The production of modern coinage is a mechanized process. Every year, to meet the public's need to carry out small transactions and make change, presses using mechanically engraved dies strike hundreds of millions of coins from metal that has been rolled into strips, cut into blanks, and rimmed by machines. It is easy to lose sight of the human dimension in the process: the artists who create and refine the images that appear on our coinage. In the past, these highly skilled artists engraved the dies by hand. Leonard C. Wyon was one such artist of particular importance for Canada.

Born in 1826 at a residence connected with the Royal Mint in London, England, Wyon was one of the last of a dynasty of engravers. His family had worked and lived at the Royal Mint since the late eighteenth century; his father, William Wyon, was employed by the Mint from 1816 to 1851 as chief engraver. Leonard's father not only taught him art, he also passed on his great skill in die engraving, giving him a firm grounding in the artistic requirements of coinage and contributing to his development as an exceptional artist. In 1851, on his father's retirement, Leonard succeeded him with the title "Modeler and Engraver." He carried out commissions for a wide range of public and private medals and military decorations and, for most of the Victorian period, designed coins in everyday use in England and throughout much of the far-flung British Empire.

Wyon's first "Canadian" commission was to produce the mayflowers (Nova Scotia's provincial flower) that grace the reverse of that province's token issue of 1856. He went on to design and engrave images appearing on the first decimal issues of Canada (1858), New Brunswick (1862), Nova Scotia (1863), and Newfoundland (1864). He also engraved the reverse of the Prince Edward Island cent (1871) and modelled the portrait on that piece. Wyon also created the obverse design for the Dominion of Canada's first coinage in 1870, modifying the portraits of Queen Victoria over the years to subtly capture the changing appearance of the aging monarch.

Wyon would have prepared these designs using a set of drawing instruments like the one pictured on the cover. Presented to Wyon by R. B. Bate, a noted London manufacturer of scientific instruments, it consists of 13 tools on two levels, including a pen, compasses, dividers, a brass protractor, and ivory rulers. Housed in a velvet-lined mahogany box, the presentation set measures 19.7 x 12.6 x 5.6 centimetres and is part of the National Currency Collection.

Photography by Gord Carter

Structural Factors, Adjustment, and Productivity

Richard Dion, Guest Editor

This special issue covers a variety of topics dealing with how structural factors or developments affect the economic performance of an advanced economy such as Canada.

One structural factor that has the potential to influence aggregate productivity is the size distribution of firms. In their article "Productivity in Canada: Does Firm Size Matter?" Danny Leung, Césaire Meh, and Yaz Terajima highlight the extensive research done at the Bank of Canada on the relationship between these two variables. They explain why a larger firm size generally supports higher productivity and estimate that the smaller average size of firms in Canada than in the United States can account for a significant portion of the productivity gap between the two countries. Finally, they briefly discuss the potential role of several factors, including financial constraints, in jointly determining average firm size and aggregate productivity.

Globalization leads to structural change and adjustment. In their article, "Offshoring and Its Effects on the Labour Market and Productivity: A Survey of Recent Literature," Calista Cheung, James Rossiter, and Yi Zheng report on the scale, evolution, and impact of one aspect of globalization: offshoring. Lower transportation and communication costs and opportunities for cost savings from offshoring have buttressed its rapid expansion in advanced economies. Since the scale of offshoring is still modest, however, its impact on aggregate employment and wages has been hard to detect and its effect on productivity, while generally positive, has been highly variable across countries.

In "Adjusting to the Commodity Price Boom: The Experiences of Four Industrialized Countries," Michael Francis compares the adjustment to the recent commodity-price boom in four advanced countries that are net exporters of commodities: Australia, Canada, New Zealand, and Norway. In these countries, the resources sector draws inputs from the rest of the economy, but the resulting expansion of production remains comparatively modest because of the long gestation period and relatively low capital productivity of large investment projects in the sector. In fact, much of the overall stimulus to the economy arises from the income and spending effects of terms-of-trade gains.

In "The Effects of Recent Relative Price Movements on the Canadian Economy," David Dupuis and Philippe Marcil describe the macroeconomic and allocative effects that the rise in commodity prices, the appreciation of the Canadian dollar, and the gains in the terms of trade have had on Canada in the past five years or so. These movements have given rise to substantial gains in real income, reduced Canadian cost competitiveness, and changed relative factor prices in favour of capital, thereby stimulating final domestic demand, depressing real net exports, and inducing intersectoral transfers of resources. The adjustment has generated frictions, which have likely contributed to hold back productivity growth.

Productivity in Canada: Does Firm Size Matter?

*Danny Leung, Césaire Meh, and Yaz Terajima, Research Department**

- *A smaller average size is one of the most distinctive structural features of Canadian firms relative to those in the United States, which in the past has systematically registered a higher productivity level than Canada.*
- *Both theory and empirical evidence suggest that a larger average size supports higher productivity at the plant and firm levels, especially in manufacturing.*
- *Canada-U.S. differences in the distribution of employment over categories of firm size accounted for nearly 20 per cent of the Canada-U.S. gap in sales per employee at the aggregate level, and roughly 50 per cent of the corresponding gap in manufacturing productivity in the late 1990s.*
- *Theory suggests that financial constraints, institutions, market size, tax codes, labour market legislation, and product-market rigidities likely play a role in jointly determining both the average firm size and aggregate productivity, but the importance of each determinant remains an open question.*

The structural features of an economy influence its level of productivity, and their evolution over time affects productivity growth, an important source of potential output growth and improvement in living standards. This article examines the findings of recent research on the effect that one such feature, the average size of firms, may have had on Canada's productivity performance. This issue is particularly relevant because a smaller average firm size is one of the most distinctive structural features of Canadian firms relative to those in the United States, which in the past has systematically registered a higher productivity level than Canada.[1] The article is organized as follows. We begin by reviewing the factors that lead to a relationship between firm size and productivity and then look at Canadian evidence of this relationship at the firm level. We subsequently quantify the extent to which the change in Canadian productivity can be accounted for by the change in the importance of large firms, and how much of the Canada-U.S. gap in labour productivity can be explained by the differences in the two countries' distribution of employment over firms of various sizes. We conclude by discussing the determinants of firm-size distribution.

Why Are Large Firms More Productive than Small Ones?

A common empirical observation in advanced economies is that large firms and plants have, on average, higher labour productivity than do small ones (Organisation for Economic Co-operation and Development

* The authors would like to thank Allan Crawford, Richard Dion, and Sharon Kozicki for their comments on earlier versions of this article.

1. There have been periods where labour-productivity growth in Canada has been stronger than in the United States (e.g., 1980–84, 1993–95).

2008). In this section, we discuss reasons for the relationship between size and productivity.

Labour productivity (i.e., output per unit of labour input) depends in part on productive efficiency. Efficiency in this context refers to the supplementary output that a firm can produce by using more advanced technology, better organization, and other factors to improve its inputs, or by exploiting increasing returns to scale in the presence of certain factors, such as fixed set-up costs.[2] Labour productivity also depends on the degree to which other inputs are employed. Where output is measured by the value added (i.e., sales minus the cost of intermediate inputs), giving each unit of labour more capital to work with would raise labour productivity. When output is measured by sales, then both higher capital intensity and intermediate input intensity would raise labour productivity. The effect of size on labour productivity can thus be traced to the relationship between size and efficiency, capital intensity, and intermediate input intensity.

Firm size and efficiency

One of the first studies to connect firm size and efficiency was Williamson (1967), which used a model to demonstrate that one factor limiting the optimal size of firms is loss of managerial efficiency in large hierarchical firms. Dhawan (2001) suggests that partly because of their greater organizational flexibility and because managers of small firms are more likely to take risks, small firms are more open and able to innovate. The bulk of the empirical evidence seems to suggest, however, that various efficiency-enhancing activities, such as the use of information and communications technology (ICT), labour training, the level of research and development (R&D), and the introduction of innovations, are positively related to size.[3] Baldwin and Sabourin (1998) show that use of advanced production technology rises with plant size in the Canadian and U.S. manufacturing sector. For the Canadian non-agricultural private sector as a whole, Charles, Ivis, and Leduc (2002) find that a gap exists between large and small firms, not only in their use of advanced ICT applications such as a websites and online transactions, but also of basic applications, such as personal computers, the Internet, and email. With respect to labour training, Chowhan (2005) finds that its incidence is much higher in large workplaces than in small ones. In the case of R&D, Boothby, Lau, and Songsakul (2008) show that the level of R&D rises with firm size in Canada; in the case of innovations, Baldwin (1997) finds that large manufacturing firms are more likely than small firms to introduce both product and process innovations.

Various efficiency-enhancing activities are positively related to size.

At least two factors, fixed costs and financial constraints, might facilitate higher efficiency in large firms than in small ones, notwithstanding the possibility that small firms might be more willing and able to take risks. The effect of fixed costs can be illustrated by the results of two studies. Cohen and Klepper (1996) theoretically derive and empirically verify that the propensity of firms to undertake R&D rises with their size, because the larger the firm, the greater the output over which it can average the costs of its R&D; and hence, the higher the returns from spending on R&D. In a similar vein, Åstebro (2002) presents empirical evidence that non-capital investment costs, such as fixed costs related to information acquisition, explain the positive relationship between firm size and technology adoption in the U.S. metal-working industry.

The effect of fixed costs could be exacerbated by financial constraints, to which smaller firms are more susceptible. Hall (1992) argues that firms prefer to use internal equity to finance R&D because of several factors: the risky nature of R&D, the preference of banks to secure loans using physical assets, and less willingness among entrepreneurs to reveal information about their innovations compared with other investments. Internal equity may be limited in smaller firms, however, because retained earnings are uncertain and share capital could be restricted to the owner's personal assets. Firms that do turn to debt and outside equity (when available) find that the cost is higher for small firms than for large ones. Leung, Meh, and Terajima (2008a) find evidence that, conditional on other firm characteristics, loan applications from larger U.S. small and medium-sized enterprises (SMEs) are more likely to be approved by a financial institution. Furthermore, larger SMEs pay lower interest rates on their loans than smaller SMEs, conditional on approval and firm and loan characteristics. Witmer and Zorn

2. Productive efficiency is also referred to as total factor productivity (TFP).

3. Hanel and Therrien (2008) and Leung and Zheng (2008) cite many papers that link ICT use, R&D expenditures, or innovations with TFP.

(2007) show that the cost of equity is negatively related to firm size in a sample of publicly traded non-financial firms in Canada and the United States. Financial frictions in turn can stifle productivity-enhancing but riskier activities. Indeed, in a sample of successful Canadian small businesses, Baldwin, Gellatly, and Gaudreault (2002) provide evidence that debt-intensive financial structures act to constrain R&D investment.

The role of economies of scale in favouring greater efficiency in large firms or plants than in small ones is also difficult to determine. Some micro studies suggest that exploiting increasing returns to scale could contribute significantly to productivity gains; for instance, in Canadian and U.S. banking services (Allen, Engert, and Liu 2006; Wang 2003) and Canadian manufacturing (Baldwin and Gorecki 1986). Other studies indicate, however, that returns to scale are constant, for example, in U.S. manufacturing (Nguyen and Lee 2002).

Firm size and input intensity

Large firms are more productive than small firms in part because they are more capital intensive. There may be at least two reasons for their higher ratio of capital to labour. First, large firms may face a lower cost of capital relative to labour. Indeed, the cost of debt and equity is lower for large firms, which in turn implies that their cost of capital is lower. Moreover, many studies find that workers in large firms are paid more than those in small firms, controlling for observable firm and worker characteristics (Oi and Idson 1999). Second, small firms may be less capital intensive than large ones because they may serve different markets and produce different products. For certain types of product, for example, the production technology is such that the optimal scale of production at the prevailing set of relative factor prices is beyond the size of small firms or plants. Another reason is that small firms may compete by offering a more stylized product and serving a niche market. The production of these individualized products does not easily lend itself to a capital-intensive, standardized process, but it does align well with the perceived adaptability of a small firm's production process.

Higher intermediate input intensity could contribute to higher productivity in large firms than in small ones. Indeed, Baldwin, Jarmin, and Tang (2004) show that the greater use of intermediate inputs in large manufacturing plants does play a role in explaining their higher output per worker than that of small firms. The incidence of outsourcing is likely greater with large firms than with small ones, given the fixed costs of outsourcing and the likelihood that large firms have more bargaining power with suppliers, which would allow them to reap greater cost savings from outsourcing.

Size and Firm-Level Productivity: Evidence from Canada

If the exact mechanisms that underpin the relationship between size and productivity are somewhat elusive, the robustness of the relationship leaves no doubt. In this section, we will examine the evidence for Canada in detail.

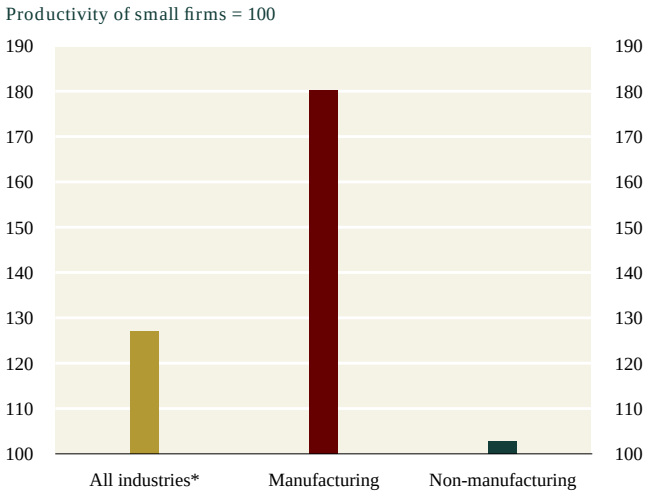
Many small firms are more productive than the average large firm.

Leung, Meh, and Terajima (2008b) calculate sales per employee by firm-size category, using Canadian administrative data on non-financial corporations with employees for the years 1984–97.[4] They find that, relative to firms with less than 100 employees, firms with 100 or more employees are 27 per cent more productive (Chart 1). There are also considerable differences across industries. The advantage large firms have over small firms is greatest in manufacturing. Here, firms with 100 or more employees are 80 per cent more productive. Outside of manufacturing, the relationship between size and productivity is much weaker. Other industries that exhibit a clear positive relationship include transportation and storage; arts and recreation; wholesale trade; construction; and mining, oil, and gas. Still other industries, such as other services, agriculture, and forestry and fishing, exhibit a strong negative relationship.

4. Leung, Meh, and Terajima (2008b) use Statistic Canada's T2-LEAP data. These data cover all corporations with employees. Firms in educational services and in finance, insurance, and real estate are excluded from the analysis because of measurement issues. A key contribution of Leung, Meh, and Terajima (2008b) is the inclusion of non-manufacturing firms in a study of size and productivity. The data currently end in 1997, but data up to 2004 may be available in the near future. Sales are deflated using industry gross output deflators from Statistics Canada. Note also that labour productivity is defined as output per worker instead of the more conventional output per hour. Thus, variations in hours worked per employee are not taken into account in the analysis.

Chart 1

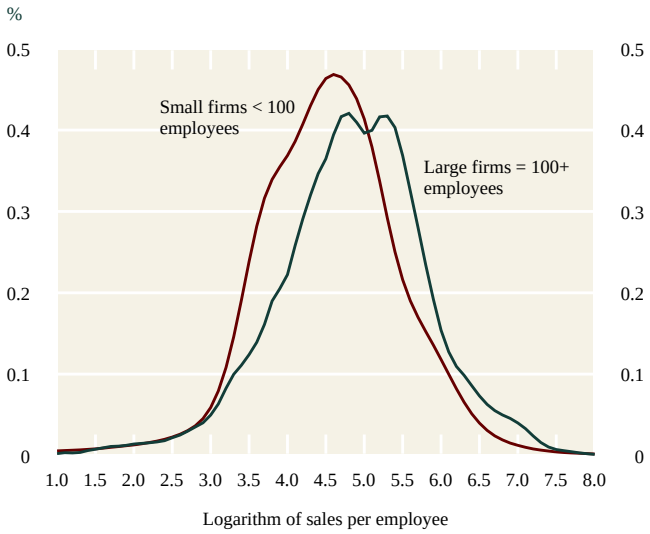
Productivity of Large Firms Relative to Small Firms in Canada



Note: Productivity is defined as sales per employee; large firms = 100 or more employees; small firms = less than 100 employees
* Excludes public administration; finance, insurance, and real estate; and educational services
Source: Leung, Meh, and Terajima (2008b)

Chart 2

Distribution of Productivity by Firm Size



Source: Leung, Meh, and Terajima (2008b)

The estimates above refer to differences in average productivity levels. There is much heterogeneity within these firm-size categories. Although the distribution of sales per employee for firms with 100 or more employees is clearly to the right of that for smaller firms, there is much overlap, indicating that many small firms are more productive than the average large firm (Chart 2).

The 27 per cent productivity gap between large and small firms at the aggregate level reflects not just pure productivity differences at the firm level, but also compositional effects. Leung, Meh, and Terajima (2008b) perform a regression analysis that examines the size-productivity relationship while controlling for three such effects: (i) the concentration of large firms in more-productive industries, (ii) firm life-cycle effects, such as the smaller size and lower productivity of entrant firms in an industry, and (iii) firm organizational type (Canadian-controlled private corporations, other private corporations, and public corporations). Allowing for the industry-concentration effect reduces the overall 27 per cent advantage for large firms to 10 per cent, and allowing for the life-cycle and organizational effects reduces it further, to 5 per cent. Within manufacturing, allowing for the industry-concentration effect reduces the advantage for larger firms from 80 to 40 per cent, and including the life-cycle and organizational effects further reduces it to 24 per cent. Even after these compositional effects are taken into account, the finding that firm size does matter, especially in the manufacturing sector, is not altered.

Firm Size and Aggregate Productivity

With large firms more productive than small ones, the productivity of a country would increase if its employment became increasingly concentrated in large firms, all else being equal. This section provides the results of two experiments conducted by Leung, Meh, and Terajima (2008b) that address the following issues: (i) what is the effect on aggregate labour productivity of changes in firm size in Canada over the 1984–97 period, and (ii) how much of the Canada-U.S. productivity gap in 1997 can be accounted for by differences in firm size?

The experiments were carried out using shift-share analysis (Box), in which aggregate labour productivity is defined as the sum of the labour productivity of each firm-size category multiplied by its employment share.[5] The importance of firm size is determined by allowing the employment shares to change exogenously while holding labour productivity for each

5. For our analysis, we use four firm-size categories: 1–19, 20–99, 100–499, and 500+ employees.

Shift-Share Analysis

Changes in labour productivity across time, or differences between countries, can be decomposed into changes (or differences) in productivity within the firm-size category and changes (or differences) in the distribution of employment across firms. For example, the change in labour productivity between 1997 and 1984 ($LP_{97} - LP_{84}$) is decomposed as follows:

$$LP_{97} - LP_{84} = \sum_k (LP_{k,\,97} - LP_{k,\,84}) w_{k,\,84} + \sum_k (w_{k,\,97} - w_{k,\,84}) LP_{k,\,84} + \sum_k (LP_{k,\,97} - LP_{k,\,84})(w_{k,\,97} - w_{k,\,84}),$$

where $w_{k,\,97}$ is the share of employees in firm-size category k in 1997, and $LP_{k,\,97}$ is the sales per worker in firm-size category k in 1997. The first term of the decomposition gives the change in labour productivity resulting from changes in labour productivity within the firm-size category while holding the distribution of employment constant. The second term gives the change in labour productivity resulting from changes in employment distribution while holding labour productivity within size categories constant, and the third term is a cross-product term that is usually small.[1]

1. The cross-product term, sometimes called the dynamic effect, weights the changes in labour shares with the growth of labour productivity. The dynamic effect is positive if there is an increase in the employment shares of firm-size categories with above-average changes in productivity (MTI 2003).

firm-size category constant. In reality, a change in employment share would alter the response of aggregate productivity because the factors that determine a country's average firm size are likely to have an effect on the productivity of firms as well. For instance, a sharp appreciation of the Canadian dollar would tend to depress employment in manufacturing and thereby the average firm size, given that manufacturing has larger firms than the rest of the economy.[6] All else being equal, this would result in a decline in aggregate productivity, given that manufacturing enjoys an above-average level of productivity. If, however, the labour shedding in manufacturing boosts productivity as firms attempt to reduce costs to remain competitive, then the aggregate outcome for productivity of the shift in the distribution of employment might turn out to be positive instead of negative. The results of the experiments described below should thus be interpreted with caution and should be used as starting points for a deeper analysis of the joint determinants of average firm size and productivity.

Impact of the decline in average firm size

Leung, Meh, and Terajima (2008b) find that, within the non-financial corporate sector, the number of employees in firms with 500+ employees fell from 42.3 per cent in 1984 to 37.2 per cent in 1997 (Chart 3). This is consistent with data for all firms with employees in Canada (Kanagarajah 2006). The decline is predominately the result of the fall in the average size of firms with 500+ employees.[7]

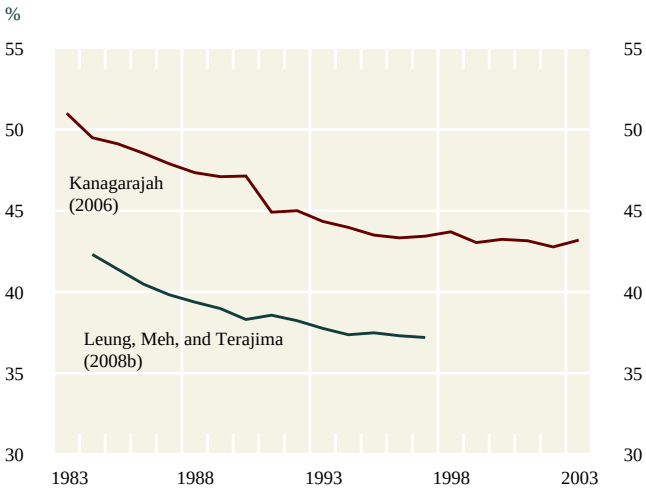
Yet the decrease in the importance of large firms exerts only a small drag on the change in labour productivity (Table 1). Changes in the distribution of employment account for -5.6 per cent of the change in labour productivity in the non-financial corporate sector and -5.3 per cent of the change in manufacturing. Note that, despite the two factors—the stronger size-productivity relationship in manufacturing than in the non-financial corporate sector and the similar decline in the fraction of workers in the 500+ category in both sectors—the drag on productivity from the size reduction in manufacturing is actually smaller. This is because what matters is not only where the decline occurred (the 500+ employee category), but also where those employees went. Compared with the non-financial corporate sector, the decline in the fraction of workers in the 500+ firm-size category in the manufacturing sector was offset more by increases in the 100–499 category and less by increases in the 1–19 firm-size category.

6. This would be the case if all manufacturing firms experienced the same percentage decline in employment. Average firm size might increase if declines occurred only among the smallest manufacturing firms.

7. The cause of this decline is unclear. Changes in industry composition account for little of the decrease. Instead, most of it can be traced to decreases in average size within industries, most notably mining, oil, and gas; manufacturing; transportation and storage; and communications and utilities.

Chart 3

Drop in Number of Employees in Firms with 500+ Employees



Source: Leung, Meh, and Terajima (2008b); Kanagarajah (2006)

Table 1

Change in Labour Productivity of Canadian Firms, 1984–97

	Factors affecting change in labour productivity (%)		
	Within-size category changes	Changes in distribution of employment across firms	Cross-product term**
All industries*	107.7	-5.6	-2.1
Manufacturing	109.1	-5.3	-3.8

Note: Productivity is defined as sales per employee. See Box for a description of the decomposition.
* Excludes public administration; finance, insurance, and real estate; and educational services
** The cross-product term, sometimes called the dynamic effect, weights the changes in labour shares with the growth of labour productivity. The dynamic effect is positive if there is an increase in the employment shares of firm-size categories with above-average changes in productivity (MTI 2003).
Source: Leung, Meh, and Terajima (2008b)

Canada-U.S. Differences in Firm Size and Productivity

Restrictions in the U.S. data limit the Canada-U.S. comparison to the non-agricultural, non-financial corporate sector.[8] In 1997, there was a 14 percentage point difference between the employment shares of U.S. and Canadian firms with 500+ employees, which was greater than the changes over time in this firm-size category in Canada (Chart 3 and Table 2). This gap was balanced mainly by a higher share of workers in firms in the 1–19 employee category. Even in manufacturing, Canada's employment share in the 500+ firm-size category was 13.6 percentage points lower than it was in the United States. In contrast to the overall numbers, this difference in manufacturing was offset by a greater proportion of workers in firms in the 20–99 and 100–499 firm-size categories.

