



Catalogue no. 13-604-MIE — No. 054

ISSN: 1707-1739

ISBN: 978-0-662-45255-3

Research Paper

Income and Expenditure Accounts Technical Series

Recent Trends in Output and Employment

by Philip Cross

Current Economic Analysis Division
18th Floor, R.H. Coats Building, Ottawa, K1A 0T6

Telephone: 1-613-951-3640



Statistics
Canada

Statistique
Canada

Canada

Recent Trends in Output and Employment

This paper examines some of the reasons behind the slowdown of output growth relative to employment during 2006. It finds the two have converged frequently in recent years, including most of 2002 and 2003. After reviewing the sources of last year's productivity slowdown by industry, it looks at the negative impact of labour shortages on the quality of labour, especially in western Canada.

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences - Permanence of Paper for Printed Library Materials, ANSI Z39.48 - 1984. 

Ottawa
February 2007

Catalogue no. 13-604-MIE no. 54
ISSN: 1707-1739
ISBN: 978-0-662-45255-3

Catalogue no. 13-604-MPB no. 54
ISSN: 1707-1720
ISBN: 978-0-662-49894-0

Published by authority of the Minister responsible for Statistics Canada

© Minister of Industry, 2007

La version française de cette publication est disponible (n° 13-604-MIF n° 54 au catalogue)

All rights reserved. The content of this electronic publication may be reproduced, in whole or in part, and by any means, without further permission from Statistics Canada, subject to the following conditions: that it be done solely for the purposes of private study, research, criticism, review or newspaper summary, and/or for non-commercial purposes; and that Statistics Canada be fully acknowledged as follows: Source (or "Adapted from", if appropriate): Statistics Canada, year of publication, name of product, catalogue number, volume and issue numbers, reference period and page(s). Otherwise, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form, by any means—electronic, mechanical or photocopy—or for any purposes without prior written permission of Licensing Services, Client Services Division, Statistics Canada, Ottawa, Ontario, Canada K1A 0T6.

Table of contents

The cyclical setting	3
Industry trends	5
Natural resources	6
Manufacturing	10
Services	12
Employment	14
Labour shortages and quality	14
Conclusion	17
Technical series	18

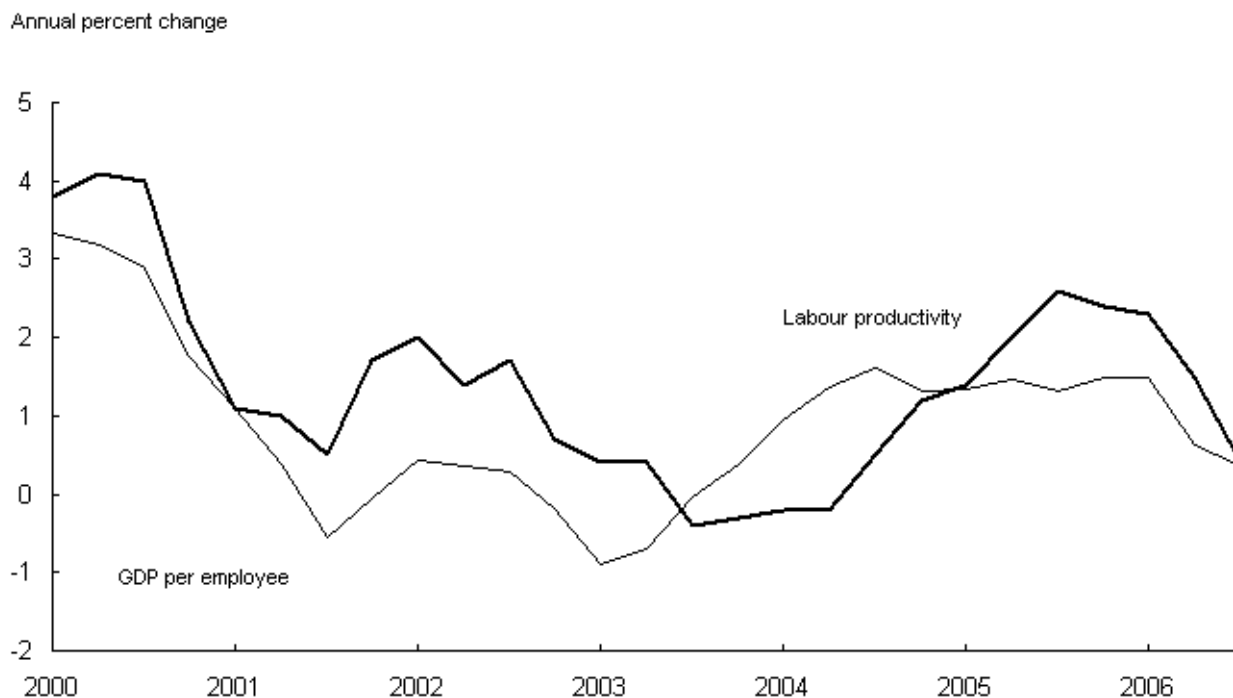
Recent Trends in Output and Employment

One of the major economic developments in 2006 was the slowdown in output growth, accompanied by continued steady gains in employment. The juxtaposition of the two increasingly dominated commentary on the economy as the year unfolded. Over the long-term, output typically exceeds employment growth by over 1% a year, reflecting the upward trend of productivity. The convergence of output and employment gains late in 2006 implies a diminution of productivity growth. This paper attempts to contribute to a better understanding of why this happened.