Overall, Canada's level of sales per employee was 82 per cent that of the United States in 1997 (Table 3).[9] This gap is the result of differences in the 1–19 and 500+ firm-size categories, where Canadian labour productivity was 77.4 per cent and 79.6 per cent of the U.S. levels, respectively. In the other categories, Canadian firms were as productive as U.S. firms. Interestingly, the categories in which Canadian firms were not as productive as their U.S. counterparts were the same categories where Canada has smaller firms, on average, than the United States. Canadian firms were 12 per cent smaller in the 1–19 category, 50 per cent smaller in the 500+ category, and roughly the same size as U.S. firms in the two middle categories.

Table 2

Distribution of Employment over Firm-Size Categories, 1997

Percentage

	Firm-size categories			
	1–19	20–99	100–499	500+
Canada				
All industries*	23.9	23.2	16.0	36.9
Manufacturing	9.8	20.1	21.4	48.7
United States				
All industries*	15.8	18.6	14.3	51.2
Manufacturing	6.7	15.4	15.6	62.3

* Excludes public administration; finance, insurance, and real estate; and crop and animal farming
Source: Leung, Meh, and Terajima (2008b)

8. Specifically, crop and animal production and several other minor industries are not covered in the U.S. data. The source of the U.S. data used in the comparison is a custom tabulation from the Statistics of U.S. Small Business, available at < http://www.census.gov/csd/susb/susb.htm>. See Leung, Meh, and Terajima (2008b) for more details.

9. Canadian sales per employee were converted to U.S. dollars using the industry purchasing-power parities developed by Rao, Tang, and Wang (2004).

Table 3

Canadian Productivity and Firm Size Relative to the United States, 1997

Percentage

	Firm-size categories				
	1–19	20–99	100–499	500+	All
All industries*					
Productivity	77.4	96.3	106.4	79.6	82.2
Firm size	87.5	99.5	96.9	51.0	60.5
Manufacturing					
Productivity	82.3	89.2	103.6	91.4	84.8
Firm size	84.1	101.0	108.8	79.3	62.4

Note: Productivity is defined as sales per employee, and size is measured by the number of employees.
* Excludes public administration; finance, insurance, and real estate; and crop and animal farming
Source: Leung, Meh, and Terajima (2008b)

In manufacturing, Canadian sales per employee were 85 per cent of those of the United States (Table 3). Canadian labour productivity relative to the United States was lower in the largest and two smallest categories, and Canadian firms were smaller than in the United States in the smallest and largest categories. This roughly mimics the pattern found in the non-agricultural, non-financial corporate sector.

The categories in which Canadian firms were not as productive as their U.S. counterparts were those where Canada has smaller firms, on average, than the United States.

Given these Canada-U.S. differences in firm size and productivity, shift-share analysis allows us to address the question: What would Canada's labour productivity be if it had the U.S. employment distribution over its firm-size categories?[10] In 1997, the differences in employment distribution account for nearly 20 per cent of the Canada-U.S. gap in labour productivity overall and roughly 50 per cent of the gap in manufacturing (Table 4). Although not all data are available to perform the same analysis in a more recent year, the data in Chart 3 and similar numbers from the U.S. Census Bureau for all firms with employees suggest that the employment distributions in both countries did not change significantly between 1997 and 2003.[11] Thus shift-share analysis would likely find that changes in employment distribution would account for little of the widening productivity gap between Canada and the United States since 1997.

The finding that Canada-U.S differences in the distribution of employment over firm-size categories account for 20 per cent of the Canada-U.S. labour-productivity gap in 1997 is consistent with the findings from Leung and Ueberfeldt (2008). They developed a structural model to evaluate the role of job uncertainty in explaining both the Canada-U.S. wage gap and why large firms pay higher wages than small firms. Since some human capital is lost when workers move between jobs, the higher degree of job uncertainty in smaller firms causes workers in these firms to accumulate less human capital. Within this framework, Leung and Ueberfeldt (2008) find that 20 per cent of the Canada-U.S. difference in wages in 1996 was the result of differences in the employment distribution over firm-size categories.

Table 4

Decomposition of Canada-U.S. Differences in Productivity, 1997

	Factors affecting labour productivity (%)		
	Within-size category differences	Differences in distribution of employment	Cross-product term**
All industries*	80.5	19.0	0.5
Manufacturing	48.6	51.2	0.2

Note: Productivity is defined as sales per employee. See Box for a description of the decomposition.
* Excludes public administration; finance, insurance, and real estate; and crop and animal farming
** The cross-product term, sometimes called the dynamic effect, weights the changes in labour shares with the growth of labour productivity. The dynamic effect is positive if there is an increase in the employment shares of firm-size categories with above-average changes in productivity (MTI 2003).

10. Technically, Table 4 shows the results of the average of two decompositions—one where the U.S. distribution of employment is imposed on Canada, and the other where the Canadian distribution is imposed on the United States.

11. See http://www.census.gov/csd/susb/susb.htm. More recent evidence from the Statistics Canada Labour Force Survey suggests that the share of workers in large firms in Canada has increased in recent years. See Table 9 in Dion (2007).

Determinants of Firm-Size Distribution

Beyond the accounting relationship between firm-size distribution and productivity, a fundamental question arises: What drives the evolution of firm-size distribution? This remains an open question. Several recent theoretical papers (Cooley and Quadrini 2001; Cabral and Mata 2003) have emphasized the role of financial constraints in explaining how firm-size distribution has evolved. Empirical evidence (Beck, Demirgüc-Kunt, and Maksimovic 2005) suggests that financing obstacles have a negative effect on firm growth. To have an impact on firm-size distribution, however, financial constraints must affect a significant proportion of incumbent firms. Recent evidence (Angelini and Generale 2008) suggests that while financial constraints play a role in the evolution of firm-size distribution in developing countries, the impact in developed countries is negligible because of the small proportion of constrained firms there.

In a similar vein, the development of legal institutions to protect the property rights of entrepreneurs and outside investors encourages investment in tangible and intangible capital and promotes capital-market depth, both of which allow firms to grow (Rajan and Zingales 2001; La Porta et al. 1998). The empirical literature is mixed, however, on whether the differences between developed countries are significant (Kumar, Rajan, and Zingales 1999; Desai, Gompers, and Lerner 2003).

A larger market size is commonly thought to allow a country to have larger firms. Becker and Murphy (1992) argue, however, that the benefits of specialization are offset by the costs involved in coordinating the activities of specialists, and that these coordination costs limit the size of the firm before it is limited by the size of the market. Furthermore, differences in average firm sizes across countries are as large in industries that produce mostly tradable goods as in those that produce non-tradables (see Table 3). This suggests that market size cannot be the only determinant.

Several authors have suggested that tax codes, labour market legislation, and product-market rigidities affect average firm size and aggregate productivity. Guner, Ventura, and Xu (2008) construct a model to show how policies that drive differences in average size can also account for a sizable part of the difference in productivity between the United States and continental Europe and Japan. Studies that compare Canada-U.S. policy differences in a general-equilibrium framework are limited to Leung, Meh, and Terajima (2006). In this preliminary work, differences in technology-adoption costs and financial constraints are identified as possible determinants of the Canada-U.S. TFP gap. These adoption costs could be related to information acquisition, development, lack of skilled personnel, and workplace reorganizations needed to take advantage of the new technology (Crawford 2003).

Conclusion

The findings highlighted in this article suggest that firm-size differences play a significant role in explaining the productivity gap between Canada and the United States. Much research remains to be done, however, to identify the joint determinants of these differences. Differing tax codes have been suggested as a possible determinant, and work on marginal effective tax rates on capital has shown that there have been substantial historical Canada-U.S. differences (Chen, Lee, and Mintz 2002). The impact of these differentials on investment, productivity, and firm size has yet to be determined.

The findings in Leung, Meh, and Terajima (2008b) also suggest that more than one factor is behind the Canada-U.S. productivity gap. Since the productivity gap and differences in firm size are concentrated in the smallest and largest categories, the barriers faced by the smallest firms are unlikely to be the same as those faced by the largest firms. Relating to small firms, recent research has shown that the rate of job reallocation resulting from firm entry and exit is higher in the United States than it is in Canada (Balakrishnan 2008), and that the United States outperforms Canada in terms of net business creation (Godin and Clemens 2007). The greater level of churning and net business creation suggests that barriers to entry and exit are generally lower in the United States. Lower entry barriers facilitate the trial of new ideas, which consequently improve productivity. Identifying the source of these higher entry and exit costs could lead to an explanation of why small firms in Canada are smaller than those in the United States, and less productive.

With respect to larger firms, Witmer and Zorn (2007) find that the cost of equity among publicly traded firms is 30 to 50 basis points higher in Canada than in the United States. It would be interesting to examine

whether this difference has a significant impact on investment in Canada. As well, Canada-U.S. differences in R&D intensity among large firms account for most of the Canada-U.S. difference in aggregate R&D investment intensity (Boothby, Lau, and Songsakul 2008). Seeing whether large firms also account for the Canada-U.S. ICT intensity gap, as suggested by Fuss and Waverman (2005), could also be a line of research.

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Offshoring and Its Effects on the Labour Market and Productivity: A Survey of Recent Literature

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- *Firms relocate production processes internationally (offshore) primarily to achieve cost savings. As offshoring becomes an increasingly prominent aspect of the globalization process, understanding its effects on the economy is important for handling the policy challenges that arise from structural changes induced by globalization in general.*
- *In advanced economies, offshoring of materials used in manufacturing has risen steadily over the past two decades. The scale of offshoring in services is much smaller, but has grown faster than that of materials since the mid-1990s. The intensity of offshoring in Canada has been higher than in many other advanced economies, probably because of our close economic relationship with the United States.*
- *Offshoring has not exerted a noticeable impact on overall employment and earnings growth in advanced economies, but it has likely contributed to shifting the demand for labour towards higher-skilled jobs.*
- *There appear to be some positive effects of offshoring on productivity consistent with theoretical expectations, but such effects differ by country.*

Over the past couple of decades, the lowering of trade and investment barriers as well as technological progress in transportation and communications have facilitated the globalization of production processes. Firms increasingly take advantage of the cost savings and other benefits that result from making or buying inputs where they can be produced more efficiently. This phenomenon of production relocation across national boundaries is generally known as offshoring.[1] Understanding the implications of offshoring in the current context is an important step towards handling the opportunities and challenges of globalization as it matures. This article contributes to such understanding by summarizing some key findings in the literature on the impact of offshoring on employment, wages, and productivity in developed economies. Note that while offshoring of services is still in its infancy, it merits as close a study as that of manufacturing offshoring, given its unique characteristics and greater potential for growth.

While offshoring can help businesses improve their profitability, and host countries (i.e., providers of offshored goods and services) generally welcome the resulting creation of jobs, its macroeconomic effect on home countries (i.e., importers of offshored inputs) remains a subject of debate. There has long been concern that labour markets in developed economies have faced adjustment challenges associated with

1. This broad definition holds regardless of whether the counterparty to the offshoring firm is an independent firm or a foreign affiliate. Outsourcing, on the other hand, emphasizes the relocation of production processes across firm boundaries.

offshoring to low-wage countries, first in the manufacturing sector and then services. The concerns are summarized as follows: “If you can describe a job precisely, or write rules for doing it, it's unlikely to survive. Either we'll program a computer to do it, or we'll teach a foreigner to do it” (Wessel 2004).

The gains to the overall economy as a result of offshoring, on the other hand, have received less publicity, partly because they usually do not occur immediately and thus are more difficult to associate directly with offshoring. Nevertheless, research suggests that offshoring may contribute to productivity gains, promote skills upgrading, enhance the purchasing power of consumers via lower import prices, and reduce the exposure of exporters to exchange rate fluctuations by providing a natural hedge.

Offshoring has likely played an important role in shifting the composition of industries in favour of those more aligned with the comparative advantages of the home economy. Furthermore, the widening of the global supply base as a result of offshoring tends to raise competitive pressures and leads to changes in relative prices, such as those of standardized manufactured goods versus metals and oil, or those of call centre services versus architectural design. Despite their still limited impact, such changes have the potential to grow in prominence and thus warrant careful consideration, along with domestic circumstances, in conducting effective economic policies. For example, the productivity effect from offshoring could influence the growth potential of the economy, while persistent relative price movements could affect inflation expectations—and both may lead to changes in inflationary pressure that need to be taken into account by monetary policy-makers (Carney 2008).

The remainder of the article begins with some recent developments in offshoring in both the international and Canadian context. This leads to a discussion of what drives offshoring. A survey of the empirical evidence regarding the impact of offshoring on labour markets and productivity follows, highlighting findings for Canada. Finally, the article concludes with a summary of the key results and a brief discussion of the future of offshoring.

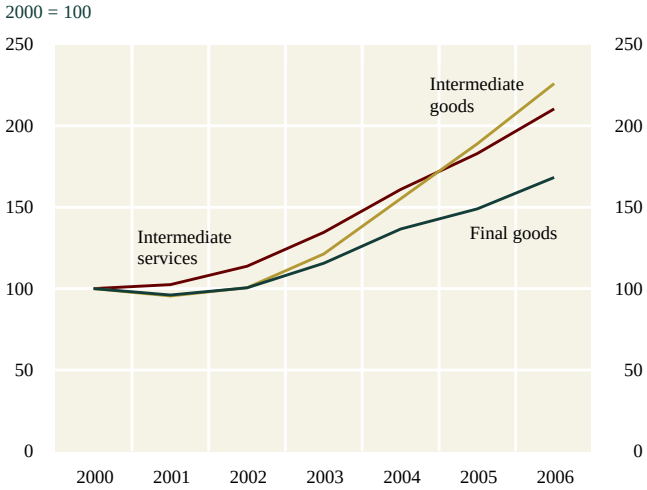
Recent Trends in Offshoring

Growth in offshoring on a global scale is evident in the steady expansion of trade in goods and services that are used as intermediate inputs.[2] For example, between 2000 and 2006, world exports of intermediate goods grew at an annual rate of 14 per cent, compared with a 9 per cent rate for final goods (Chart 1).[3]

Following common practice, we quantify the intensity of offshoring by country and by industry using two ratios: (a) imported intermediate inputs over gross output, and (b) imported intermediate inputs over their total usage. Both are calculated from standard industry datasets maintained by national statistical agencies and thus allow for international and cross-industry comparisons. While measures based on import content are derived under some restrictive assumptions and do not convey a complete picture of

Chart 1

World Exports of Intermediate and Final Goods and Services



Note: Intermediate goods: agricultural raw material, fuel and mining products, iron and steel, chemicals and other semi-finished goods
Final goods: all merchandise except intermediate goods
Intermediate services: commercial services excluding travel and transportation
Source: World Trade Organization

2. Throughout this article, the term intermediate inputs means goods (material inputs) and services (service inputs) that undergo further processing before being sold as final. For example, rolled steel and car engines are material inputs to motor vehicle manufacturing, while call centre services and accounting are typical examples of service inputs to many industries.

3. The globalization of production has also led to multiple border crossings of semi-finished goods with incremental value added at each production stage (Yi 2003), further boosting the share of intermediate goods in overall trade. Indeed, as of 2006, 40 per cent of world merchandise exports consisted of intermediate goods.

the globalization of production (see Box), they are likely indicative of the general trends.

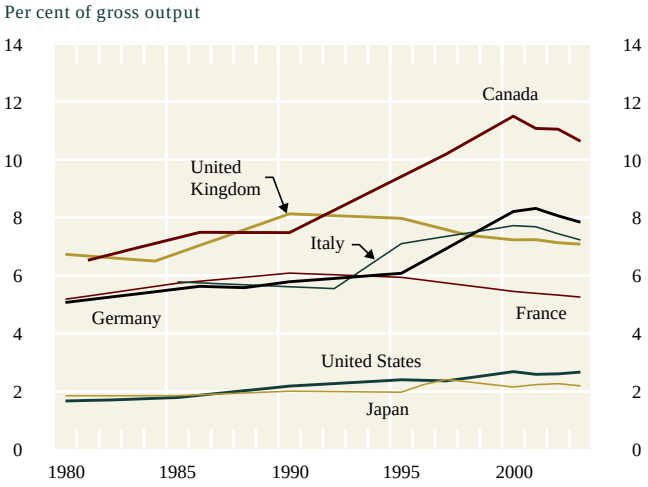
According to the International Monetary Fund (IMF 2007), imports of material and service inputs in 2003 represented about 5 per cent of gross output in advanced economies belonging to the Organisation for Economic Co-operation and Development (OECD).[4] Within the G-7, a wide dispersion of scale exists, ranging from 2 to 3 per cent in the United States and Japan, to more than 10 per cent in Canada (Chart 2). In addition, starting in the 1990s, Canada, Italy, and Germany saw a noticeable increase in the degree of offshoring.

The manufacturing sector is most affected by offshoring because of its greater openness to trade and high intermediate-input content.

The manufacturing sector is most affected by offshoring because of its greater openness to trade and high intermediate-input content in the production process. In the advanced OECD economies, the weighted average share of imported material inputs in manufacturing gross output rose from 6 per cent in 1981 to 10 per cent in 2001 (Chart 3).[5] The ratio in Canada is almost three times as high. Canadian manufacturers engage intensively in trade in intermediate inputs with the United States, given the existence of a tightly knit cross-border supply chain arising from the geographical proximity of the two countries and the signing of trade agreements that have fostered a large volume of regional investment and trade flows.[6, 7] A

Chart 2

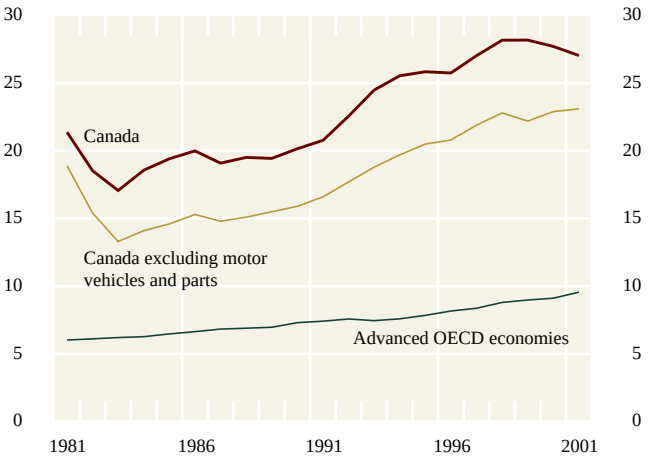
G-7 Offshoring of Non-Energy Inputs



Source: International Monetary Fund, *World Economic Outlook* (April 2007)

Chart 3

Offshored Material Inputs in the Manufacturing Sector



Note: Advanced economies include Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States
OECD = Organisation for Economic Co-operation and Development
Source: International Monetary Fund *World Economic Outlook* (April 2007), Bank of Canada

4. Advanced OECD economies in IMF (2007) include Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States.

5. Shares are weighted using share of nominal gross domestic product denominated in U.S. dollars. Data from IMF (2007).

6. These were the Canada-United States Auto Pact (1965), the Canada-United States Free Trade Agreement (1989), and the North American Free Trade Agreement (1994).

7. While the trade and investment linkages among European countries are also strong, these countries have, on average, a lower offshoring intensity than Canada. This is somewhat puzzling. One possible explanation is the labour market rigidity in some of these countries, which has prevented firms from reaping the expected benefits of offshoring, thus dampening the motivation to offshore.

Issues with Imputed Import-Based Measures of Offshoring

Since official statistics do not separate an industry's intermediate inputs into domestic and imported components, virtually all measures of offshoring are constructed from national input-output (I-O) tables, under the assumption that the import share of a commodity used as an intermediate input is the same as the share of imports in total domestic consumption of this commodity (following Feenstra and Hanson 1996, 1999).[1] As such, the differences in offshoring among industries largely reflect different commodity composition by industry, since no inter-industry variation in import propensity is allowed, by construction. How accurate are such imputations? Table B1 illustrates the potential measurement bias for the manufacturing industries.[2] The second column shows the average share of material inputs imported, as reported by plants responding to a Statistics Canada survey.[3] The third column lists the imputed share from the I-O table. The imputed value exceeds the survey-based value for almost all industries. For the manufacturing sector as a whole, the discrepancy amounts to 16 percentage points. While the survey-based direct measure is subject to sampling bias (among other things), the comparison serves as a reminder of the data challenges faced by researchers.

Even with the availability of industry data that separately quantify imported inputs, a complete account of the extent of international production relocation may still be difficult. Trade-based offshoring measures rely on the assumption that all offshored inputs will be imported by the home country before being integrated into the final product. However, this misses those cases where the final link in the global value chain is not located in the home country. For example, a final stage of production could be carried out in an offshore location before the product is imported in its final form. Alternatively, the entire production process could be delegated under contract to a different country so that the final product is sent directly from that location to serve its consumers. These situations generate productivity and labour market effects that are not captured by the intermediate-import-based measures of offshoring.

Table B1

Share of Material Inputs Imported into Canada

Percentage

Industries	Shares reported by		
	Innovation Survey 2005 (2002–04)	Input-output tables (2003)	Difference
Computer and electronics	49.9	71.8	21.9
Transportation equipment	42.6	65.4	22.8
Textile mills and textile products	53.3	62.5	9.2
Plastics and rubber	42.7	57.2	14.5
Miscellaneous manufacturing	30.9	55.4	24.5
Apparel and leather	43.6	54.3	10.7
Electrical equipment	42.2	53.5	11.3
Machinery	31.8	53.3	21.5
Petroleum and coal	24.0	47.7	23.7
Chemical	39.7	44.1	4.4
Printing	25.6	43.2	17.6
Primary metal	30.3	40.8	10.5
Furniture	17.8	37.0	19.2
Fabricated metal	24.0	33.7	9.7
Non-metallic mineral	22.6	26.9	4.3
Paper	31.6	26.9	-4.7
Food and beverage and tobacco	16.4	19.8	3.4
Wood	10.8	11.9	1.1
Total manufacturing	**29.0**	**44.7**	**15.7**

Source: Statistics Canada: Survey of Innovation 2005 as reported in Tang and do Livramento (2008), and input-output tables 2003; authors' own calculations

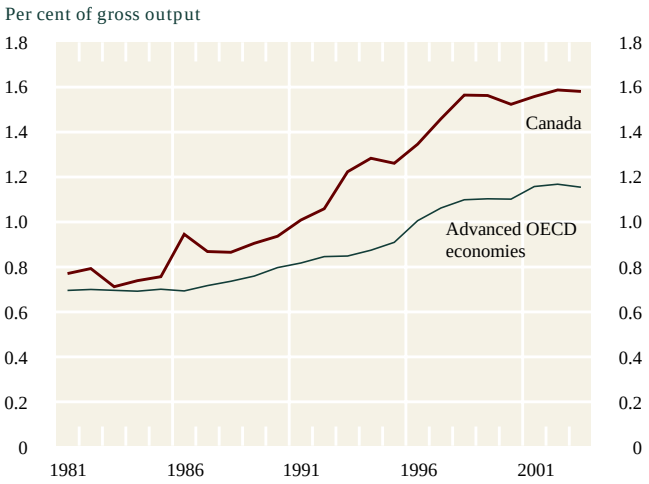
1. The annual I-O tables provide time series of detailed information on the flows of goods and services that comprise industry production processes.

2. For an evaluation pertaining to business services, see Yuskavage, Strassner, and Medeiros (2008).

3. Statistics Canada, Survey of Innovation (2005), reported in Tang and do Livramento (2008); table statistics based on a sample of 5,653 manufacturing plants, or 36 per cent of the population.

Chart 4

Offshored Service Inputs in the Overall Economy



Note: Advanced economies include Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States
OECD = Organisation for Economic Co-operation and Development
Source: International Monetary Fund *World Economic Outlook* (April 2007), Bank of Canada.

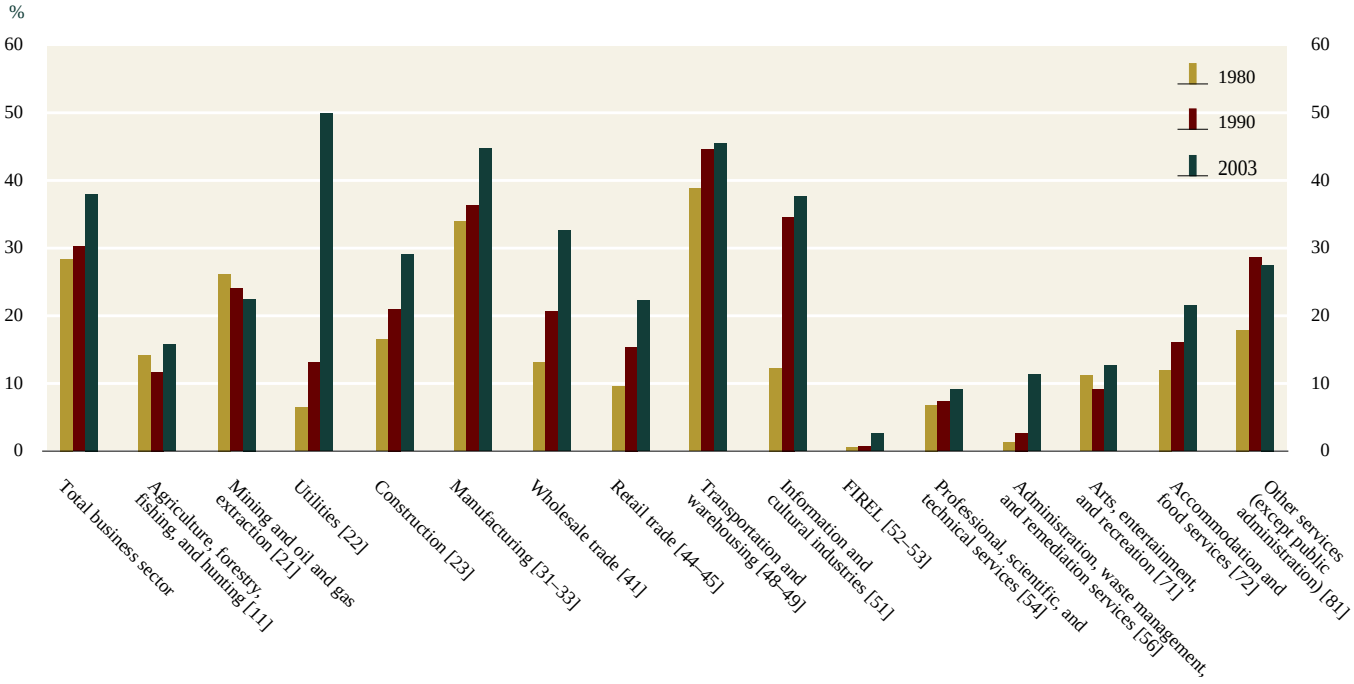
recent study finds that roughly 70 per cent of the Canada-U.S. bilateral merchandise trade is in components within the same industry (Goldfarb and Beckman 2007). The North American motor vehicle and parts industry offers a prime example in this regard, with 45 per cent of its gross output represented by imports and accounting for some 30 per cent of all the material inputs imported by the entire manufacturing sector. As demonstrated in Chart 3, however, the high propensity to import is also evident in other Canadian manufacturing industries.

Imports of service inputs by the overall economy, on the other hand, constitute a fairly low share of gross output, reaching 1 per cent only after 1995. Nevertheless, since the mid-1990s, this share has grown at a faster rate than its materials counterpart. The ratio in Canada is just slightly higher than the average of advanced OECD economies (Chart 4).

A more detailed examination of industry-level data for Canada reveals three industries with an above-average share of imported material: transportation and warehousing, manufacturing, and information

Chart 5

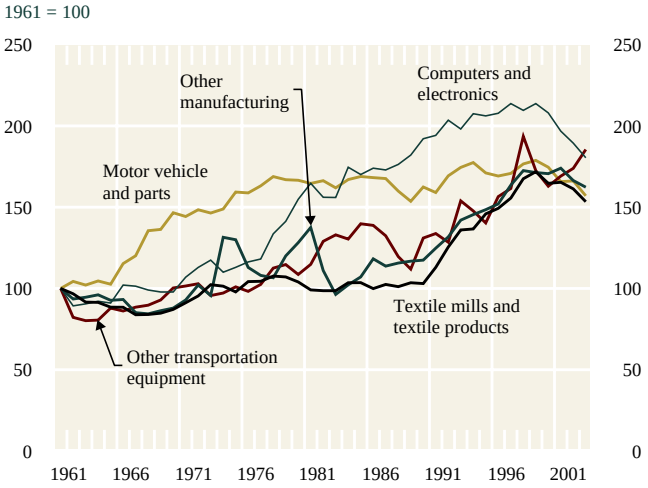
Imported Share of Material Inputs, by Industry*



* Numbers in brackets represent North American Industry Classification System (NAICS) codes.
FIREL = Finance, insurance, and real estate
Source: Statistics Canada

Chart 6

Offshoring of Material Inputs by Manufacturing Industries



Source: Statistics Canada

and cultural industries (Chart 5).[8] Within manufacturing, computers and electronics, transportation equipment, and textile products are the most offshore-intensive industries. Interestingly, while the motor vehicle and parts industry drove the upward trend in material offshoring in Canada in the 1960s and early 1970s, its import share of material inputs has remained flat in the past three decades, while a broad-based surge in offshoring has taken place in other manufacturing industries (Chart 6).

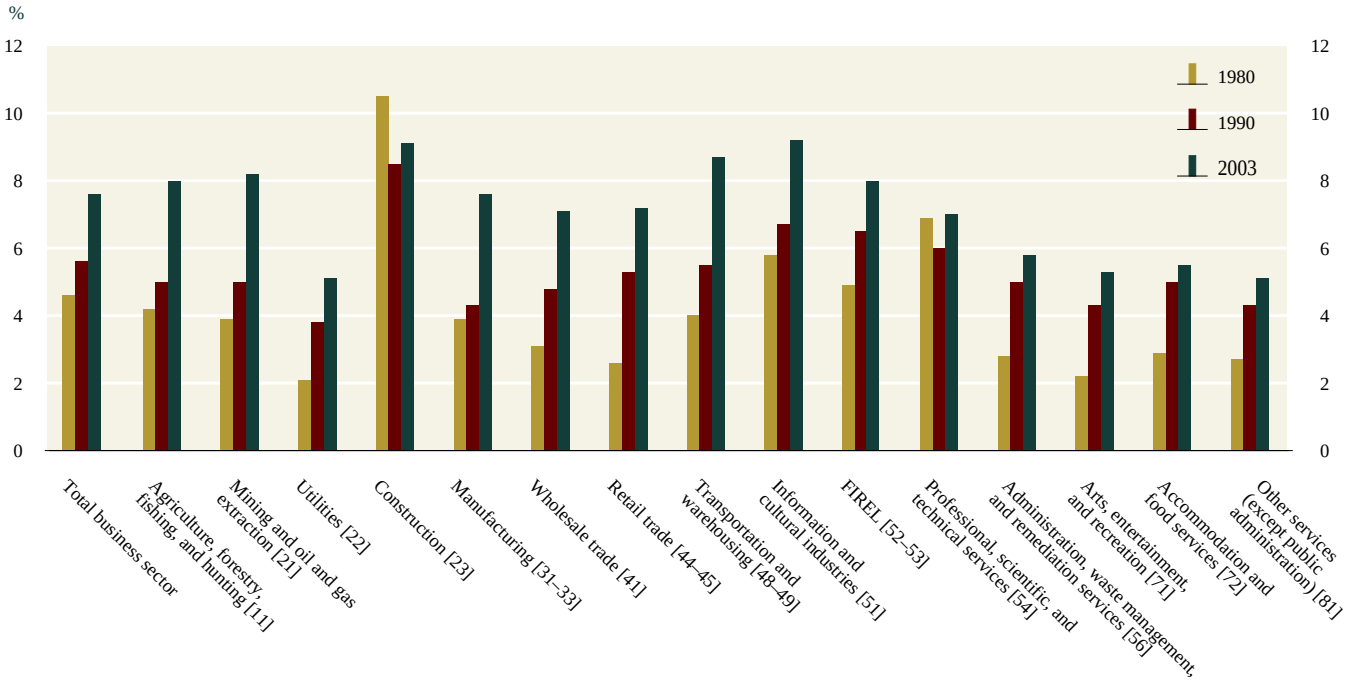
Since the mid-1990s, the share of imports of service inputs in gross output has grown at a faster rate than its materials counterpart.

For service inputs, the import proportion in the Canadian business sector increased to 7.6 per cent in

8. All industries shown in the chart are at the 2-digit level, the highest level of aggregation according to the North American Industry Classification System.

Chart 7

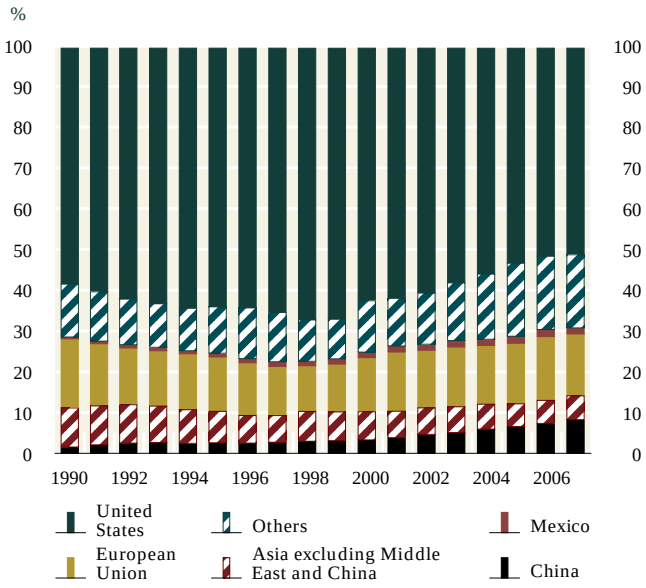
Imported Share of Service Inputs, by Industry



* Numbers in brackets represent North American Industry Classification System (NAICS) Codes.
FIREL = Finance, insurance, and real estate
Source: Statistics Canada

Chart 8

Origin of Imported Industrial Intermediate Inputs



Source: Industry Canada

2003, from 4.6 per cent in 1980 (Chart 7). In 2003, business services, finance, and insurance accounted for more than 70 per cent of imported service inputs, while the share of software development and computer services was only 3 per cent (Baldwin and Gu 2008).

Canadian firms have traditionally imported most of their intermediate inputs from the United States (Chart 8). In recent years, however, more imports have originated from the European Union, China, and other countries, leading to a decline in the U.S. share from 67 per cent in 1998 to 51 per cent in 2007.[9]

Factors Facilitating Offshoring

Broadly speaking, there are two types of offshoring. The first involves offshoring of labour-intensive intermediate inputs to developing countries, where cheaper labour abounds. The second entails offshoring of sophisticated inputs to industrialized economies to benefit from more advanced technologies or economies of scale. The latter type of offshoring lowers the costs of capital-intensive goods and services for firms in the home country. Regardless of the type, firms offshore when the cost to do so is lower than the cost of domestic production, enhancing the profits of home-country firms. This section discusses the recent drivers of offshoring and presents survey evidence on the benefits and costs associated with it.

Improvements in information and communications technology (ICT), especially since the 1990s, have reduced the adjustment and transactions costs faced by offshoring firms (Abramovsky and Griffith 2005). As ICT has fallen in price, it has been widely adopted by firms that are offshoring material inputs, resulting in immensely improved transportation logistics, inventory management, and production coordination. Offshoring of ICT hardware itself has contributed significantly to price declines of ICT, which has in turn facilitated the offshoring process in general (Mann 2003). Service offshoring has become more feasible in the past decade, owing to advances in ICT. The deployment of fast global telecommunications infrastructure, digital standardization (which facilitates the sharing of structured data across different information systems), and broadened access to lower-cost ICT equipment has enabled instant interaction between parties across the globe, reducing the importance of physical proximity in service delivery. The importance of ICT to service offshoring is emphasized by van Welsum and Vickery (2005), who specify four criteria that make a service occupation offshorable: intensive use of ICT; producing an output that can be traded or transmitted via the Internet; highly codifiable knowledge content; and no face-to-face contact requirements.

Improvements in ICT have reduced the adjustment and transactions costs faced by offshoring firms.

Aside from ICT, a global shift towards more open trade and investment policies, reductions in transportation costs, and improvements in transportation logistics (such as containerization and coordination among different modes of transportation) has expedited offshoring in recent years (Trefler 2005). For instance, the accession of China to the World Trade Organization in 2001 following decades of increasingly open trade policies led to an important shift in the

9. The increase in China's share is largely offset by a corresponding decline in the share of other Asian countries.

global labour supply. In addition, the reduction of trade tariffs and quotas by the Canada-United States Free Trade Agreement (1989) and the North American Free Trade Agreement (1994) substantially decreased the cost of offshoring between member countries.

A wealth of survey evidence exists on the factors that drive firms to offshore.[10] The most commonly cited motive is cost reduction. Other reasons include firms' desire to focus on core business, to expand capacity, to improve quality, and to create 24-hour operational flexibility for services. Firms might also expect to benefit from access to a skilled workforce, expansion into rapidly growing markets, and a closer proximity to customers (Trefler 2005).

The expected benefits from offshoring may not always materialize, however. For example, firms offshoring to developing countries must weigh the savings on wages against coordination costs that would not otherwise be incurred (Baldwin 2006). This is especially important for offshoring in services where the coordination between tasks is crucial. Other common challenges faced by offshoring firms include uncertainty surrounding the enforceability of contracts, issues with quality control, poor communication with the vendor, high costs of searching for the right partner, and weak protection for proprietary rights. The difficulty of learning how to offshore might also temporarily mask some of the gains from offshoring.[11] These negative aspects may limit the scale of offshoring.

The Effects of Offshoring on Advanced Economies

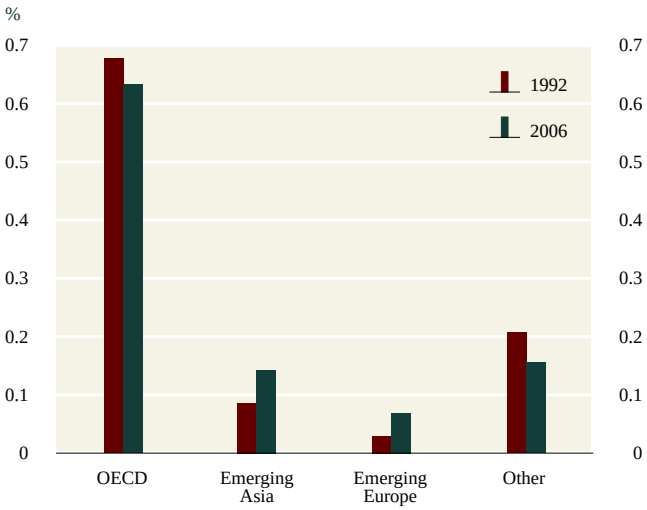
The global economy has experienced an important shift in production arrangements and the composition of labour supply. The ease with which firms are now able to employ workers in foreign countries has increased the degree of job competition on a global scale. This has the potential to significantly affect employment, wages, and productivity in countries involved in offshoring. These issues are the focus of the remainder of the article.

10. See, for example, Accenture (2004); Bajpai et al. (2004); Gomez and Gunderson (2006); PriceWaterhouseCoopers (2005, 2008); and Gomez (2005).

11. Bajpai et al. (2004) note that 26 per cent of their survey respondents, almost all of which had been in such arrangements for one year or less, were unsatisfied with their service outsourcing experience (four out of five involve a foreign provider).

Chart 9

Source of G-7 Imports of Material Inputs



Note: The G-7 countries are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.
OECD = Organisation for Economic Co-operation and Development
Source: OECD International Trade Statistics

Effects on the labour market

Overall impact

The impact of offshoring on the labour markets of the home country depends to a large extent on where the inputs are imported from. While most G-7 economies continue to import the majority of their material inputs from other advanced economies, the share of imports from emerging economies with abundant labour supply has roughly doubled since the early 1990s (Chart 9). In terms of service inputs, India's development as an important provider of offshore information technology and call centre services illustrates the same point. Given the rising share of imported inputs from low-wage countries, standard trade theory would suggest that labour demand and wages in the import-competing industries of the home country would decline.[12]

Beyond what standard trade theory would predict, trade in intermediate inputs may have more widespread effects on employment and wages than trade

12. According to Bhagwati, Panagariya, and Srinivasan (2004), offshoring is fundamentally a trade phenomenon that should therefore generate employment and wage effects qualitatively similar to those from conventional trade in final goods.

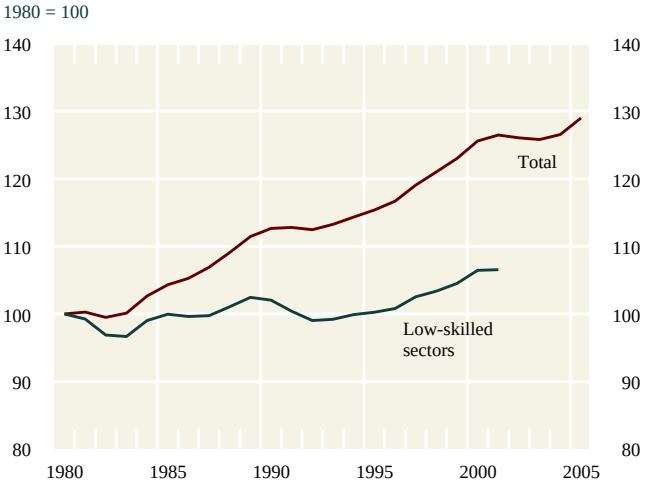
Chart 10

Advanced Economies: Employment and Earnings Growth

Note: Advanced economies = Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States
Source: International Monetary Fund, *World Economic Outlook* (2007)

Chart 11

Advanced Economies: Employment



Note: Advanced economies = Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States
Source: International Monetary Fund, *World Economic Outlook* (2007)

in final goods and services, since it affects labour demand not only in import-competing sectors but also in sectors that use the imported inputs (Feenstra and Hanson 2003).[13] Furthermore, to the extent that low-skilled activities are increasingly offshored to low-wage countries, labour demand in the home country is expected to be shifted towards high-skilled activities within industries, raising the skill premium for wages (Feenstra and Hanson 1996).[14]

In the long term, the offshoring of low-skilled tasks should not affect aggregate employment levels, barring impediments to the adjustment of relative wages and demand for skilled versus unskilled labour. Moreover, the initial loss of low-skilled jobs could be offset by the creation of new jobs made possible by cost savings resulting from offshoring (Bhagwati, Panagariya, and Srinivasan 2004). Likewise, the decrease in demand for high-skilled labour when high-skilled tasks are offshored could prove temporary, since importing skill-intensive inputs typically leads to technological spillover from more advanced host countries to the home country and eventually boosts demand for skills.

Chart 10 illustrates that it is indeed difficult to detect any sustained slowdown in overall employment or earnings growth in the advanced economies. In addition, there appears to be no systematic association between cross-country differences in trade openness and labour market outcomes (OECD 2005). Granted, labour market developments at the aggregate level mask the adjustment costs that can occur in the short run, in the form of job displacement or earnings loss for certain workers. Several studies suggest that industries with increased exposure to international competition are associated with higher rates of temporary unemployment (see OECD 2005 for a review). The loss in earnings is found to be significantly larger for trade-displaced manufacturing workers who change industry (Kletzer 2001).

Shifts in the skill composition of labour demand and wages

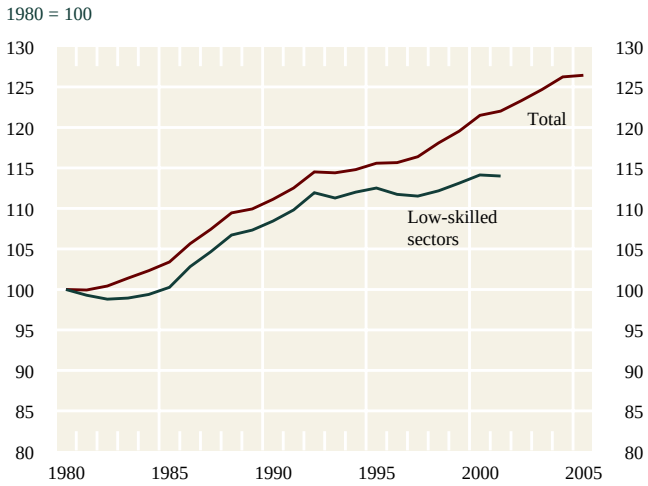
Many studies find evidence for OECD countries that increased offshoring is associated with slower growth

13. Egger and Egger (2005) also find that offshoring in one industry may have important spillover effects arising from sectoral input-output interdependencies and worker flows triggered by expanding or contracting production in different sectors.

14. Grossman and Rossi-Hansberg (2006a, 2006b) propose that the offshoring of low-skilled tasks generates cost savings to sectors most reliant on low-skilled labour, allowing output to expand in these sectors. The authors argue that, if sufficiently large, this productivity effect may even push up the wages of low-skilled labour.

Chart 12

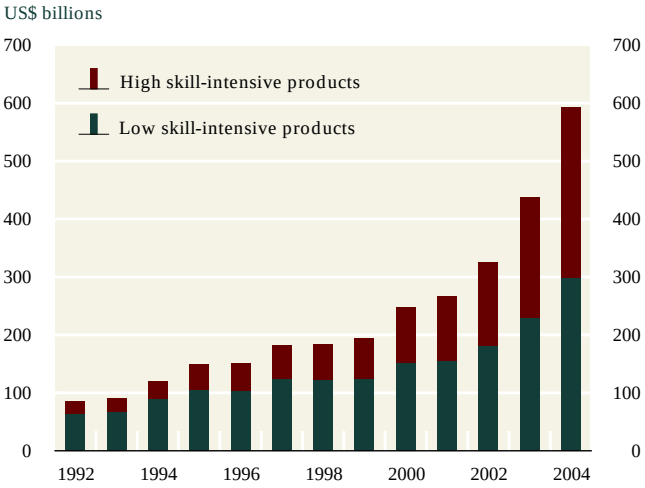
Advanced Economies: Real Labour Compensation per Worker



Note: Advanced economies = Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States
Source: International Monetary Fund, *World Economic Outlook* (2007)

Chart 13

China's Export Composition



Source: OECD International Trade by Commodity Statistics

in employment and wages of low-skilled labour relative to their high-skilled counterparts in the manufacturing sector.[15] Charts 11 and 12 show that, for the advanced economies, growth in employment and earnings in low-skilled intensive sectors has stagnated relative to total employment and earnings growth.[16] Although the relatively slower growth observed in low-skilled employment and earnings is consistent with the expected effects of increased offshoring of low-skilled tasks, it may also be attributable to technological progress that favours high-skilled jobs.[17] In general, while offshoring has been found to affect both labour shares and wages significantly, the impact of technological progress has been larger (IMF 2007; Feenstra and Hanson 1999).

Furthermore, the overall influence of offshoring on the skill structure of labour demand and wages in the home country may evolve over time, along with changes in the composition of host countries (advanced versus emerging economies), the nature of offshored operations (high-skilled versus low-skilled), and the skill structure of the host country. On the last point, Chart 13 illustrates that low-wage countries such as China have shifted increasingly towards skill-intensive exports in recent years. As offshored inputs move up the skill ladder, the effect of offshoring on a home country's labour demand by type of skills may become more difficult to quantify.

Is service offshoring different?

Service offshoring has expanded rapidly in recent years. Unlike their manufacturing counterparts, the service occupations that can be offshored are not usually characterized by low skill requirements. In the United States, displaced workers in tradable service jobs tend to have greater educational attainment, as well as higher skills and earnings, than those in manu-

15. For example, Feenstra and Hanson (1996, 1999) conclude that offshoring can account for 30–50 per cent of the increase in relative demand for skilled labour in U.S. manufacturing industries during the 1980s, and about 15 per cent of the increase in their relative wages between 1979 and 1990. Using the same method for the United Kingdom, Hijzen (2003) attributes 12 per cent of the increase in the relative wage gap during the 1990s to offshoring. For Canada, Yan (2005) finds that a 1 percentage point increase in the use of imported material inputs leads to an average 0.026 percentage point increase in the wage share of skilled workers in the manufacturing sector.

16. The sector classification by skill level used here is from the IMF study (2007), which is based on calculations in Jean and Nicoletti (2002) on the average share of skilled workers in each sector across 16 OECD economies. The study defines skilled workers as those having attained at least upper secondary education. Consequently, the trends illustrated do not capture possible within-sector shifts in skill level, but only shifts from low-skilled sectors to high-skilled sectors. This sector classification would also not capture the offshoring of low-skilled occupations that may have occurred within high-skilled sectors. Data at the sectoral level were only available up to 2001.

17. It is also difficult to know whether these changes result from a shift in final demand towards high-skilled-intensive products and services.

facturing (Jensen and Kletzer 2005).[18] Its perceived threat to domestic high-skilled jobs in which the United States has traditionally had a comparative advantage may be the reason that offshoring of service jobs has generated greater public concern in the United States than has the offshoring of manufacturing jobs.

The OECD (2005) finds limited evidence, however, that the offshoring of business services has undermined employment in industries providing such services, although this may be because of generally smaller trade flows and the relatively healthy employment performance of this sector. After examining a vast dataset by industry and occupation, Morissette and Johnson (2007) conclude that offshoring does not appear to be correlated with the evolution of employment and layoff rates in Canada. Jensen and Kletzer (2005) find that tradable service occupations in the United States experienced employment growth similar to that of non-tradable service activities, although, at the lowest skill levels, employment in tradable service industries and occupations has declined. In other words, the majority of displaced service workers are at the bottom end of the skill distribution, consistent with a movement away from low-skilled tasks in which the United States has a comparative disadvantage.

Effects on productivity

Offshoring may enhance productivity growth for several reasons. First, offshoring firms can specialize. This reduces the scope of work done in-house, so firms can focus on their core functions. Second, offshoring may accompany business restructuring; the change in the composition of the firm's labour force and the adoption of new best practices may be productivity enhancing. Third, low-cost offshored inputs may free up firm resources that can then be invested in productivity-enhancing capital and technology. Finally, some tasks may be offshored to more technologically advanced firms, allowing final-goods producers to learn productivity-enhancing production processes from foreign suppliers.

Measuring productivity gains from offshoring is challenging, owing to the so-called self-selection bias. Not only is it possible that offshoring improves firms' productivity, but also that highly productive firms take advantage of offshoring more than less-productive ones. Despite this bias, empirical studies find evidence of productivity gains from offshoring, but the results differ somewhat by country. For example, in the United States, the offshoring of service inputs accounts for a larger fraction of manufacturing productivity gains than does the offshoring of material inputs (Amiti and Wei 2006). Offshoring firms in the United States also tend to be outstanding in many regards (including productivity growth) prior to offshoring, but continue to experience higher productivity gains once offshoring has begun (Kurz 2006). In Canada, material offshoring has significantly contributed to multifactor productivity gains, while there is no such evidence from service offshoring (Baldwin and Gu 2008). Other evidence suggesting a causal link between offshoring and productivity growth is discussed in Olsen (2006).

Technology has played a complex role in the recent rise in offshoring.

Technology has played a complex role in both the recent rise in offshoring and in more generalized productivity gains, making it difficult to isolate the effects of ICT within the scope of offshore-induced productivity gains. It has been found in the United Kingdom, for example, that plants owned by U.S.-based multinational firms make better use of ICT than plants owned by other countries' multinational firms (Bloom, Sadun, and Van Reenen 2005). In principle, this more effective use of ICT by U.S. affiliates should lead to greater productivity growth from their offshoring activities. Technological improvements and software standardization have also further enhanced productivity gains from offshoring because they allow firms to buy services based on advanced technologies without having to incur the sunk costs of acquiring those technologies; Bartel, Lach, and Sicherman (2005) make this case for outsourcing in general. Finally, it has been shown that as the price of offshoring-related ICT falls, firms may invest in more of this technology, which increases the productivity of workers using it (Grossman and Rossi-Hansberg 2006b).

18. Service occupations classified as most tradable were those in the following sectors: management; business and financial; computer and mathematical; architecture and engineering; physical and social sciences; legal; and art, design, and entertainment.

Going forward, offshoring of service inputs may have a greater effect on productivity growth than material inputs. Over the past two decades, it is possible that the marginal benefit of material offshoring has declined considerably, as firms have long realized its greatest advantages. Given the recent improved affordability of ICT, however, the offshoring of services is a newer phenomenon. It thus has much more room to grow, as technological frontiers expand and service providers in host countries develop. The incremental benefits accrued to service offshoring may therefore be expected to increase over time.

Conclusions

In summary, the balance of empirical evidence suggests a linkage between improved productivity and offshoring. While offshoring has not exerted a noticeable influence on overall employment and earnings growth in advanced economies, it has likely contributed to a shift in the demand for labour towards higher-skilled jobs, although this effect is often difficult to disentangle from that of technological change and more general trade expansion.[19]

Offshoring has affected the Canadian economy in much the same way as it has other industrialized economies, despite the country's above-average offshoring intensity. In the case of employment and wages, this outcome attests to the flexibility and resilience of Canada's labour market in adjusting to the challenges of globalization. It could also mean that Canadian businesses have taken advantage of the opportunities presented by a more open world market. It remains to be seen, however, to what extent a further diversification of Canada's trading partners away from the United States to emerging economies would change this finding.

Continued technological improvements and labour shortages resulting from population aging in many industrialized countries could further encourage offshoring. At least four factors create some uncertainty about the future of offshoring, however, particularly for material inputs. First, if energy prices reach very high levels, as they have done recently, certain activities that have been offshored may be brought back to the home country. Second, although the cost of labour in developing countries is still relatively low, it is rising rapidly, partly as a result of strong economic growth that will likely persist for some time yet. Third, the ongoing global realignment of exchange rates could shift the distribution of offshoring activities among countries, with those featuring a depreciating currency more likely to become a host.[20] Finally, changes in some countries' environmental policies could alter a firm's decision to offshore.

Offshoring has affected the Canadian economy in much the same way as it has other industrialized economies, despite the country's above-average offshoring intensity.

As the offshoring phenomenon evolves, it may have ramifications for other branches of economic studies as well. In particular, the potential for rapid expansion in the offshoring of services could have profound effects on how an economy is modelled. Yet, typically, the service sector is assumed to be untradable. Clearly, such an assumption needs to be revisited, and more effort should be devoted to designing, monitoring, and analyzing indicators that are suitable for the service sector.

19. Many studies cited in this article include offshoring in regressions without controlling for other globalization indicators such as export orientation and import competition that likely also influence productivity and labour market outcomes. Accounting for these variables appropriately in light of their high correlation with offshoring could be a challenge.

20. On the other hand, Ekholm, Moxnes, and Ulltveit-Moe (2008) find that Norwegian exporting firms increased offshoring as a natural hedge against the appreciation of the Norwegian krone in the early 2000s.

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Adjusting to the Commodity-Price Boom: The Experiences of Four Industrialized Countries

Michael Francis, International Department

- *Since 2002, there has been an unprecedented, broad-based increase in global commodity prices. Although this increase has had a large economic impact on the major industrialized commodity-exporting economies, the resource-producing sectors have not expanded as a share of GDP in Australia, Canada, New Zealand, and Norway (collectively referred to as the CX4 countries).*
- *This article analyzes the economy-wide effects of the commodity-price boom by considering two key channels of adjustment: a direct channel through which increasing commodity prices reallocate productive inputs into the commodity-producing sectors, and an indirect channel whereby the growth in income generated by the commodity-price boom stimulates a broader economic adjustment.*
- *The indirect channel has generally proven to be relatively more important, generating increases in spending and exchange rate adjustment in all of the CX4 economies.*

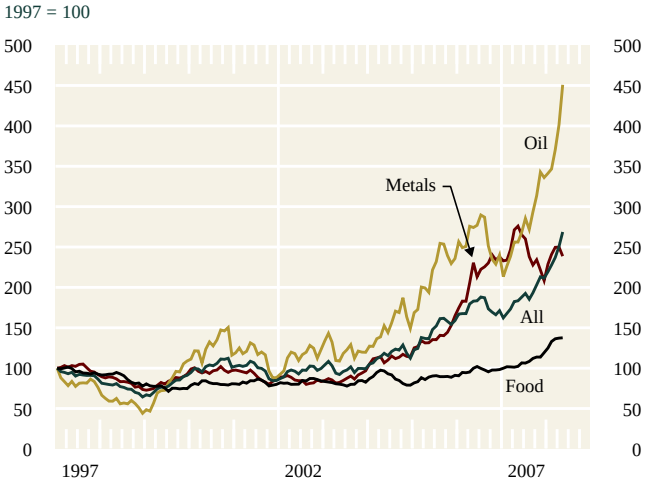
Since 2002, the world has experienced an unprecedented increase in commodity prices.[1] Oil prices have risen by over 300 per cent, metals prices by more than 180 per cent, and food prices by 66 per cent (Chart 1).[2] These price increases have provided a significant economic boost to the major commodity-exporting countries, including emerging markets like Chile, Russia, and the Middle East. But some industrialized countries that are major commodity exporters, such as Australia, Canada, New Zealand, and Norway (referred to here as the CX4) have also been particularly well placed to take advantage of the price increase (Table 1). For example, in nominal terms, almost 50 per cent of Canadian merchandise exports are commodity based, with oil and gas, which account for about 20 per cent of total exports, being particularly important. In the other three economies, the shares of commodity-based exports are even higher, ranging from 73 per cent of exports for New Zealand to 83 per cent in Norway. In comparison, the share of manufactured goods in merchandise exports ranges from approximately

1. Since this article was written, the global economy entered a mild recession. Global economic growth began to decelerate in the late summer and fall of 2008 as the problems with the U.S. subprime-mortgage market and falling house prices spread to consumption and investment.This has also led to a decline in commodity prices in recent months.

2. In this article, unless otherwise stated, commodity-price statistics are taken from the International Monetary Fund's commodity-price database, and are measured in terms of the IMF's Special Drawing Right (SDR). Using SDR as the unit of account for commodity prices provides a "global" measure, effectively removing the influence of any individual exchange rate. In particular, it largely accounts for the depreciation of the U.S. dollar, which would otherwise inflate the price of commodities measured in dollar terms. It also accounts for the strength of the currencies of the commodity-exporting countries, which would otherwise deflate the global commodity price.

Chart 1

Primary Commodity Prices



Source: International Monetary Fund commodity statistics

Table 1

Export Shares of Major Industrialized Commodity-Exporting Countries, 2005

	(%)			
	Australia	Canada	New Zealand	Norway
Food, beverages, and tobacco	17	7	50	5
Wood and wood products	2	10	9	2
Metals and minerals	29	11	8	8
Coal	16	1	0	0
Petroleum	7	10	2	50
Gas	3	9	0	18
Other commodities	3	0	4	0
Commodity subtotal	**75**	**47**	**73**	**83**
Chemicals	5	7	5	3
Finished manufactures	13	39	16	11
Other	8	7	6	4
Total	100	100	100	100

Note: Columns do not sum to 100 per cent due to rounding.
Source: United Nations Comtrade database and author's calculations

40 per cent for Canada to just over 10 per cent for Norway.[3]

An intriguing element of the current resource boom, however, is that the commodity-producing sectors in the CX4 economies have not generally increased their share of real gross domestic product (GDP) during the past five years. In Australia, Canada, and New Zealand, where the extractive industries and agriculture account for between 7 and 10 per cent of GDP, the share of the commodity-producing sectors fell marginally (by 1.3 per cent in Australia, 0.2 per cent in Canada, and 0.3 per cent in New Zealand). In Norway, where the commodity-producing sector accounts for approximately 23 per cent of GDP, the share in GDP declined by close to 6 per cent (Table 2).

The modest contribution to GDP of the commodity-producing sectors raises some interesting questions: How have these sectors adjusted to the boom and, given that their direct contribution to GDP has been relatively modest, what are the channels through which economic adjustment and resource reallocation have occurred?

This article describes the key elements of adjustment within these four industrialized commodity exporters.[4] The focus of the discussion is on two main channels through which the rise in commodity prices operates.[5] The first channel is via a direct effect—the rise in commodity prices raises wages and profits in the commodity-producing sectors, which in turn brings labour and capital into those sectors.

The second channel is via an indirect effect that results from the growth in income generated by the rise in commodity prices. This indirect effect consists of two parts: (i) the growth in spending associated with the increase in incomes, and (ii) an adjustment to the real exchange rate. The second part results from the rise in the prices of non-traded goods relative to the prices of traded goods that occurs if some of the income increase is spent on domestically produced, not readily traded goods (such as construction or services). This relative price change, referred to as a real appreciation, can be brought about by either an appreciation of the CX4 nominal exchange rates or by inflation in

3. Based on 2005 United Nations Comtrade data. The composition of imports is generally the reverse. Imports of finished manufactures account for over 50 per cent of imports in all the CX4 economies compared with commodity-based imports, which account for around 30 per cent.

4. Dupuis and Marcil, in this issue, provide a more detailed analysis of the Canadian case.

5. The theoretical framework for the analysis is based on the three-sector small open economy model as described in Corden (1984). The three sectors are a non-traded sector, which produces goods and services (such as construction) that do not typically compete on global markets, and two traded sectors—a "booming" commodity-producing sector and a "lagging" sector that produces tradable goods, such as manufactures. Corden uses this model to consider the effects of a resource boom.

Table 2

Size of the Extractive and Agricultural Sectors

		Australia		Canada		New Zealand		Norway	
		Extractive	Agriculture	Extractive	Agriculture	Extractive	Agriculture	Extractive	Agriculture
Share in total employment	2002	0.9	4.4	0.9	2.7	0.2	8.8	1.4	3.8
(%)	2007	1.3	3.4	1.2	2.3	0.3	7.2[a]	1.5	2.8
Share in total capital expenditure	2002	20.0	n/a	13.0	2.0	0.4	7.4	63.0	2.5
(%)	2007	28.0	n/a	16.8	1.3	0.4	7.2[b]	63.2	1.9
Share in gross domestic product (GDP)	2002	8.0	3.0	5.0	2.2	2.7	4.8	27.9	1.6
(%)	2007	7.4	2.3	4.8	2.2	2.3	4.9	21.9	1.6[a]

Note: a) 2006 estimate; b) 2005 estimate

Source: Employment and capital expenditure figures are from national statistical agencies and author's calculations. GDP shares are taken from Datastream and author's calculations, except for Norway (World Bank)

the non-traded sectors of their economies. In either case, the real appreciation will tend to encourage resources to move out of the CX4 traded sectors like manufacturing and into their non-traded sectors. Largely because of these expenditure and real exchange rate effects on the demand for non-traded goods, the resource boom affects other sectors of the economy, such as construction and manufacturing.

The direct effect of the resource boom is discussed in the following section, followed by a discussion of the indirect effect. The final section of the article provides some concluding remarks.

Direct Effects of the Resource Boom

As commodity prices have risen, so too, has the incentive to reallocate resources to the commodity-producing sectors in the CX4 countries. But, as discussed in this section, impediments to this process have limited the speed and size of the adjustment. To facilitate exposition, the extractive (mining and oil and gas) sector is discussed separately from the agricultural sector.[6] The focus is on the response of employment and capital expenditure, and the resulting impact on the contributions of these sectors to CX4 GDP.

Adjustment in the extractive industries

Both Australia and Canada have abundant supplies of energy and mineral resource deposits of varying grades. In the extractive industries, a rise in price can act as a signal to producers to "move through the grades" and commence exploitation from deposits that were not previously profitable. Canada's oil sands are an excellent example. Extraction of oil was not generally commercially viable at an oil price below US$25 per barrel, but as the price rose above this level, commercial production became profitable (National Energy Board 2004, 2006). At higher prices, extraction of oil from subterranean deposits, which requires the oil sands to be heated and liquefied before the oil can be drawn to the surface, also became feasible. Thus, as the price of oil rose from US$10 per barrel to more than US$100, the possibility of large-scale exploitation of low-grade oil deposits has become possible.

In Canada, the response to the rising commodity prices has been to invest heavily in the development of new and existing mines (Dupuis and Marcil 2008). The same has been true for Australia. Between 2002 and 2007, in both Australia and Canada, the average pace of real capital-expenditure growth in the extractive sector significantly exceeded that for the economy as a whole (respectively, 23 per cent year-over-year versus 13 per cent in Australia, and 10 per cent versus 8 per cent in Canada).[7] In Australia, where resource extraction accounts for more than one-quarter of economy-wide capital expenditure (Table 2), the sector has been a major contributor to economy-wide investment.

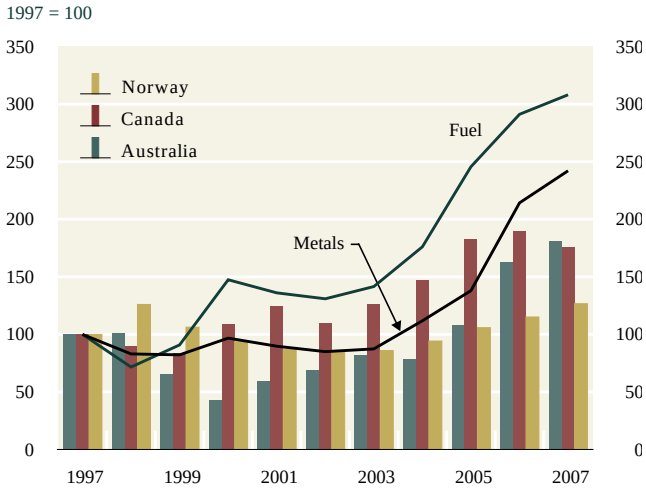
Generally speaking, growth in capital expenditure in the extractive sectors has been quite well correlated with the movement in commodity prices, albeit with a lag of approximately one year (Chart 2). Such a lag is

6. Due to the small scale of its extractive industries, New Zealand is omitted from the discussion of the extractive sector. Norway is excluded from the discussion of agriculture because it is a net importer of food.

7. The numbers reported here are the average annual percentage change starting from 2003 (with 2002 as the base) through to 2007. They cover the same period used by Dupuis and Marcil (in this volume).

Chart 2

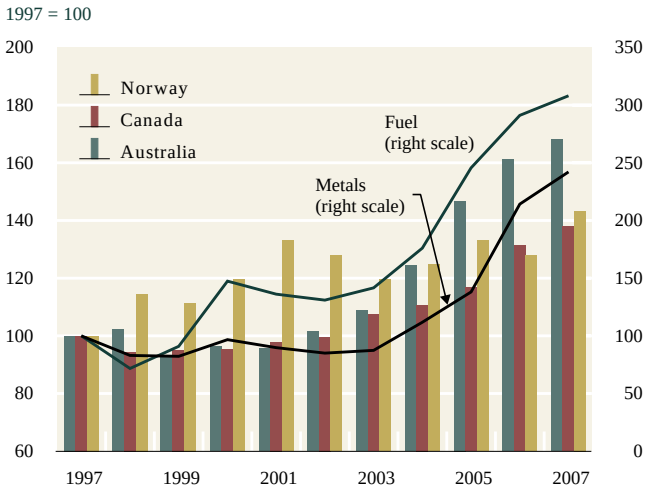
Indexes of Metals and Fuel Prices and Capital Expenditure in the Extractive Industries, 1997–2007



Source: International Monetary Fund, national statistical agencies, and author's calculations

Chart 3

Indexes of Metals and Fuel Prices and Employment in the Extractive Industries, 1997–2007



Source: International Monetary Fund, national statistical agencies, and author's calculations

not surprising. Mining investments are often large, expensive, and irreversible.[8] Consequently, because mining companies are forward-looking entities, their investment activities tend not to respond immediately to price rises, which may be temporary. Rather, investment in new projects will only occur when there is an expectation that prices will remain sufficiently high to ensure that the cost of the initial investment can be recovered from the stream of expected future profits. Because commodity prices are volatile, forming an expectation of a sufficiently persistent increase can take time.

In the case of new mining projects, once a decision to invest is taken, the development of the project can be another source of delay. The International Monetary Fund (IMF) estimates that investment gestation can be three to five years in the minerals sector and even longer in the oil sector (IMF 2006). These delays in turn affect employment and output growth. Consequently, although trend employment in the Canadian and Australian extractive sectors has been well correlated with prices (Chart 3), short-term fluctuations have tended to reflect the opening of new mining projects. In 2003, for example, employment growth in the Canadian extractive sector rose sharply as Shell Canada's $5.7 billion Athabasca Oil Sands facility commenced operations. Similarly, employment growth in the Australian mining sector accelerated in 2004 and 2005 as the value of newly completed mining projects increased from A$1.6 billion in the year ending October 2003 to approximately A$8 billion in each of the two subsequent years.[9] GDP growth shows a similar pattern. In Canada, GDP growth in the Canadian mining and oil and gas sector peaked at 2.8 per cent in 2003 compared with an average rate of sectoral growth of 1.7 per cent between 2002 and 2007. In Australia, there is a clear relationship between the commencement of production at newly completed mines and the growth rate of Australia's extractive sector (Chart 4).

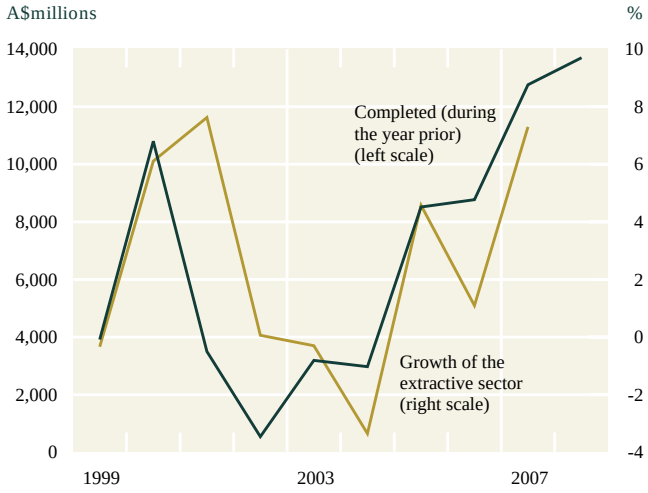
There is also evidence that both Australia and Canada are experiencing some challenges in meeting the growing demand for labour in the extractive sector. Rapid wage growth in the sector is one indication of this. Both countries had experienced employment growth in their extractive sectors during the 2002–05 period, but wage growth remained similar to (or even slightly slower than) manufacturing wages in both countries. Between 2005 and 2007, however, wages in the extractive sector accelerated as sectoral employment grew three to four times faster than the economy-wide average in both economies, which suggests

8. In Australia, for example, the typical cost of a new mining project ranges from A$30 million to A$5billion and averages approximately A$500 million (Australian Bureau of Agricultural and Resource Economics [ABARE] 2008).

9. The data on completed mining projects were provided by ABARE (see ABARE 2008 for a discussion). For each year, the period November to October is represented.

Chart 4

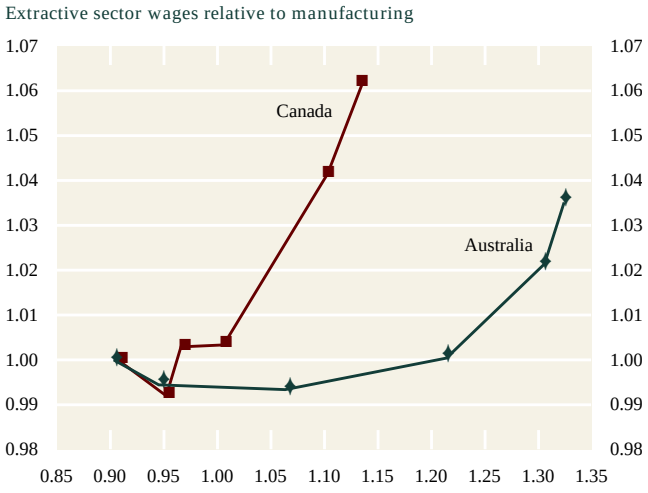
Australia: Newly Completed Mining Projects and Growth of the Extractive Sector



Source: Australian Bureau of Agricultural and Resource Economics, Australian Bureau of Statistics, and author's calculations

Chart 5

Wages and Employment in the Australian and Canadian Extractive Sectors



Source: National statistical agencies author's calculations

that labour demand in the sector was growing even faster than supply (Chart 5).[10]

An important implication of the foregoing discussion is that the employment growth experienced by the Australian and Canadian extractive sectors has the potential to continue for some time as new mining projects become operative in the years ahead. For example, ABARE (2008) reported that the stock of advanced mining projects was valued at A$70 billion in the early part of 2008 (close to seven per cent of Australia's GDP). Similarly, capital-expenditure intentions reported by Statistics Canada (2008) indicated that investment spending in the mining and oil and gas industries would grow significantly during 2008.[11]

Unlike Australia and Canada, Norway's extractive sector accounts for over 20 per cent of GDP. Its oil industry is considered mature, however, since most of the country's oil fields have reached their peak production capacity, and oil production has been in steady decline since 2001.[12] Norway's gas fields are expanding, however, and the economic effects of a declining oil industry and growing gas industry have somewhat offset each other. Between 2002 and 2007, capital-expenditure growth in the extractive sector averaged 8 per cent per year (equal to the economy-wide average), employment growth only slightly exceeded the economy-wide average, and wages in the sector actually grew slower than manufacturing wages. Thus, despite its significant size, the mature state of Norway's extractive sector has limited its ability to be a driver of growth. In fact, between 2002 and 2007, the sector contracted at an average rate of approximately two per cent per year.

Agriculture

Food prices have also risen in recent years (Chart 6), but have behaved somewhat differently than metals and energy prices. In particular, increases in food prices have, on average, been smaller and more recent. As is evident in Chart 6, prices of cereals such as wheat and barley began to rise modestly in 2005 and accelerated sharply upwards in 2007. Dairy prices began to rise earlier, but also escalated in 2007 (partly

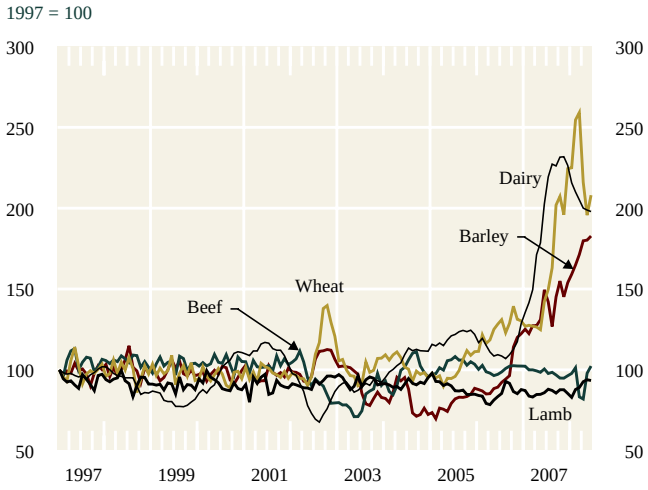
10. Employment in the Australian and Canadian mining and oil and gas sectors grew at 7 per cent and close to 9 per cent per year, respectively, during the 2006–07 period. In comparison, growth of economy-wide employment averaged just over 2 per cent in both economies during the same period.

11. The survey of capital-expenditure intentions indicated that investment would grow by 4.3 per cent in the oil and gas sector and by 12 per cent in the mining sector. Of course, the deepening of the credit crisis and a softening of commodity prices may adversely affect realized investment in the sector in both countries.

12. Opportunities to expand production farther from existing reserves are limited. Substantial deposits are thought to exist off Norway's northern coast but, to date, government policies have largely constrained exploration and development (for a discussion, see Energy Information Administration 2006).

Chart 6

Primary Food Prices in SDR, 1997Q1–2008Q1



Source: International Monetary Fund and author's calculations

in response to the winding down of European Union export subsidies). Some food commodities, such as meat (reflected on the chart in the prices of beef and lamb) have remained stable, however.

At the same time, other non-food commodity prices were also rising, and the cost of inputs such as fertilizers, fuel, and feed increased significantly. As a result, the ratio of farm-product prices to farm-input prices (often referred to as the "farmers' terms of trade") for Australia, Canada, and New Zealand began declining in 2002 and 2003 and did not start rising until after 2005 for Australia, 2006 for Canada, and 2007 for New Zealand. Thus, despite the rise in global food prices, the farming sectors, until recently, have not been significant beneficiaries of the commodity-price boom.

Other factors have also influenced structural adjustment within the agricultural sectors. Drought has had an extremely detrimental impact on the Australian farm sector over the past five years or so. Australian wheat production, for example, contracted by close to 60 per cent in 2002, and by almost 50 per cent in 2006 and 2007 relative to 2005. Similarly, Canada's beef industry was affected by the incidence of bovine spongiform encephalopathy (BSE), which effectively closed the export markets for Canadian beef for much of the period under examination. In addition, farm support and supply-management policies may have also impeded agricultural adjustment to world price movements. In 2006, Australia, Canada, and New Zealand provided farm support equal to 6 per cent, 23 per cent, and 1 per cent of gross farm revenue, respectively, compared with an OECD average of 29 per cent of gross farm revenue (OECD 2007).

The balance of different economic forces operating on the agricultural sectors has tended to limit their expansion.

Overall, it is difficult to separate the effects of rising food prices from the combination of higher input costs, problems with drought and disease, and government assistance policies. Nevertheless, the following generalizations can be drawn. First, as with the mining and energy sectors, the agricultural sectors are relatively small. Second, employment growth has been negative, with the exception of Canada, where it was modestly positive. And lastly, the contribution to GDP growth has also been small. Even in New Zealand, where agriculture accounts for 7 per cent of the labour force and 5 per cent of GDP, and where capital expenditure growth has been robust, the sector has been growing more slowly than the rest of the economy. In other words, despite the strength of food prices, the balance of different economic forces operating on the agricultural sectors has tended to limit their expansion. Given their comparatively small size, their contribution to overall employment and GDP growth in the CX4 countries has been even more modest.

Broader Economic Adjustment

The relatively small size of the CX4 commodity-producing sectors and their seemingly modest contribution to GDP growth raises the question: How can these sectors be having such a significant effect on the commodity-exporting economies, as is widely perceived? The answer lies with the second channel of adjustment and the indirect-spending and exchange rate effects. When commodities are important exports, increases in the prices of these goods relative to imports cause a terms-of-trade improvement, and the purchasing power of GDP in international markets also rises. This increase in real income is the catalyst for broad adjustment in the rest of the economy. It triggers increased spending on domestically produced goods through several channels: (i) as inputs demanded by the resource-producing sectors, (ii) as increased demand from individuals whose wealth and income

have risen because they own factors of production specific to the resource-producing sectors (e.g., the owners of shares in mining firms), and (iii) as increased demand by governments, whose revenues have risen. Since a proportion of this spending occurs on goods and services that aren't readily traded, it will cause the prices of these goods to rise relative to traded goods and, hence, a real appreciation of the currency.[13] This appreciation in turn erodes the profitability of the sectors that compete on international markets (such as manufacturing), while increasing the profitability of the sectors that do not trade. This section explores the impact of these indirect channels on macroeconomic adjustment, particularly in the manufacturing and construction sectors of the CX4 economies.

Income and expenditure growth

As a result of the terms-of-trade improvement experienced over recent years, the real purchasing power of domestic production in world markets has increased for all four of the CX4 economies. This increase in real incomes is best measured by real gross domestic income (GDI), which adjusts GDP to account for the change in purchasing power from the change in the terms of trade. GDP is a poor measure of the macroeconomic consequences of a terms-of-trade improvement because although nominal GDP rises with the terms of trade, the GDP deflator also increases. This leaves real GDP mostly unchanged, even though real value-added and real income must have increased (Kohli 2006, 46).[14] Chart 7 illustrates the cumulative growth in real GDI relative to real GDP for the CX4 during the periods 1997–2002 and 2002–07. Note that the trading gains associated with the terms-of-trade improvement have contributed an additional 6–7 per cent to real incomes in excess of GDP gains during the past five years. The exception is Norway, where the trading gains have been much greater.

The income gains will accrue, in the first instance, primarily to the owners of the various factors of production in the resources sector. This includes not only firms (via increased profits) and workers (through increases in wages), but also governments, via increases in royalties collected from the sector and other taxes, such as corporate and personal income taxes. In this respect, as global commodity prices have risen, mineral, oil, and gas resources have become potentially important sources of government revenue. In Norway, for example, where the oil and gas sector consists primarily of conventional offshore oil and gas, over 50 per cent of the gross value of oil and gas production is channelled back to the state in one form or another. In 2006, petroleum revenues accruing to the government accounted for 17 per cent of GDP (up from 10 per cent in 2002) (OECD 2007). In Australia and Canada, the revenues generated through resource royalties have grown slower than industry profits, but because profits have been rising, tax revenues collected through corporate taxation have risen considerably. Compared with Norway, however, the government revenue in Australia and Canada that is directly attributable to the resources sector is relatively small, with the sum of royalties and corporate taxes from the sectors accounting for less than 2 per cent of GDP in both countries (Chart 8).[15]

Chart 7

Cumulative Increase in Real Gross Domestic Income Relative to Real Gross Domestic Product

Note: Data for Norway end in 2006.
Source: National statistical agencies and World Bank (for Norway)

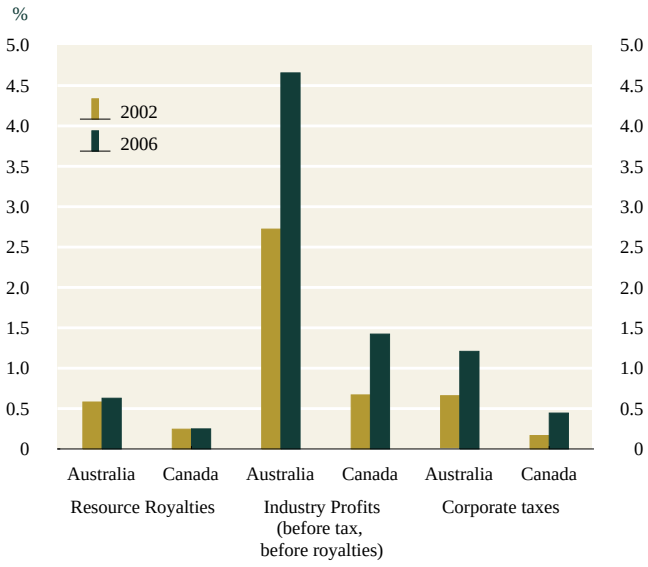
13. The real appreciation itself generates a reinforcing increase in demand from the general population, which benefits from a fall in the price of imports.

14. Kohli (2006) and Macdonald (2007a, b) provide useful discussions of the measurement of real GDI with applications to Canada; see also Duguay (2006). For an analysis of the Australian experience, see Diewert and Lawrence (2006).

15. Nevertheless, compared with other sectors of the economy, which do not generate royalties and have not been as profitable in recent years, the mining sectors account for a disproportionately large amount of revenues in all three countries.

Chart 8

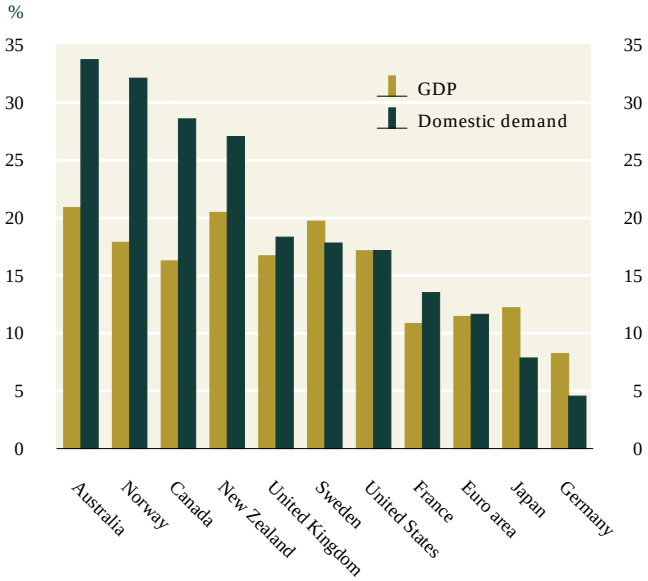
Extractive Sector Profits, Royalties, and Corporate Taxes as a Percentage of Gross Domestic Product



Source: National statistical agencies and author's calculations

Chart 9

Cumulative Real Growth in Gross Domestic Product and Domestic Demand Growth, 2002Q1–2007Q4



Source: Organisation for Economic Co-operation and Development

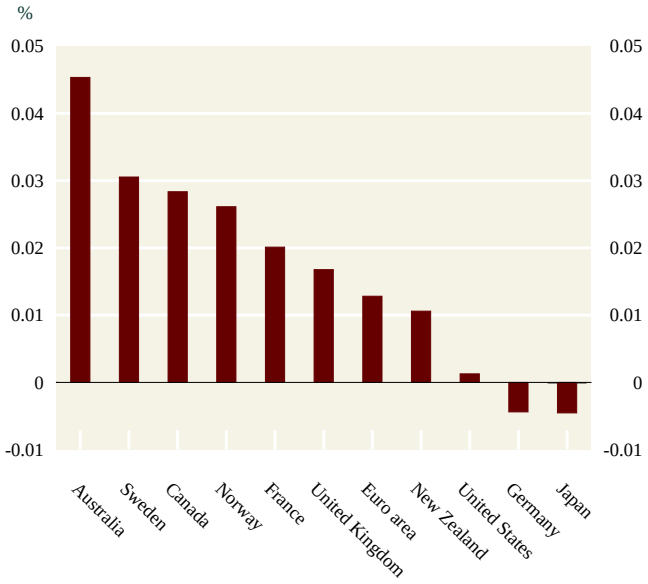
As global commodity prices have risen, mineral, oil, and gas resources have become potentially important sources of government revenue.

The income gain is one of the most important drivers of the economic adjustment that follows a terms-of-trade shock because it directly affects expenditure, which in turn transmits the shock through the rest of the economy. The income gain from the terms-of-trade improvement helps to explain the particularly strong growth in domestic demand that has occurred in the CX4 countries over the past five years. As Chart 9 shows, between 2002 and 2007, CX4 domestic demand increased by approximately 30 per cent, much more than CX4 GDP growth. Furthermore, the growth in domestic demand was significantly greater than that in many other industrialized countries.[16]

One reason for the strength in domestic demand has been growth in investment spending. As illustrated by

Chart 10

Change in the Investment Share of Gross Domestic Product, 2002–2007



Source: International Monetary Fund

16. According to theory, permanent (or long-lasting) terms-of-trade shocks are more likely to be spent than temporary shocks as households attempt to smooth consumption.

Chart 10, between 2002 and 2007, the share of investment in GDP rose significantly for Australia, Canada, and Norway (and less so for New Zealand), reflecting growth in capital spending across a range of sectors. Nevertheless, the contribution to investment growth from the Australian, Canadian, and Norwegian extractive sectors was disproportionately high, on average. In this regard, there is a link to the direct effect, since some of the terms-of-trade income gain has accrued directly to mining companies as profits, which in turn have been used to finance the purchase of capital equipment. To the extent that this capital equipment is domestically produced, this investment spending has also contributed to the expansion in domestic demand and increased economic activity in other sectors of these economies.

If it is spent, or finances tax cuts, the growth in government income is also a potential source of domestic demand. Unlike past episodes, however, when commodity-price booms helped to fund pro-cyclical fiscal policies, governments in the CX4 countries have taken the opportunity in recent years to improve their balance sheets by running sizable surpluses. In particular, the restraint on spending has helped to limit the exchange rate appreciation, which (as discussed below) would otherwise be detrimental to manufacturing and other industries that compete on world markets.[17] Government outlays in the CX4 have fallen as a share of GDP during the period of the commodity-price boom compared with the five previous years (Chart 11). In this respect, the CX4 governments have directly offset the strength in domestic demand experienced during the 2002–07 period. In Norway, where the government invests its oil revenues in the offshore Government Pension Fund–Global (GPFG), the growth in government spending reflects a spending cap of 4 per cent of the real rate of return on the value of the fund.[18, 19] In Australia and Canada, although

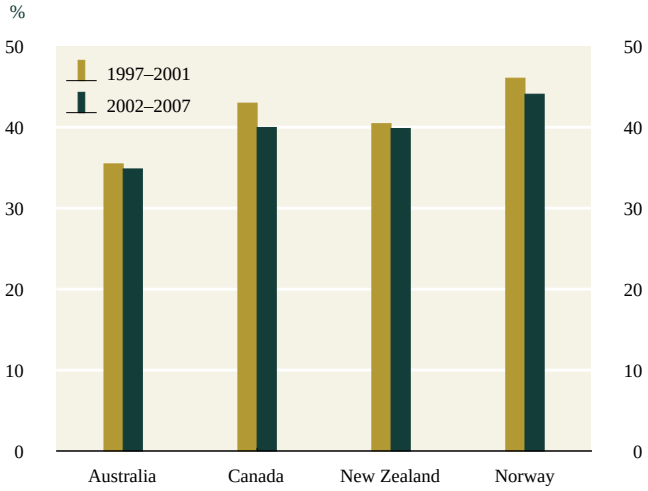
17. See Carney (2008) for a discussion of the Canadian experience during the previous commodity-price boom.

18. The GPFG is designed to preserve much of the wealth generated from oil and gas extraction for future generations. In addition, by investing the funds in foreign assets, the effects of inflows of oil revenue on the current account are largely matched by an outflow on the capital account, leaving the overall balance of payments in equilibrium, without the need for an exchange rate appreciation.

19. It is not the Norwegian government's intention that this cap be binding in every year, but on average over a number of years. Thus, the cap was not met prior to 2005, but has been met since.

Chart 11

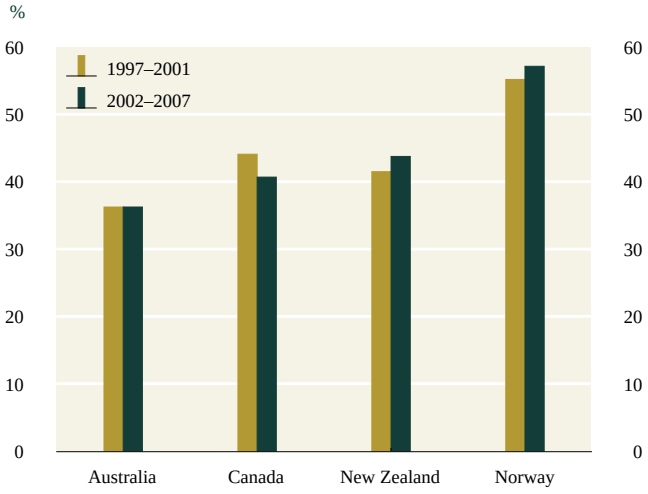
Average General Government Outlays as a Percentage of Gross Domestic Product



Note: General government includes all levels of government.
Source: Organisation for Economic Co-operation and Development

Chart 12

Average General Government Revenues as a Percentage of Gross Domestic Product



Note: General government includes all levels of government.
Source: Organisation for Economic Co-operation and Development

government spending has decreased as a share of GDP, some indirect stimulus has been provided because the increase in tax revenues earned from higher royalties and corporate taxes on mining firms has largely been redistributed to taxpayers. As a result, general government revenues have not increased but have remained constant in Australia and have declined in Canada (Chart 12).

Real exchange rate changes and associated adjustment

The growth in domestic demand can also be expected to have an effect on exchange rates. In principle, if the income transfer is spent primarily on domestic goods, the income effect resulting from the change in the terms of trade should cause the real exchange rate to appreciate.[20] In practice, under a floating exchange rate system, such as that employed in the CX4 economies, the nominal exchange rate will respond quickly to changes in commodity prices (and in the terms of trade) in anticipation of the future consequences of increased demand.

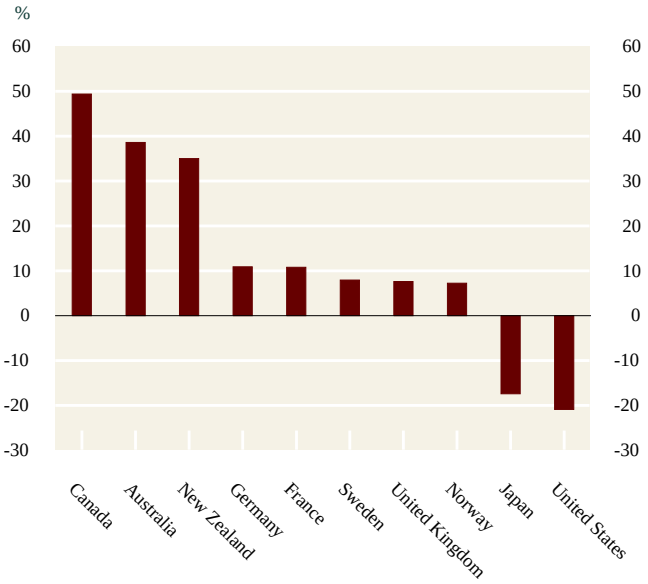
As shown in Chart 13, the trade-weighted real exchange rates appreciated in all four countries, although less so in Norway.[21] Moreover, with the exception of Norway, the CX4 currencies have generally exhibited greater strength than those of other industrialized economies. The appreciation of Norway's exchange rate has been more muted than that of the other CX4 economies because a significant amount of oil revenues are invested abroad in the GPFG.

The appreciation of the real exchange rate also tends to partially offset the impact of the increase in domestic demand by causing internationally traded goods and services to fall in price (in domestic currency terms) relative to those that are not traded. As a result, the exchange rate appreciation tends to reduce the profitability of the manufacturing sector and to stimulate the services and construction sectors, thus facilitating the adjustment of productive resources within the economy.[22, 23] The real appreciation can most easily be accomplished with an appreciation of a flexible exchange rate; otherwise, the real appreciation would have to take place via higher inflation. As is well documented elsewhere, a lack of nominal exchange rate adjustment is widely accepted as a reason for the high inflation that coincided with, and followed, earlier resource booms.[24, 25]

In each of the CX4 economies, the non-traded construction and utilities sectors (labelled as "other" on Charts 14 and 15), have grown dramatically between 2002 and 2007 while, with the possible exception of

Chart 13

Percentage Change in Real Effective Exchange Rate (CPI-based), 2002Q1–2007Q4



Source: International Monetary Fund

20. The transmission of a terms-of-trade shock might also affect the exchange rate via capital flows.

21. A variety of other factors have affected exchange rates during this period, including a weakening of the U.S. dollar against other currencies in response to its large current account deficit. Nevertheless, the currencies of commodity exporters have generally exhibited greater strength than those of commodity-importing economies.

22. The exchange rate effect also partially offsets the direct effect of the global increase in commodity prices.

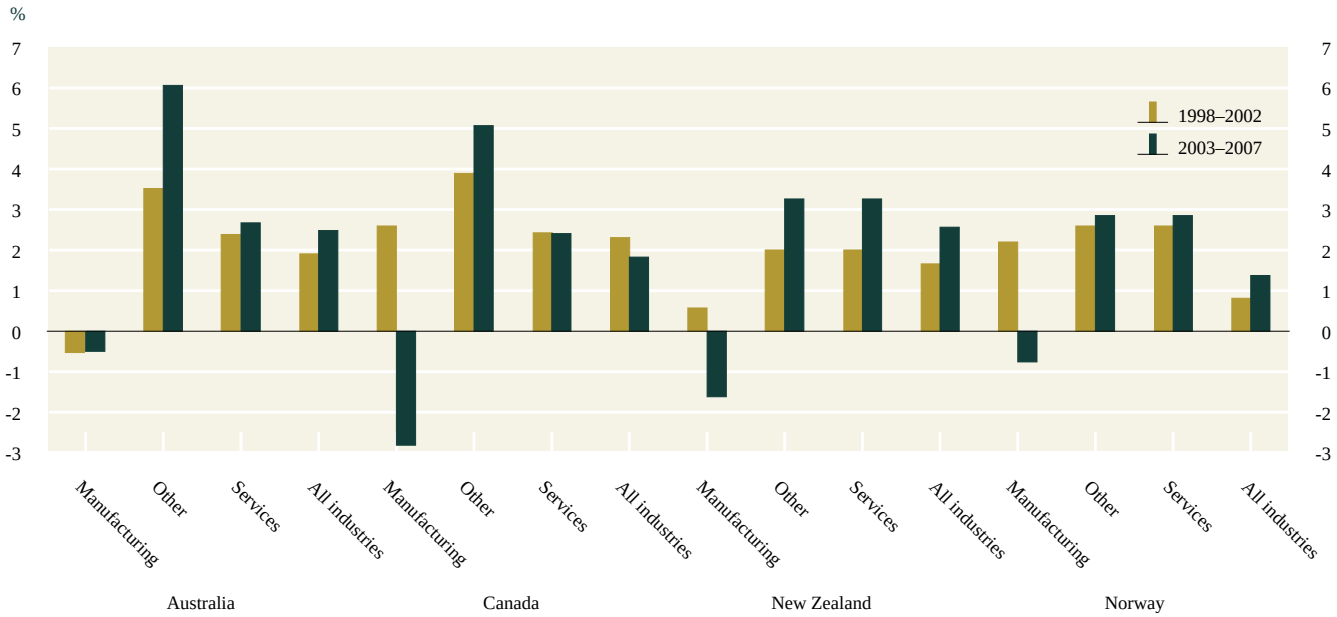
23. The decline in the manufacturing sector due to the real exchange rate appreciation is sometimes referred to as "Dutch Disease" (as in Corden 1984, for example). Some authors have argued that Dutch Disease can lead to a lower rate of economic growth and possibly a lower level of welfare. Such a possibility could arise if firms in the manufacturing sector experience learning-by-doing, and thereby generate improvements in technology that spill over to other firms in the sector (see, for example, Krugman 1987; and Sachs and Warner 1995). However, the mining sector may also be a source of learning-by-doing, and it is unclear to what extent, if at all, the decline in manufacturing that a commodity boom induces will reduce long-run growth.

24. See, for example, Schembri (2008) for a discussion of Canada's experience with flexible exchange rates following the Korean War resource boom. Carney (2008) and Stevens (2008) provide a discussion of past Canadian and Australian experiences and the benefits of exchange rate flexibility under the current circumstances.

25. The benefits of a flexible exchange rate have been widely discussed. Friedman's 1953 article is the seminal contribution.

Chart 14

Employment Growth by Sector



Source: Organisation for Economic Co-operation and Development and author's calculations

Norway, the performance of the (relatively more traded) manufacturing sector has remained weak. In particular, employment growth in construction greatly outstripped that in the manufacturing sector, which was negative across all four economies. The strong performance of the construction sector in these economies is partly owing to the expansion of the mining and energy sectors, but is also a result of the income effects, which are feeding back through strong residential and commercial property investment.

In each of the CX4 economies, the non-traded construction and utilities sectors grew dramatically between 2002 and 2007.

The data also indicate that, since 2002, manufacturing in Australia and Norway has performed better than might have been expected (generally showing a slower rate of employment decline and, in Norway, stronger output growth, than before). One explanation is that the manufacturing sectors in these countries have directly benefited from the increase in investment spending, perhaps because the manufacturing sector is partly integrated with the mining sector. In Norway, for example, where the manufacturing sector has performed especially well during the boom, a survey of Norwegian enterprises found that about one-quarter (27 per cent) of surveyed enterprises supplied the oil industry (Solheim 2008). In Australia, seven per cent of manufacturing firms cited the strength of the mining sector during 2007 as a factor contributing positively to their own production growth.[26] Similarly, in New Zealand, between 2002 and 2007, the meat and dairy-processing sectors accounted for one-third of the expansion in manufacturing output. In the specific case of Norway, it is also likely that limited appreciation of the Norwegian krone (which could be due to the investment of oil revenues in the GPFG) may have contributed to the relatively strong performance of the sector.[27]

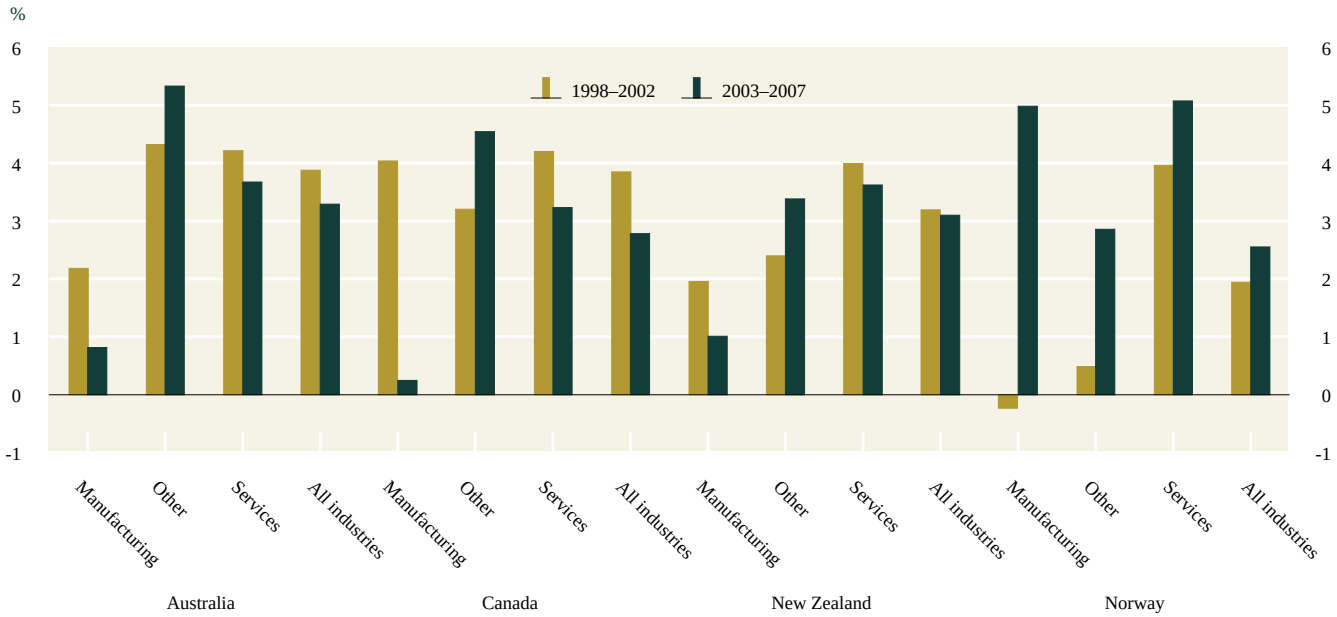
Canada has had a somewhat different experience than the rest of the CX4. Manufacturing growth in the pre-boom period was much stronger than it was for the other countries, and it has been weaker during the

26. Australian Industry Group and PriceWaterhouseCoopers, Survey of Australian Manufacturing, June 2007

27. In addition, firms in the manufacturing sector may have also benefited from lower costs of imported inputs and investment goods.

Chart 15

Average Annual Growth of Gross Domestic Product by Sector



Source: National statistical agencies and author's calculations

boom period. This could reflect several factors, such as the appreciation of the exchange rate, which are discussed by Dupuis and Marcil in this volume.

Conclusion

The direct adjustment of the resources sectors in Australia, Canada, New Zealand, and Norway (collectively known as the CX4) to the rise in commodity prices has been small relative to the size of their respective economies, and they tend to lag price movements. In addition, output and employment in the resources sectors, which tend to increase sharply when new projects finally commence production, have not adjusted to the resource boom as smoothly as has investment. Given the large stock of new projects under development in Australia and Canada and the long lags involved, the prospects exist for the resources sectors in these countries to continue to act as a source of employment and output growth for some time. In Norway, the mature state of the oil sector limits the scope for further development.

In agriculture, adjustment has also been modest because not all food prices have shown strong rises and, for those that have risen, the increase has generally been more recent than that for metals and energy prices. Moreover, the combination of rising feed and fertilizer prices and the influences of disease and drought have also had a significant impact on the industry, somewhat diluting the beneficial impact of rising food prices.

On the other hand, the indirect effects of the commodity-price increase have been more dramatic and have helped to transmit the adjustment to other sectors of the CX4 economies. With the exception of Norway, where the process of investing oil revenues abroad has limited the exchange rate appreciation, the increases in domestic demand help to explain the relatively large exchange rate appreciations and the associated impact on the construction and manufacturing sectors that have taken place.

Unlike past commodity cycles, the current rise in commodity prices is likely to be more persistent because it reflects an unprecedented structural change in the global economy. The opening up and integration of China, and increasingly India, which together account for almost 40 per cent of the world's population, are causing a fundamental change in primary commodity demand (Francis 2007; Francis and Winters 2008). While the process could slow, it is highly unlikely that it will be fully reversed.

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The Effects of Recent Relative Price Movements on the Canadian Economy

David Dupuis and Philippe Marcil, Research Department

- *A sharp rise in real commodity prices has boosted Canada's terms of trade and exchange rate over the past five years. These relative price movements, underpinned by a strong global demand for commodities, have generated substantial real income gains, reduced Canadian cost competitiveness, and changed relative factor prices in favour of capital, thereby stimulating final domestic demand, depressing real net exports, and inducing intersectoral transfers of resources.*
- *While the standard of living of Canadians has improved as a result of the terms-of-trade gains, the frictions generated in adjusting to the relative price shock have likely contributed to hold back aggregate productivity growth.*
- *For the economy as a whole, both the investment rate and the employment ratio have increased markedly, and profit margins have risen. Wage pressures have been largely confined to industries and areas involved in resource extraction.*
- *Canada's ability to take advantage of commodity-price increases crucially rests on its capacity to adjust to price signals without undue pressure on costs. The required mobilization and reallocation of resources are facilitated by flexible product and labour markets and sound macroeconomic policies.*

Strong global demand for commodities has underpinned a major price realignment both in Canada and around the world since 2003. Commodity prices have soared relative to the prices of both manufactured goods in international markets and services in domestic economies. In real terms, the Bank of Canada commodity price index climbed 118 per cent between 2002Q4 and 2008Q2 as a result of a 200 per cent jump in energy prices and a 57 per cent increase in non-energy commodity prices (Chart 1). This unprecedented boom in the prices of raw materials was propelled by robust commodity-intensive growth in emerging-market countries, along with a muted supply response for many commodities, particularly energy.

Partly in response to these important price movements, the Canadian dollar has appreciated rapidly and substantially against its U.S. counterpart, as Canada is a net exporter of commodities.[1] After reaching its lowest level in early 2002, the Canadian dollar had appreciated by 58 per cent by mid-2008. Among other things, this has reduced Canada's cost competitiveness, as well as the price of machinery and equipment relative to labour. A further outcome of the surge in commodity prices and, to a limited extent, of the appreciation of the Canadian dollar, has been a remarkable improvement in Canada's terms of trade (the ratio of the price of exports of goods and services to the price of imports of goods and services), which increased by 22 per cent between the end of 2002 and

1. The appreciation of the Canadian dollar has also been part of a multilateral adjustment to global imbalances (Bailliu and King 2005).

the beginning of 2008 (Chart 2). This gain considerably boosted the real income of Canadians.

The commodity-price increase triggered structural adjustments by altering underlying economic incentives, leading to appreciable resource reallocations.

Chart 1

Bank of Canada Real Commodity Prices

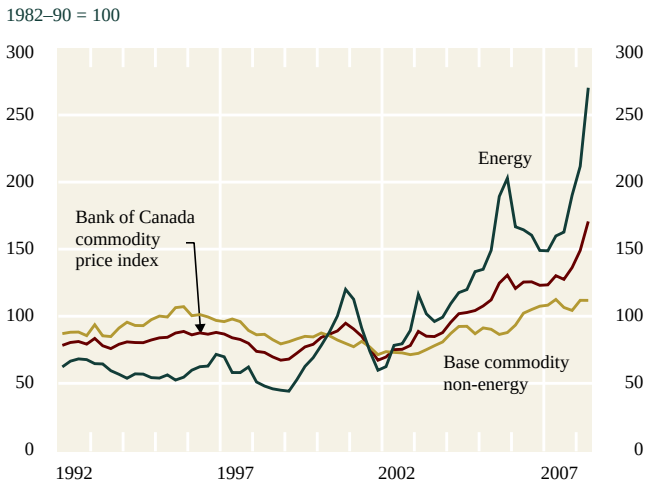
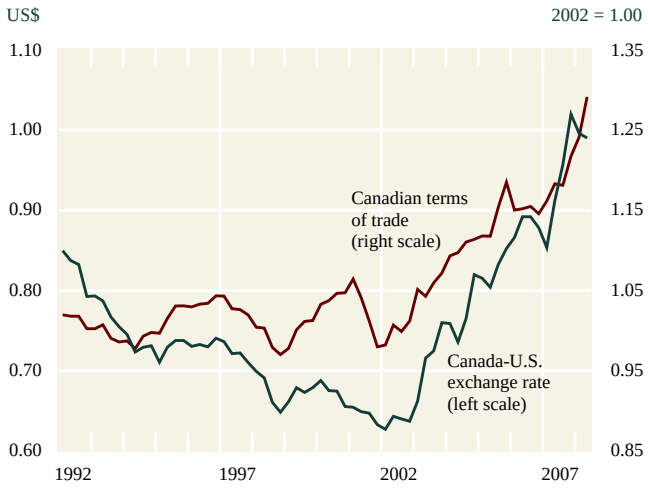


Chart 2

Canada's Terms of Trade, 1992–2008



The commodity-price increase, combined with the exchange rate appreciation and the real income gain, triggered structural adjustments by altering underlying economic incentives and has led to appreciable resource reallocations within the Canadian economy. This article examines these adjustments, in particular the resource reallocation between the different sectors of the economy and its effects on employment, output, and productivity. It also analyzes the responses of final domestic demand and external trade flows.

Sectoral Adjustments

A rise in commodity prices is expected to cause resource firms to expand production and employment in the short term and to increase capacity in the longer term, through investment.[2] The resulting increase in labour demand pushes up wages in the natural resources sector. In an economy that is a net exporter of commodities like Canada, the accompanying gains in the terms of trade boost real gross national income (GNI), final domestic demand, and the value of the currency. The currency appreciation facilitates both the transfer of resources to the commodity-producing sector and the buildup of capacity in the non-tradable sector to accommodate the expansion of domestic demand. It does so by redirecting this demand towards imported goods and services, by discouraging the production of manufactured goods for exports, and by reducing the price of imported machinery and equipment relative to labour. As a result of these adjustments, the manufacturing sector contracts, and the non-tradable sector tends to expand provided that it remains relatively insulated from the ongoing wage pressures in the resources sector.

By and large, this is the scenario that has unfolded in Canada over recent years. This can be seen by comparing the performances of three sectors of the economy: mining, oil, and gas (the extractive sector); manufacturing; and the non-tradable business sector.[3] While the extractive sector represents only 50 per cent of the overall resources sector, it has experienced the

2. For an analysis of the effects of changes in real commodity prices on the terms of trade, see Macklem (1993).

3. Unless otherwise specified, the non-tradable business sector comprises North American Industry Classification System (NAICS) sectors 23, 41, 44–45, 48–49, 51, 52, 53, 54, 56, 71, 72, and 81. We chose to exclude management of companies (55) as well as non-business-sector industries because quarterly data from Statistics Canada's productivity accounts are not directly available for these industries.

Chart 3

Real Gross Domestic Product by Sector

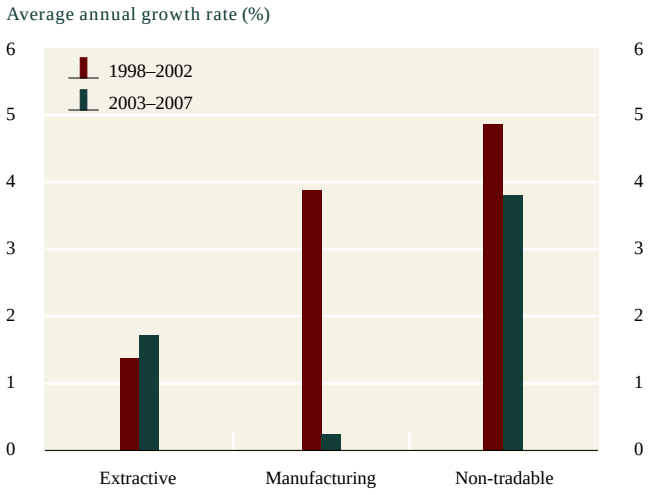
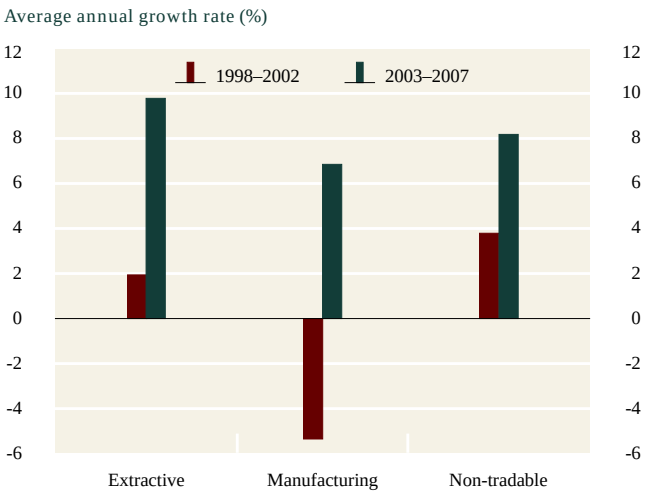


Chart 4

Real Investment by Sector



sharpest price increase by far.[4] For this reason the analysis will focus on its performance.

Over the 2003–07 period, real gross domestic product (GDP) in the mining and oil and gas extractive sector rose 1.7 per cent per year on average, a somewhat faster pace than the 1.4 per cent observed over the 1998–2002 period (Chart 3). This relatively subdued pace in the face of high prices suggests that production was constrained by capacity. Responding with some delay to these pressures, real investment in the extractive sector, which had picked up temporarily in the mid-1990s, accelerated again, to an average growth rate of 9.8 per cent annually in the 2003–07 period (Chart 4). Employment in the sector jumped by some 30 per cent, and growth in hours worked shot up to 7.7 per cent per year on average over the same period (Charts 5 and 6), while operating profit margins oscillated between 15 and 20 per cent, a high rate by historical standards (Chart 7). Labour shortages quickly became apparent, particularly in Alberta, where wage growth picked up sharply beginning in 2005 and averaged 4.5 per cent annually between 2003 and 2007 compared with 2.9 per cent nationally (Chart 8). Taking advantage of the buoyant Alberta labour market and helping to alleviate further pressures on wages and production capacities, net interprovincial migration to Alberta accrued to 120,000 in the 2004–06 period, before slowing markedly to 10,000 in 2007.

Wage spillovers from the resources sector to other sectors of the economy appear to have been contained. Labour compensation per hour grew on average by 5.3 per cent in the mining and oil and gas extractive sector in 2003–07 compared with 3.4 per cent and 4.1 per cent in the manufacturing and non-tradable sectors, respectively (Chart 9). A credible monetary policy kept inflation expectations well anchored during the period, which likely contributed to limit wage-inflation spillovers.

The manufacturing sector has meanwhile been confronted with a rapid appreciation of the Canadian dollar in addition to increased competition from emerging-market countries. Manufacturing output grew on average by a meagre 0.2 per cent per year over the 2003–07 period. This was a much slower pace than the 3.9 per cent annual average posted over the 1998–2002 period, when a depreciation of the Canadian dollar, driven in part by the weakness in commodity prices, stimulated growth in the sector (Chart 3).[5] Benefiting from declining import prices for investment goods, real investment growth in the sector nevertheless picked up substantially, averaging

4. A more complete coverage of the primary resources sector would also include agriculture; forestry, fishing, and hunting; and utilities. It is worth noting as well that the manufacturing sector itself includes resource-processing industries such as wood, paper, and primary metals, whose performance is affected by movements in commodity prices. For the purpose of this article, they have not been separated from the rest of manufacturing.

5. The share of the manufacturing sector in total nominal GDP rose to a peak of 19 per cent in 2000 and steadily declined to 16 per cent by 2004, a level still higher than that in several advanced countries. Nominal GDP for Canadian manufacturing is not available beyond 2004 from the economic accounts released by Statistics Canada. Rough estimates suggest that it may have fallen to 13–14 per cent of total GDP by 2007.

Chart 5

Employment Trend by Sector

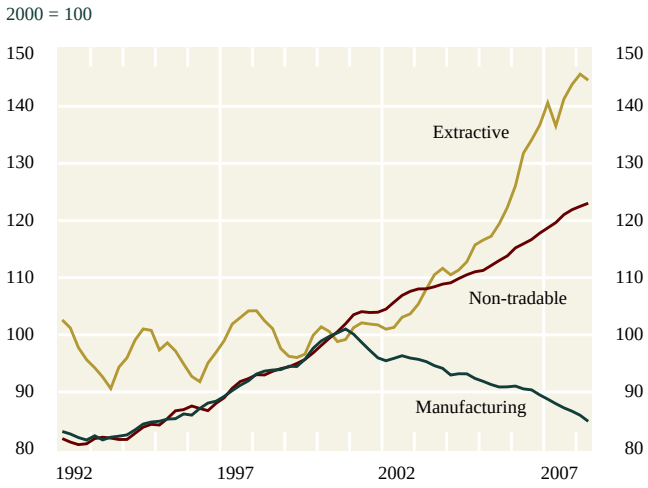
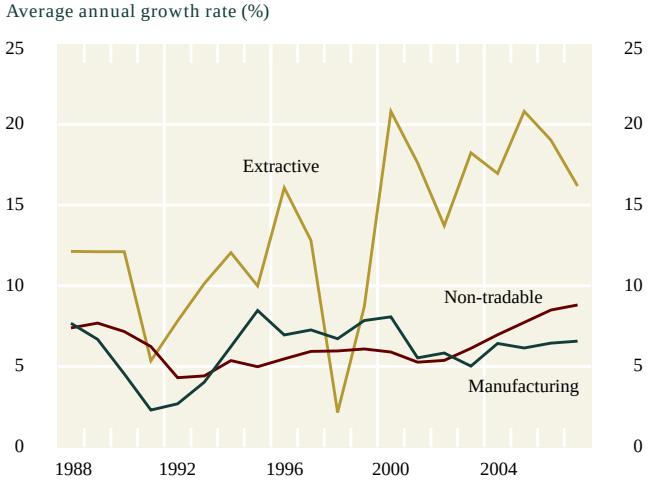


Chart 7

Operating Profit Margins by Sector



6.9 per cent over the 2003–07 period, compared with a decline of 5.4 per cent over the 1998–2002 period (Chart 4). Employment in the sector declined some 10.9 per cent between January 2003 and July 2008, as a little over 221, 000 jobs were shed,[6] while hours worked dipped 1.2 per cent per year on average over 2003–07 (Charts 5 and 6) . This has contributed to maintaining the rate of increase in hourly compensation close to its decade-long average of 3.4 per cent (Chart 9) and the operating profit margin close to its historical norm of around 6 per cent (Chart 7). Some manufacturing industries have fared much worse than others, however, in terms of profitability because of relatively high external trade exposure or because other, longer-term factors compounded the competitiveness problem arising from the appreciation of the Canadian dollar. This is particularly true for the clothing, textile, and leather; wood and paper; and motor vehicle and parts industries.

Chart 6

Hours Worked by Sector

New income and wealth deriving from the rise in commodity prices fed demand for non-tradable goods and services, including housing whose relative price has considerably increased, particularly in Alberta, where substantial immigration contributed to the demand pressures. As a result, starting in 2003 after having slowed for four years, output growth picked up in the non-tradable sector. Gains have been particularly important in the construction; finance, insurance and real estate; and wholesale and retail trade sectors.[7] Real investment spending in the non-tradable sector as a whole increased on average by 8.2 per cent per year over the 2003–07 period, an acceleration after a two-year slump (Chart 4). In addition, as a result of its dynamism, the non-tradable sector of the economy created close to one million new jobs between January 2003 and July 2008, while operating profit margins for the sector as a whole posted steady increases from 2003 to 2007 (Chart 7).[8]

6. From its peak employment in November 2000, the manufacturing sector shed close to 320, 000 jobs.

7. To a significant extent, output growth in construction has been directly stimulated by increased investment in the resources sector.

8. Operating profit margins are calculated for the non-tradable sector using NAICS sectors 23, 41, 44–45, 48–49, 51, 52, 53, 54, 56, 71, and 72, since there are no data available for NAICS code 81 (other services).

Chart 8

Labour Force Survey: Wages by Provinces

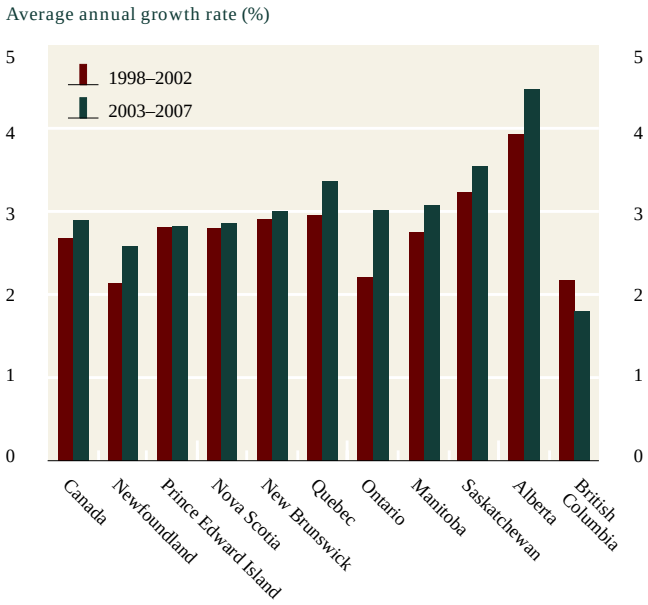
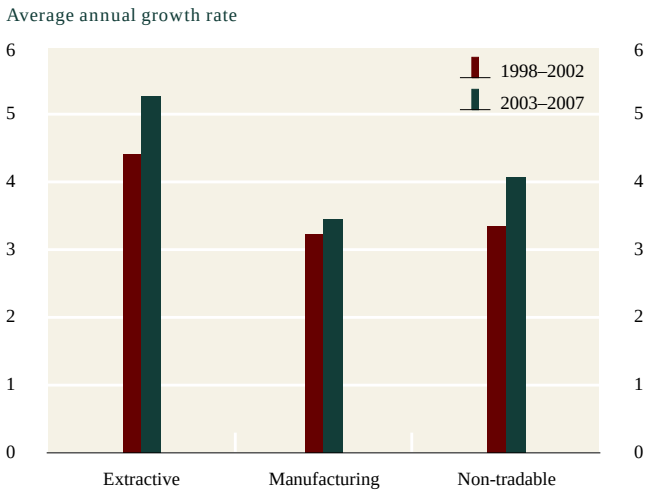


Chart 9

Labour Compensation by Sector



Overall, the Canadian economy has responded well to the latest global price realignment. In fact, the adjustment process appears to have been much smoother than in the commodity-price cycles of the 1970s and 1980s. One reason is that the current round of commodity-price gains has been driven by a strong global expansion rather than by supply cutbacks. As well, stronger competition and increased flexibility in the product and labour markets have facilitated the mobilization and reallocation of resources. These structural improvements reflect, among other things, less anti-competitive regulation; a reform of the employment insurance regime; improved labour market information; and easier access to foreign goods, services, and workers. Finally, better macroeconomic policies have defused potential pressures on costs and prices by firmly anchoring inflation expectations and making the public sector a net saver rather than a net spender.

Potential Impact on Productivity

Productivity growth has been an issue in Canada in recent years. While labour productivity in the business sector posted a robust 2.3 per cent average annual growth rate between 1998 and 2002, its progression dropped to 1.1 per cent over the 2003–07 period. One hypothesis concerning the slower growth is that adjusting to the large relative price movements has had negative effects on aggregate productivity growth. This section investigates three possible effects that the economic adjustments discussed in the previous section may have had on productivity: i) an accounting effect, ii) an incentive effect, and iii) an adjustment-cost effect. The key conclusion of the analysis is that adapting to the changes in relative prices has likely contributed to hold back productivity growth by increasing adjustment costs.

The changes in relative prices have likely contributed to hold back productivity growth by increasing adjustment costs.

Given that productivity levels and growth rates differ markedly between sectors, the intersectoral shifts of labour that have occurred in the past five years have had the potential to affect aggregate productivity growth, since they have changed the relative importance of the various sectors of the economy. This is the accounting effect.[9] As Table 1 shows, labour-productivity growth for the business sector as a whole over

9. See Fagerberg (2000) for a decomposition of aggregate productivity growth that explicitly identifies the effects of labour shifts between sectors with different productivity levels (static shift) and with different productivity growth rates (dynamic shift).

Table 1

Decomposition of Labour-Productivity Growth, 2003–07

	Labour productivity level 2002 2002	Change in share of hours worked 2002–07 (%)	Static shift	Dynamic shift	Within-industry growth	Total effect (%)
Total business sector	41.4	0.0	1.3	-0.9	5.5	5.9
Extractive sector	158.1	33.2	1.5	-0.5	-1.5	-0.5
Manufacturing	46.7	-14.2	-0.3	-0.2	1.7	1.2
Non-tradable*	37.1	3.5	-0.3	0.0	4.9	4.6
Construction	32.4	17.2	-0.3	0.1	0.3	0.0
Agriculture, forestry, fishing and hunting	263.0	-15.8	0.2	-0.1	0.7	0.8
Utilities	167.2	7.6	0.2	0.0	-0.3	-0.1

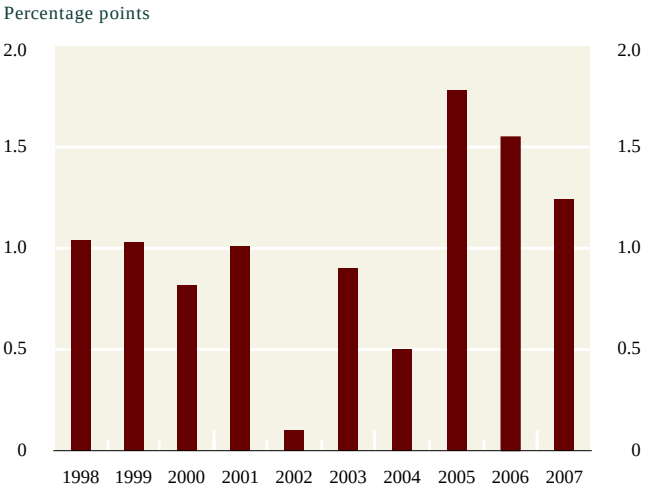
* The non-tradable sector includes: North American Industry Classification System (NAICS) sectors 23, 41, 44–45, 48–49, 51, 52, 53, 54, 56, 71, 72 and 81.

the past five years benefited from a reallocation of hours worked towards sectors with relatively high productivity levels (static shift, fourth column). These specific gains, which account for 22 per cent of the total increase, essentially originated from the large inflow of labour in the extractive sector (third column), which enjoys one of the highest levels of productivity among all sectors of the economy (second column). Manufacturing, with above-average productivity levels, contributed negatively, since its share of hours worked declined over the period, thereby offsetting a similar but positive contribution from the non-tradable sector, where the effect of a shift of labour towards the high-productivity finance, insurance, and real estate industry played a major role. Within the non-tradable sector, the influx of labour in construction exerted a negative but far less important effect. Aggregate labour-productivity growth was also affected negatively by the effect of a dynamic shift (fifth column) as labour moved out of manufacturing, a sector with comparatively high positive productivity growth over the period, and into the mining and oil and gas extractive sector, which posted negative productivity growth over the 2003–07 period.

Large movements in relative prices such as those recently experienced in Canada alter economic incentives and should prompt adjustments that would affect productivity in several ways.[10] One way this incentive effect works is through raising the capital-to-labour ratio as the currency appreciation that accompanies the commodity-price increase lowers the costs of imported machinery and equipment relative to labour. This effect, which can be significant because machinery and equipment are largely imported in Canada, likely contributed to the observed faster rise in the capital intensity of the business sector and its contribution to labour-productivity growth over 2005–07 (Chart 10). Another way, as suggested by Harris (2001), is through intensified competitive pressures, particularly in the manufacturing sector, in view of its high external trade exposure. These pressures could lead to closure of the least-efficient plants and exit of the least-efficient firms, improvement in technology, changes in work practices, and other productivity-enhancing adjustments. While incentive effects have no doubt taken place in many firms, aggregate data suggest that they played a secondary role over the 2003–07 period, when in fact productivity growth in manufacturing slowed to 1.7 per cent per year, compared with 2.8 per cent over the previous 20 years (1983–2002).

Chart 10

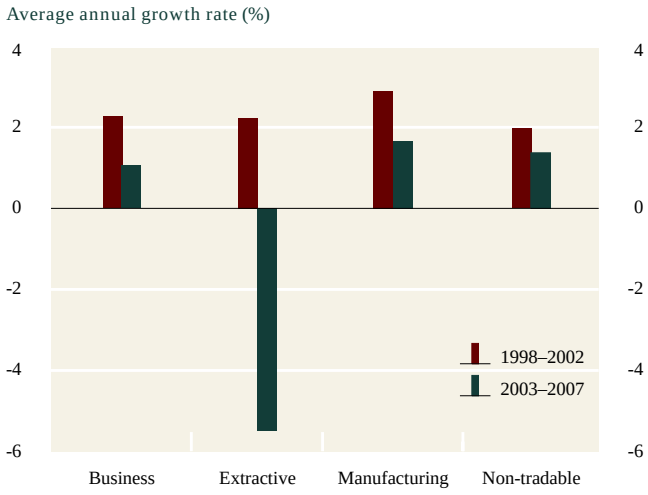
Contribution of Capital Deepening to Labour-Productivity Growth in the Business Sector



10. See Lafrance and Schembri (1999–2000) for a discussion of the possible links between the exchange rate and productivity.

Chart 11

Labour Productivity by Sector



When an economy is reallocating resources following an important change in relative prices, higher adjustment costs likely reduce the pace of efficiency gains. This is the adjustment-cost effect, which has probably slowed productivity growth more over the past five years than it did previously. Intersectoral labour transfers lead to some disruption of regular work in both declining and expanding sectors, with negative effects on productivity (Hamermesh and Pfann 1996). In the declining sector, the remaining workers have to take over unfamiliar tasks when colleagues leave, and the work has to be reorganized. At the same time, in the expanding sector, new workers have to be trained and experienced workers will see their productivity decline as they contribute to the integration of new employees. These costs are likely exacerbated in a period of rapid absorption of labour, when the labour market is tight and marginal workers have relatively little experience or skills. This may have been the case recently, particularly in the oil and gas and construction sectors, which have seen their share of total hours worked jump during the 2003–07 period. Adjustment costs also intensify when the investment rate (the ratio of investment to capital) increases, as it did in the 2004–07 period, partly in response to relative price changes. One sector in which the investment rate has reached higher levels is mining and oil and gas extraction. Developing costly marginal reserves has exacerbated normal adjustment costs or amplified diminishing returns to investment in the sector. In addition, the longer time-to-build required for oil sands projects, which have risen in relative importance in Canada, would have temporarily depressed the productivity of capital.[11] These factors explain at least in part the relatively steep decline of productivity in the mining and oil and gas extractive sector since 2003 (Chart 11). This decline alone, weighted by the share of total hours worked by the sector, has subtracted 1.5 per cent from the rate of aggregate productivity growth between 2003 and 2007, as indicated by the within-industry effect presented in column 6 of Table 1.

Measuring Income and Trade-Flow Adjustments

The improvement in the terms of trade resulting from higher commodity prices and the appreciation of the Canadian dollar have created significant income effects in Canada. These effects are not adequately captured by traditional measures of output, such as real GDP. In this context, a more appropriate measure, used by Duguay (2006) and Macdonald (2007) and consistent with the approach proposed by Kohli (2006), is gross national income (GNI), representing the amount of real final domestic spending that Canadians can afford out of their income from production in Canada and net investment abroad.[12, 13]

The improvement in the terms of trade resulting from higher commodity prices and the appreciation of the Canadian dollar have created significant income effects in Canada.

From 2003 to 2007, GNI grew much faster than GDP as the escalation of the terms of trade pushed the price obtained for Canadian production much higher than the price paid for final goods and services used in Canada (Chart 12).

11. The time-to-build factor should have only a moderate effect on aggregate productivity because the temporarily forgone output in the extrative sector is compensated for by higher output in the construction sector. The net impact on aggregate productivity should be negative because labour productivity is much higher in the extrative sector than in construction.

12. GNI = nominal GNP / price of final domestic demand.

13. Net investment income from abroad is negative because the investment income earned in Canada by non-residents exceeds that earned abroad by Canadians.

Chart 12

Comparative Growth of Gross National Income and Gross Domestic Product

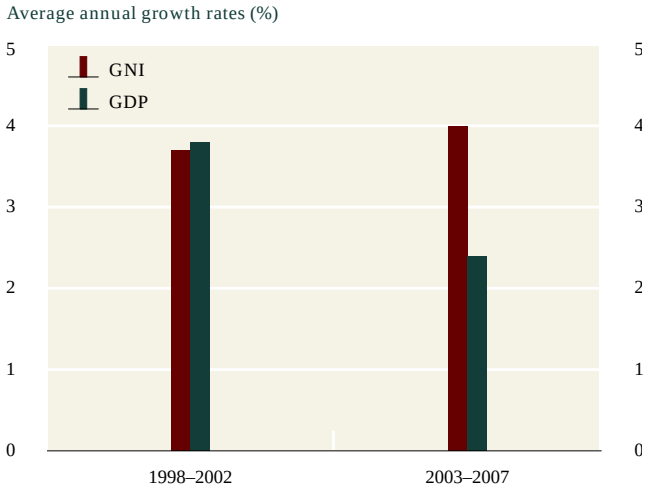
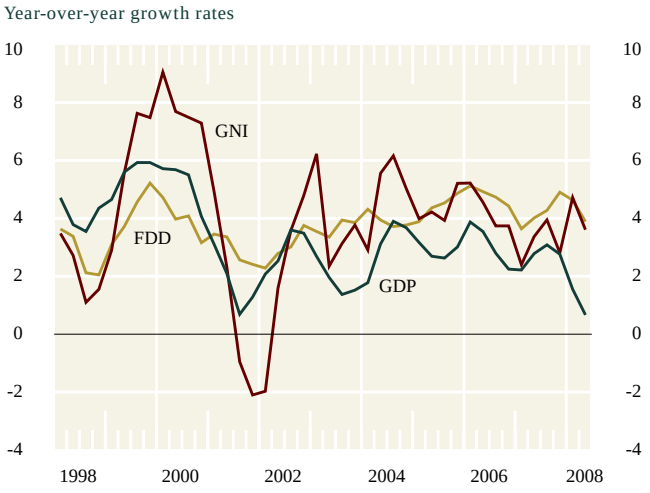


Chart 13

Change in Gross National Income, Gross Domestic Product, and Final Domestic Demand



Income and wealth effects attributable to better terms of trade have in fact stimulated final domestic demand (FDD), which has posted robust growth during the past five years (Chart 13). A decomposition of the growth of real per capita consumption over this period highlights the exceptional contribution of improved terms of trade via their effect on the relative price of GDP to consumption (Table 2).[14] During the past five years, the resulting "trading gains" alone account for more than half of the expansion in real per capita consumption. Typically, in the longer term, growth in labour productivity provides the principal engine of growth in real income and consumption.

Table 2

Decomposition of Real Per Capita Consumption Growth

Annual composite rates

	2003Q1–2008Q1	1984Q1–2008Q1
Real per capita consumption	2.9	2.0
= Consumption $ / disposable income $	-0.1	0.6
+ Disposable income $ / labour income $	-0.3	-0.4
+ Labour income $ / GDP $	0.2	-0.1
+ Relative price of GDP to consumption ("trading gains")	1.6	0.1
+ Labour productivity	0.7	1.2
+ Hours worked / total population	0.8	0.6

Despite the remarkable pace of growth posted by domestic demand, the imports that sustained it expanded even more rapidly, owing to the appreciation of the Canadian dollar and a shift in spending to import-intensive components. Conversely, this same appreciation exerted a drag on exports. In the following sections, these adjustments are examined more closely.

Imports

Between 2003 and 2007, the pace of import growth accelerated, exceeding that of GDI. The contribution of various factors to this growth in imports can be assessed using the error-correction model developed for the Bank of Canada by Jean-Philippe Cayen.[15] To focus the analysis on underlying trends, only the long-term equation from the model is used. This equation can be written as follows, when re-estimated for the period 1973Q1–2008Q1 (t values in parentheses):

$$\log(M_t) = \underset{(-4.57)}{-0.77}*\log(PM_t/PY_t) + \underset{(3.85)}{0.24}*\log(C_t) + \quad (1)$$

$$\underset{(0.86)}{0.14}*\log(I_t) + \underset{(5.60)}{0.63}*\log(X_t)\,.$$

This equation specifies that imports of goods and services are stimulated by a decline in the price of

14. See Freedman (1977) for an earlier but similar analysis of real income and expenditure per capita.

15. For details of the model, see Dion, Laurence, and Zheng (2005).

Table 3

Modelling Contributions to the Growth in Imports*

	1998Q1–2002Q4	2003Q1–2008Q1
Imports	3.1	5.5
Growth forecast by the model	4.0	7.8
Contribution of Canadian demand ($C + I$)	1.1	2.2
Contribution of Canadian exports	2.9	0.5
Contribution of import prices	0.0	4.7

* Growth rates are expressed in mean annualized geometric terms.

Table 4

Growth in Total Real Imports and Selected Components*

Chained 2002 dollars

	1998Q1–2002Q4	2003Q1–2008Q1
Total imports	3.1	5.5
Machinery and equipment	2.1	9.4
Consumer goods	6.5	9.0
Industrial products	2.4	4.1
Services	2.1	5.6
Travel services	-1.3	11.5

* Growth rates are expressed in mean annualized geometric terms.

imports relative to the GDP deflator (PM / PY) and by growth in total consumption of goods and services (C), business fixed investment (I), and exports of goods and services (X). Calculations based on equation 1 indicate that the appreciation of the Canadian dollar (reflected in the relative price of imports) accounts for approximately 60 per cent of the growth in imports between 2002 and 2007 (Table 3). This appreciation of the Canadian dollar contributed substantially to the accelerating growth in imports over this period, relative to the previous period, despite the pronounced slowdown in export-based demand, as the following section will show.[16]

Among the components of consumption, it appears that semi-durable goods and goods and services associated with foreign travel responded most strongly to the appreciation of the Canadian dollar, judging by the growth in both consumption and imports in these categories (Table 4). Imports in machinery and equipment, including equipment parts, also surged over the past five years. Their expansion relative to the corresponding spending on business investment has been hampered, however, by flagging demand for parts following the slowdown in equipment exports from Canada. Nevertheless, precisely because of its high import content, investment in machinery and equipment was directly stimulated by the appreciation of the Canadian dollar. The content of imported industrial products in industrial output has expanded considerably as Canadian firms, especially in the manufacturing sector, have taken advantage of cheaper imported physical inputs to maintain their profit margins.

16. In fact, the model overpredicts the growth of imports over both the 1998Q1–2002Q4 and 2003Q1–2008Q1 periods. This may have several causes, including omitted variables and a structural break in the determination of imports. It is worth noting that the elasticities of imports to the demand components, which sum to one, have been estimated freely.

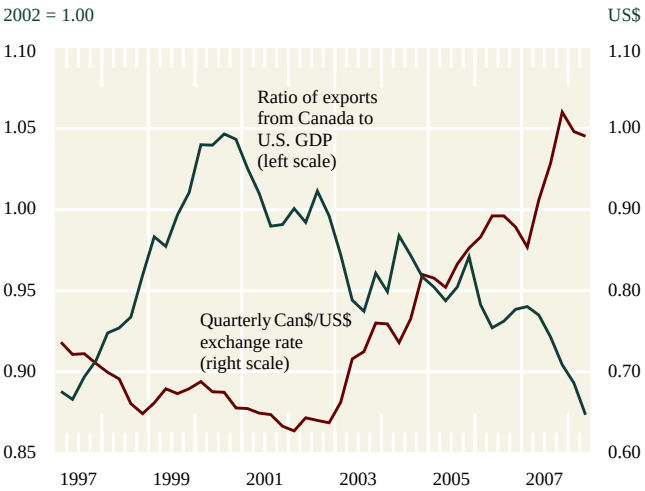
Exports

The marked appreciation of the Canadian dollar since 2003 has severely curtailed export growth. Indeed, the ratio of Canadian exports to U.S. GDP continued to fall well after the fallout from the bursting of the tech bubble had dissipated in the early 2000s (Chart 14).

As in the case of imports, the long-term equation for exports from Cayen's error-correction model provides an order of magnitude for the impact of the appreciation of the exchange rate on Canadian exports while excluding the volatility inherent in short-term dynam-

Chart 14

Ratio of Canadian Exports to U.S. Gross Domestic Product



ics. Re-estimates for the period 1973Q1–2008Q1 are as follows (*t* values in parentheses):

$$\log(X_t) = \underset{(-8.86)}{-0.64}*\log(RER_t) + \underset{(3.71)}{0.39}*\log(C_{USt}) + \quad (2)$$

$$\underset{(3.06)}{0.32}*\log(IME_{USt}) + \underset{(5.33)}{0.41}*\log(X_{USt}).$$

As expected, this equation shows that exports contract in response to an appreciation in the real exchange rate (*RER*) and expand when the United States posts growth in consumption (C_{US}), investment in machinery and equipment (I_{MEUS}), or exports (X_{US}).[17] A simulation reveals that the negative effects of the appreciation of the Canadian dollar partly offset the positive impact of robust growth in final demand and production in the United States during the period 2003–07 (Table 5). Moreover, the pronounced slowdown in export growth from earlier levels is owing entirely to the increased value of the Canadian dollar relative to the U.S. dollar. In recent quarters, however, the softening of U.S. activity, particularly motor vehicle sales and residential construction, which are intensive in Canadian exports, has been the major source of further weakness in Canadian exports.[18]

Table 5

Modelling the Contribution of Exports to Growth*

	1998Q1–2002Q4	2003Q1–2008Q1
Exports	4.6	0.6
Growth forecast by the model	4.1	1.1
Contribution of U.S. demand ($C + X + I$)	2.5	5.8
Contribution of real exchange rate	1.5	-4.7

* Growth is expressed in mean annualized geometric terms.

Relative to the United States, all regions of the globe saw their share of Canadian exports expand (Table 6) and, aside from Japan, posted rapid growth in their imports from Canada. Canadian exports to the European Union rose nearly as fast as those to countries that do not belong to the Organisation for Economic Co-operation and Development (OECD), despite much slower economic growth in Europe. These developments suggest that the appreciation of the euro and of the pound sterling relative to the U.S. dollar stimulated Canadian exports to Europe relative to exports to non-OECD countries and the United States.

Table 6

Regional Shares of Canada's Exports of Goods and Services

%

	2003	2007
World	100.0	100.0
United States	79.1	73.9
European Union	7.5	9.6
Japan	2.4	2.2
Other OECD countries	3.6	4.3
Non-OECD countries	7.5	9.9

OECD = Organisation for Economic Co-operation and Development

Exports of machinery and equipment and of consumer goods other than automobiles seem to have been most affected by the appreciation of the Canadian dollar, although their sluggishness also reflects, in part, the expanding penetration of emerging economies, especially China, in U.S. markets for these products (Table 7). Exports of automotive products showed slightly more strength until 2006, for at least two reasons: (i) their high content in imported parts, the cost of which declined with the appreciation of the Canadian dollar, and (ii) the success in the U.S. market of Japanese models manufactured in Canada. With the decline in real spending by tourists and other foreign

Table 7

Growth in Total Real Exports and Selected Components*

Chained 2002 dollars

	1998Q1–2002Q4	2003Q1–2008Q1
Total exports	4.6	0.6
Natural resources and products	2.5	2.3
Highly manufactured goods	5.2	0.3
Machinery and equipment	6.1	0.5
Automotive	4.1	-1.5
Other consumer goods	8.6	-1.8
Services	5.7	-1.5

* Growth is expressed in mean annualized geometric terms.

17. Indeed, Canadian and U.S. production are so intertwined that an increase in exports from the United States usually coincides with an increase in U.S. imports of commodities, parts, and semi-manufactured goods from Canada.

18. An unfavourable composition of U.S. activity, not properly captured by the export equation, may have contributed to the overestimation of Canadian export growth over the 2003Q1–2008Q1 period, as shown in Table 5.

visitors to Canada, exports of services, especially travel services, seem to have been particularly affected by the appreciation.

The growth in real exports of commodities between 2003 and early 2008 remained virtually unchanged compared with the previous five-year period. The stimulus created by higher commodity prices in international markets apparently offset the detrimental effects of the appreciation of the Canadian dollar and of certain sector-specific factors, especially the outbreak of mad cow disease (BSE) in 2003, the relative weakness in the U.S. residential construction market since 2006, sluggish trend growth in the consumption of newsprint in favour of electronic media, and oil reserves that are time-consuming and costly to develop.

Concluding remarks

Most certainly, as a small open economy well endowed in natural resources, Canada will continue to face important challenges and opportunities as commodity prices fluctuate on the world market and affect the exchange rate, the terms of trade, and the allocation of resources. Overall, the Canadian economy has responded well to the latest global price realignment. Its ability to take advantage of higher commodity prices crucially rests on its capacity to adjust without undue pressure on costs. Flexibility in the product and labour markets, which has further room to improve, as well as sound macroeconomic policies, are key elements in the economy's current and future prosperity.

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The Bank of Canada's *Senior Loan Officer Survey*

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- *Since 1999, the Bank of Canada has been conducting a quarterly survey of the business-lending practices of major Canadian financial institutions.*
- *The* Senior Loan Officer Survey *gathers information on changes to both the price and non-price terms of business lending over the current quarter and surveys the views of financial institutions on how changing economic or financial conditions are affecting business lending.*
- *Analysis of the information in the survey shows that it is correlated with future growth in both credit and real business investment.*
- *The* Senior Loan Officer Survey *data complement information on firms' access to credit, which is collected in a question in the Bank's* Business Outlook Survey. *High correlation exists between the results of the two surveys, which assess credit conditions from the perspectives of lenders and borrowers.*

Information and analysis from various sources and perspectives form important inputs into the larger set of information used by the Bank of Canada to arrive at its monetary policy decision. Data on the various developments that might be affecting the growth of money and credit, such as changes in the willingness of financial institutions to lend, can provide important insights about future changes in credit growth and economic activity and are therefore included in this larger information set.[1] As well, the recent turmoil in financial markets following the problems with asset-backed commercial paper and subprime mortgages in the United States highlights the importance of actively monitoring credit-market developments, including business-lending conditions.

The Senior Loan Officer Survey *collects information from selected financial institutions.*

The Bank of Canada maintains regular contact with financial institutions as part of its information-gathering process. Since 1999, the Bank has been conducting a quarterly survey of the business-lending practices of major Canadian financial institutions. The *Senior Loan Officer Survey* (SLOS) collects information from selected financial institutions on changes to both the price and non-price terms of business lending over the current

1. For a more detailed discussion of the information and analysis used in monetary policy decision making, see Macklem (2002).

Box 1: Lending Surveys among Central Banks

A number of central banks conduct and publish surveys of lending conditions, including the U.S. Federal Reserve (1967), the European Central Bank (ECB) (2003), the Bank of England (2007), and the Bank of Japan (2000).

Although there are many similarities between the Bank of Canada's *Senior Loan Officer Survey* and other international business-lending surveys, several differences exist. For example, the sample sizes differ, depending on the structure of the banking market in each country. While the Bank of Canada surveyed 11 institutions in April 2008, the ECB surveyed 113 banks across its member countries. The U.S. Federal Reserve Board (currently) surveys 56 domestic banks and 21 U.S. branches and agencies of foreign banks. Still, the survey's coverage of over 60 per cent of business lending by financial institutions in Canada compares favourably with that of the ECB and the U.S. Federal Reserve surveys.[1,2]

Another difference concerns the type of information solicited by business-lending surveys, with other surveys tending to cover a broader range of questions than the *Senior Loan Officer Survey*. The U.S. Federal Reserve Board survey, for example, queries financial institutions on lending to consumers, in addition to business lending, and the Bank of England survey asks both backward-looking and forward-looking questions on credit conditions.

Despite these differences, the widespread use and publication of the results of credit surveys among major central banks underlines their importance as part of the information used to assess financial conditions and to conduct monetary policy.

1. For Canada, business lending by financial institutions is defined as the sum of short- and long-term business loans, non-residential mortgage loans, leasing receivables, bankers' acceptances, and foreign currency business loans by chartered banks and non-banks.

2. See Driver (2007) for a summary of the coverage provided by the ECB and Federal Reserve Board surveys.

quarter. The survey also includes supplementary questions to collect the views of financial institutions on how changing economic or financial conditions are affecting business lending. The *Senior Loan Officer Survey* complements information on lending conditions from the borrower's perspective that is collected in the Bank's *Business Outlook Survey* (BOS).[2]

Analyzing trends in business-lending conditions presents several challenges. First, data on business-borrowing activity show the outcome, but not the underlying causes, of credit developments. For example, an increase in the growth of business credit could result from increased demand for credit, increased willingness of lenders to lend, or a mix of the two. The implications for policy-makers may differ, depending on whether this credit growth reflects strong economic activity that has spurred an increased demand for credit, or simply an easing in the lending policies of financial institutions that has allowed firms to become more highly leveraged. Second, while some pricing information for business loans is publicly available, the coverage of non-pricing aspects of business lending (such as lending terms or covenants) is limited in currently published Canadian data. Yet changes in non-pricing conditions for loans may contain as much or more information for credit-market analysis as the pricing component. The survey is particularly useful in addressing the latter challenge, since it collects information about both the pricing and non-pricing dimensions of business-lending conditions in Canada.

In October 2008, the Bank began publishing the results of the *Senior Loan Officer Survey* to share potentially important information on credit conditions with analysts and market participants. Publication of the results is consistent with current practices at other major central banks (Box 1). The results of both surveys will be published simultaneously in the weeks leading up to the release of the Bank's *Monetary Policy Report* and *Monetary Policy Report Update*.

The remainder of this article focuses on how the survey is conducted, describing the questions posed to lenders, explaining the construction of the summary statistics,

2. See Martin (2004) and Martin and Papile (2004) for a general description of the BOS survey design, questionnaire, and correlations with relevant economic data. The credit-conditions question was added to the publication with the release of the winter 2007–08 survey. For background information, see "Backgrounder on Questions in the *Business Outlook Survey* Concerning Past Sales and Credit Conditions" (14 January 2008) on the Bank of Canada's website at: <http://www.bankofcanada.ca/en/bos/2008/winter/bos_backgrounder0108e.pdf>. See footnote 13 for the wording of the BOS credit-conditions question.

and highlighting key statistical relationships in the historical survey data.

Methodology

At the end of each quarter, respondents are asked a set of standard questions covering their lending practices for three types of business borrowers: corporate, commercial, and small business (defined in Box 2). These questions focus on changes to both the pricing and non-pricing dimensions of lending. In particular, financial institutions are asked to assess the qualitative *change* in pricing and non-pricing lending practices over the current quarter (compared with the previous quarter) and, if there was a change, to indicate their reason for tightening or easing (see Box 2 for more details). Although the standard questions have remained largely unchanged since the survey began in 1999, they are supplemented in each quarterly survey with one or two topical questions focusing on how changes to specific economic or financial factors are affecting business lending.[3]

Eleven financial institutions are currently surveyed.[4] At each institution, the senior officers responsible for corporate, commercial, and small business lending typically complete the survey. The survey is currently conducted over a two-week period just before the end of the calendar quarter.[5] Previously, the survey was conducted shortly after the end of the quarter, but the timing has been adjusted to allow for simultaneous publication of the results of both Bank of Canada surveys.

Financial institutions are asked to assess the qualitative change *in pricing and non-pricing lending practices.*

The survey is conducted in three parts. First, Bank of Canada staff finalize the topical questions for the upcoming survey, based on internal consultations, and send the survey to participating financial institutions. Second, following receipt of the completed questionnaires, responses are discussed individually with each financial institution. This discussion is an important part of the survey, since it allows respondents to expand or qualify their answers and permits Bank of Canada staff to ask follow-up questions to better understand developments in business-lending conditions. Finally, the survey results are aggregated to maintain the anonymity of individual respondents,

3. For example, in the 2008Q1 survey, financial institutions were asked how their own cost of financing had been affected by the turmoil in financial markets.

4. The composition of the sample has remained mostly unchanged since the survey began in 1999.

5. The survey for the third quarter of 2008, for example, was conducted in the second half of September.

Box 2: *Senior Loan Officer Survey* Question on Business-Lending Conditions

The *Senior Loan Officer Survey* asks financial institutions: "How have your institution's general standards (i.e., your appetite for risk) and terms for approving credit changed in the past three months?"

Respondents indicate that their practices have tightened, remain unchanged, or eased with respect to each of the following conditions:

(i) pricing of credit (spreads over base rates, fees)

(ii) general standards

(iii) limit of capital allocation, and

(iv) terms of credit (collateral, covenants, etc.).

This question is asked about corporate loans and commercial and small business loans. In the latter two cases, responses are provided for five regions: British Columbia, the Prairies, Ontario, Quebec, and the Atlantic provinces.

Corporate, commercial, and small business borrowers are differentiated by the size of the loans authorized for each, using the following suggested definitions: corporate—over $50 million; commercial—between $2 and $50 million; and small business—less than $2 million. Respondents are allowed to answer based on internal reporting definitions, which may differ from the definitions suggested.

and the aggregated results concerning lending conditions are communicated to senior management of the Bank of Canada and made available on the Bank's website.

Survey Statistics

The key statistics summarizing responses to the survey are shown in Charts 1 and 2.[6] At the most aggregated level, the survey provides information on overall business-lending conditions (Chart 1). This overall measure can be broken into two dimensions: pricing and non-pricing lending conditions (Chart 2). The pricing dimension is constructed using the responses to the first subquestion in Box 2. A measure of non-pricing conditions is constructed using the following methodology: If an institution's response to any of subquestions (ii) to (iv) indicates that lending conditions have tightened (eased), it constitutes a tightening (easing) in non-price lending conditions.[7] The remainder of this section outlines the method used to calculate the results shown in Charts 1 and 2.

The balance of opinion is defined as the weighted "tightened" responses minus the weighted "eased" responses.

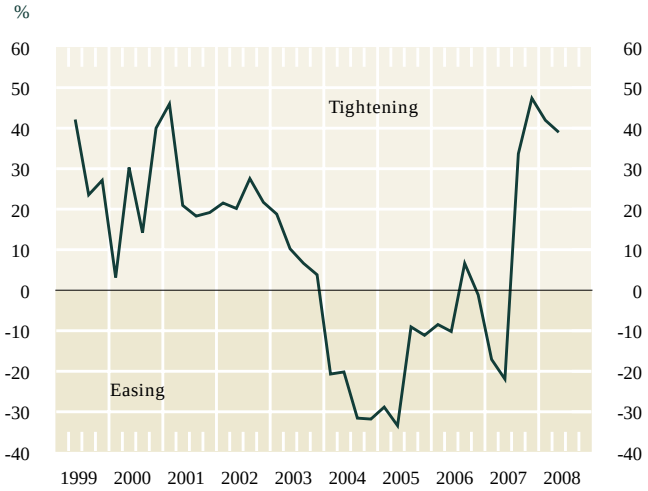
The first step in compiling the aggregate information is to construct a balance of opinion for the pricing and non-pricing dimensions of lending conditions for each of the corporate, commercial, and small business borrowers. The balance of opinion is defined as the weighted "tightened" responses minus the weighted "eased" responses for each dimension of lending conditions, where each respondent's weight is based on its relevant market share.[8]

The second step is to construct the aggregate balance of opinion for each of the pricing and non-pricing dimensions of business-lending conditions (Chart 2). For each dimension, this involves taking the simple average of the balance of opinion for corporate, commercial, and small business borrowers.[9] Finally, overall business-lending conditions are calculated as a simple average of the pricing and non-pricing dimensions (Chart 1).

For the survey results (overall business-lending conditions and pricing and non-pricing lending conditions), a positive balance of opinion corresponds to a net tightening of credit conditions, whereas a negative value implies an easing of lending conditions. By construction, the balance of opinion always ranges between -100 and +100. Responses falling at either extreme of this range would indicate that all respondents agreed on the direction of the change in business-lending conditions. The measure indicates only the

Chart 1

Overall Business-Lending Conditions: Balance of Opinion*



* The balance of opinion is calculated as the weighted percentage of surveyed financial institutions reporting tightened credit conditions minus the weighted percentage reporting eased credit conditions. Thus, a positive balance of opinion implies a net tightening. The chart shows the average of the balance of opinions for the pricing and non-pricing dimensions of lending conditions.

6. The release of each quarter's results will consist of a short summary (including both charts) and associated time series and will be available on the Bank of Canada's website at <http://www.bankofcanada.ca>.

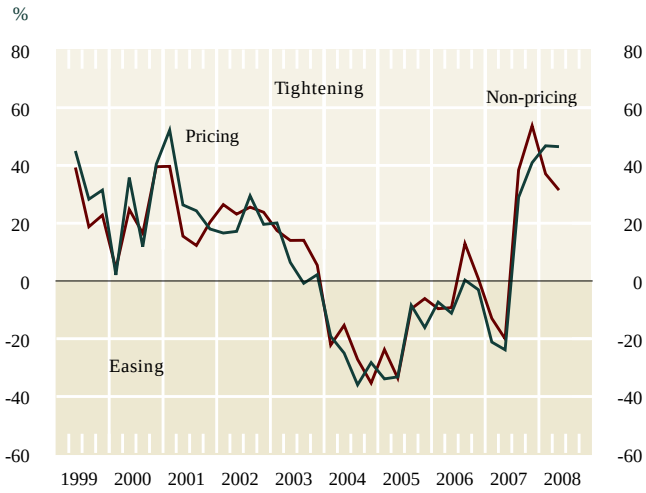
7. A tightening (easing) response in more than one of the three non-price subquestions (i.e., (ii)–(iv)) would also translate into an overall tightening (easing) in non-price lending conditions. In the rare case where a respondent indicates a tightening (easing) in one non-price subquestion and an easing (tightening) in another subquestion, the responses would be netted out.

8. Survey weights are updated annually using regional loans data for small and commercial credit and national loans data for corporate credit.

9. Historical survey results show that the variation in lending conditions for corporate loans is larger than that for small business and commercial borrowers. While using weighted averages to aggregate across the small business, commercial, and corporate sectors would be preferable, data limitations force us to use the simple average approach. Since corporate loans are substantially larger in total volume than small business and commercial loans, the simple average approach tends to give credit conditions in the corporate sector a lower weight than they would otherwise receive. Our analysis suggests, however, that the effect of our aggregation methodology on the balance of opinion is small.

Chart 2

Pricing and Non-Pricing Lending Conditions: Balance of Opinion*



Note: Each series is the simple average of the balance of opinions for the small business, commercial, and corporate sectors.
* The balance of opinion is calculated as the weighted percentage of surveyed financial institutions reporting tightened credit conditions minus the weighted percentage reporting eased credit conditions.

direction of the change in conditions and the amount of agreement; it does not provide any information on the magnitude of the change.

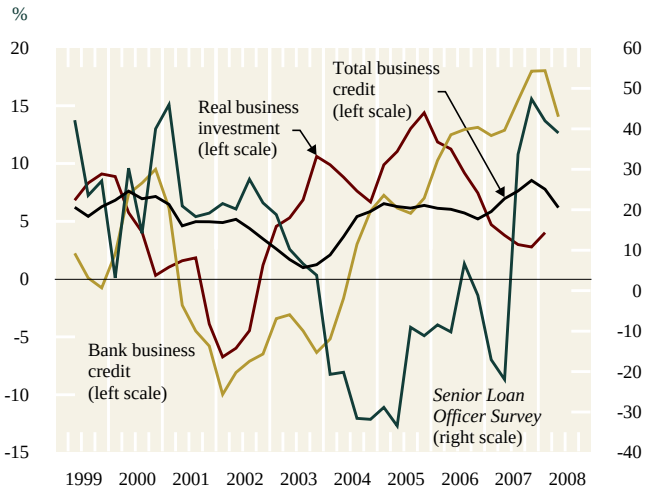
Survey Results as an Indicator of Economic Activity

Overall, the historical profile of changes in lending conditions derived from the *Senior Loan Officer Survey* is consistent with our broader understanding of the domestic credit cycle. Charts 1 and 2 illustrate that, during the economic slowdown earlier this decade, credit conditions (as proxied by the balance of opinion) tightened. Also evident are the easing in lending conditions over the 2004–06 period and the tightening through the financial market turmoil that began in mid-2007.

Since one important use of the survey results is to provide leading information about borrowing and business investment decisions of firms, we look at correlations between the survey results and measures of financial and economic activity in Canada. Table 1 shows the correlation of the overall balance of opinion with year-over-year growth rates for three economic and financial variables: business investment, total business credit, and bank business credit. Business

Chart 3

Credit and Investment Growth (year-over-year) and Survey Results



investment used for this analysis comprises real investment in structures and equipment by firms.[10] Total business credit includes all borrowing by the non-financial sector in Canada, including capital-market financing (issuances of bonds and equity).[11] Bank business credit is the portion of total business credit extended to non-financial firms by chartered banks.[12] Chart 3 shows the survey level and the growth rates of these economic variables.

The correlation analysis employs year-over-year growth rates for credit and investment, reflecting the expectation that changes in credit conditions may affect economic and financial decisions by businesses across several quarters, or in different quarters (Chart 3). The use of year-over-year growth rates also implies that both backward-looking (known) and forward-looking (unknown) information is embodied in the growth of credit and investment up to period t+3; beyond that horizon, the year-over-year growth rates represent only forward-looking information. The survey history is relatively short for calculating correlations, so the results below should be considered with caution, especially at longer horizons.

10. Source: Statistics Canada series v1992144

11. Bank of Canada series v122647, converted from monthly to quarterly by averaging months (Bank of Canada, various issues)

12. Bank of Canada series v122645 + v122634 + v122649 + v122656 + v122661, converted from monthly to quarterly by averaging months (Bank of Canada, various issues)

Table 1

Correlation between Survey Overall Balance of Opinion and Credit and Investment Growth

	Quarter												
Year-over-year growth	*t*–2	*t*–1	*t*	*t*+1	*t*+2	*t*+3	*t*+4	*t*+5	*t*+6	*t*+7	*t*+8	*t*+9	*t*+10
Real business investment	-0.53*	-0.56*	-0.54*	-0.50*	-0.52*	-0.56*	-0.67*	-0.65*	-0.59*	-0.42*	-0.25	-0.14	-0.04
Total business credit	0.54*	0.39*	0.20	-0.06	-0.24	-0.36*	-0.40*	-0.39*	-0.42*	-0.49*	-0.55*	-0.58*	-0.63*
Bank business credit	0.19	0.11	0.01	-0.19	-0.39*	-0.55*	-0.66*	-0.66*	-0.69*	-0.75*	-0.78*	-0.77*	-0.78*

Note: The sample period for the correlation analysis between the survey results and real business investment is 1999Q2–2008Q1. For total and bank business credit, the sample period is 1999Q2–2008Q2.

* The absolute value of the correlation coefficient is larger than 2 divided by the square root of the number of observations. This value is often used as an indication that the correlation between series is significantly different from 0 (at the 5 per cent level). While technical assumptions are violated in the present case, it still serves as a rough indicator that the correlations are important.

The analysis shows that the expected negative correlations exist in the data: Periods of tightening in credit conditions are correlated with future reductions in the growth rates of business investment, total business credit, and business credit provided by banks. Not surprisingly, correlations are strongest with the bank-provided portion of business credit (Table 1). In addition, these correlations rise steadily and remain strong over the horizon considered. The relationship between the survey results and the growth of total business credit is somewhat weaker, possibly because the survey covers only lending by financial institutions, which is a small portion of the total business-credit market. Finally, the correlations between the survey results and future year-over-year growth in business investment are fairly strong, especially around the 1-year-ahead (*t*+4) time horizon. Overall, the correlation analysis suggests that the survey results provide useful leading information about future investment and the availability of business credit.

Survey Perspectives on Credit Conditions

The SLOS provides a "supply-side" view of borrowing, i.e., an overview of credit conditions from the lenders' standpoint. The BOS asks businesses about the availability of credit (among other things), which gives insights into credit conditions from the demand side, i.e., from the perspective of the borrower.[13]

Together, these two surveys provide complementary information on business-credit conditions in Canada.

Before proceeding to a comparison of the results of the two surveys, other relevant differences in their methodologies regarding timing, weighting, and coverage should be noted, even though the impact of these differences on the comparability of the results has been small. First, the SLOS focuses on business lending by financial institutions, primarily banks, while the BOS asks firms about all sources of business financing.[14] Second, while both surveys ask about changes in credit conditions over the past three months, the surveys are conducted at slightly different times, implying that the resulting reference periods are not identical. In particular, the SLOS is conducted over a two-week period near the end of the quarter and pertains to changes in conditions over the quarter in which it is conducted. The BOS interviews, on the other hand, start mid-quarter and are conducted over a three- to four-week period, implying that the three-month reference period overlaps part of the previous quarter. Finally, in calculating the balances of opinion, the individual responses of the 11 institutions in the SLOS are weighted according to each institution's share of business lending in Canada, whereas the responses of the 100 firms surveyed in the BOS are weighted equally.[15]

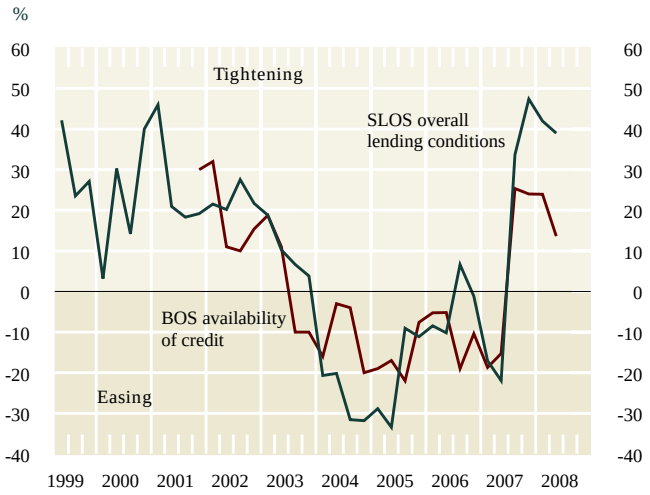
13. The BOS question on credit conditions is: "Over the past three months, how have the terms and conditions for obtaining financing changed compared with the previous three months? (For example, have banks changed their spread over prime or collateral requirements on loans or are capital markets more/less receptive to new issues of debt or equity?)."

14. For instance, the BOS question would capture developments in capital and equity markets and firm-specific events in addition to lending by financial institutions.

15. Firms in the *Business Outlook Survey* are selected such that the regional and industrial mix of companies approximates their share of business sector gross domestic product (GDP), and the sample covers a cross-section of firm sizes. This approach accomplishes similar goals to weighting the results.

Chart 4

SLOS Overall Business-Lending Conditions vs. BOS Availability of Credit*



Note: SLOS = *Senior Loan Officer Survey*; BOS = *Business Outlook Survey*

* The SLOS series starts in 1999Q2, the BOS series in 2001Q4.

The similarities and differences between the two surveys suggest that while we should expect their results to follow similar patterns, they will not provide identical information.

Chart 4 shows that, despite these methodological variations, the balance of opinion in the BOS on the availability of credit and the SLOS balance of opinion on credit conditions generally move together throughout the common sample period (2001Q4–2008Q2). The correlation between the two series is 0.8, a strong positive contemporaneous relationship, which suggests that the indicators of the two surveys should provide very similar information about future economic activity. While it is beyond the scope of the present article, one would usually expect the combined information to be more valuable than that for the separate series (see, for example, Gilbert and Meijer 2006). This would be especially important when the samples are so short.

To compare the leading information for credit and economic activity provided by these two series, it is instructive to examine their correlations with bank business credit and investment. Once again, however, these statistics should be used with caution, since the small sample size implies that the confidence bands for these correlations are wide, and become wider at longer horizons.

Table 2

Survey Correlation with Future Values of Year-over-Year Growth of Bank Business Credit (2001Q4–2008Q2)

	Quarter								
	t	*t*+1	*t*+2	*t*+3	*t*+4	*t*+5	*t*+6	*t*+7	*t*+8
SLOS	0.01	-0.14	-0.33	-0.55*	-0.69*	-0.68*	-0.70*	-0.73*	-0.75*
BOS	-0.18	-0.27	-0.45*	-0.67*	-0.85*	-0.83*	-0.79*	-0.76*	-0.79*

Note: SLOS = *Senior Loan Officer Survey*; BOS = *Business Outlook Survey*

* The absolute value of the correlation coefficient is larger than 2 divided by the square root of the number of observations. This value is often used as an indication that the correlation between series is significantly different from 0 (at the 5 per cent level). While technical assumptions are violated in the present case, it still serves as a rough indicator that the correlations are important.

Table 3

Survey Correlation with Future Values of Year-over-Year Growth of Business Investment (2001Q4–2008Q2)

	Quarter								
	t	*t*+1	*t*+2	*t*+3	*t*+4	*t*+5	*t*+6	*t*+7	*t*+8
SLOS	-0.61*	-0.58*	-0.58*	-0.52*	-0.52*	-0.40*	-0.20	0.07	0.32
BOS	-0.72*	-0.73*	-0.64*	-0.47*	-0.28	-0.15	-0.08	0.08	0.31

Note: Reflecting updated data for business investment growth, the correlation figures for the BOS presented in this table differ slightly from those in the "Backgrounder on Questions in the Business Outlook Survey Concerning Past Sales and Credit Conditions."
SLOS = *Senior Loan Officer Survey*; BOS = *Business Outlook Survey*

* The absolute value of the correlation coefficient is larger than 2 divided by the square root of the number of observations. This value is often used as an indication that the correlation between series is significantly different from 0 (at the 5 per cent level). While technical assumptions are violated in the present case, it still serves as a rough indicator that the correlations are important.

Table 2 shows the correlations of both surveys with future year-over-year growth rates of bank-supplied business credit for the common sample period (2001Q4–2008Q2). Both surveys are strongly correlated with bank business credit, although the correlations are higher for the BOS, especially over the shorter time horizon (*t*+2 to *t*+5). Table 3 shows the correlations of both surveys with future year-over-year growth in business investment. In this case, the BOS measure is more closely correlated over the near term (*t* to *t*+2), while the SLOS measure shows a higher correlation with business investment growth over the *t*+3 to *t*+5 horizon.

Concluding Remarks

The *Senior Loan Officer Survey* provides information on changes in the price and non-price dimensions of business-lending conditions from the perspective of the lenders and is useful for analyzing credit-market trends.

Results of the survey were initially published in October 2008. The Bank of Canada will continue to publish quarterly updates to the overall balance of opinion and the balance of opinion on the pricing and non-pricing dimensions. Publication of this information will coincide with the release of the results of the *Business Outlook Survey*, i.e., just before the publication of the *Monetary Policy Report* and the *Monetary Policy Report Update*.

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