This study provides an overview of the sources of the deceleration of output growth relative to employment during 2006. It looks to past experience for recent precedents for the convergence of output and employment growth. It then reviews a variety of economic events that could explain why output and employment converged late in 2006. These include the rapid shift in the fortunes of various industries and regions – broadly, the resurgence of resource industries in western Canada and the slump of manufacturing in central Canada – and changes in the quality of labour firms face as unemployment hit the lowest level in a generation. It examines in detail irregular events and changing seasonal patterns that affected specific industries.

Inevitably, much of the discussion is highly technical. People often treat output per employee and labour productivity as inter-changeable concepts. However, there are differences that can cause these series to diverge over time (Figure 1). Most important is that the official labour productivity data cover only the business sector, which excludes the 15% of Gross Domestic Product (GDP) in the non-business sector (bypassing the conceptual problems of measuring productivity growth in this sector). As well, productivity is calculated as output per hour worked, not output per employee. Hours worked can differ from employment due to changes in multiple job holders, the mix of full-time and part-time positions and the length of the workweek. When this paper refers to productivity, rather than output per employee, it is the data on business sector GDP per hour worked that are being used. Unless otherwise noted, the employment data in this paper come from the Labour Force Survey (LFS), while total output is aggregate real GDP, including both the business and non-business sectors.

Figure 1 Output per employee and productivity



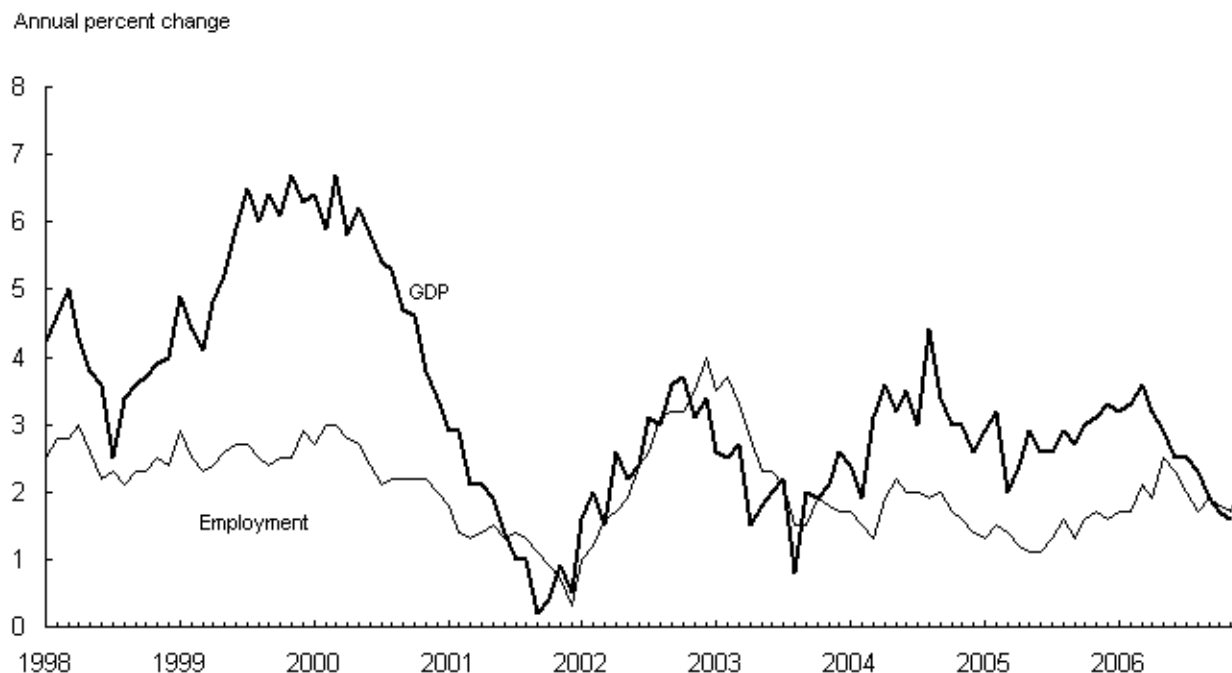
The paper focuses on factors that contributed to the slowdown of both output per employee and productivity in 2006. As such, little reference is made to the determinants of productivity growth over the long-run. Economists broadly agree these range from the population's structure and skills, capital investment, research and innovation as well as institutional factors such as taxes and trade regulations. However, since most of these variables were little changed last year (except for some shifts in population and investment), they do not figure prominently in this paper.

The cyclical setting

Output often slows relative to employment growth for short periods of time outside of recessions (during recessions economists expect output and employment to converge, as firms hoard some labour while cutting output). As recently as 2002 and 2003, output growth fell farther below job growth and for a longer period of time than in 2006.

In fact, Figure 2 shows that a narrowing of the gap between total output and employment growth has been the rule, not the exception, since the economy began to recover from a stall late in 2001. Year-over-year growth in output per employee was below 1% in 44 out of the last 69 months (or 63.8% of the time), and was negative for 16 of the 26 months between July 2001 and August 2003. Output struggled to keep up with employment growth a majority of the time: falling behind late in 2001, barely keeping ahead in 2002, and slipping below again in much of 2003. Only in 2004 and 2005 did output growth clearly exceed job gains, implying positive labour productivity growth. Even then, the productivity gains were far short of those in 1999 and 2000. So the convergence of the output and employment late in 2006 is hardly a new phenomenon.

Figure 2 Total output and employment



In retrospect, the slowdown of output per employee in 2002 and 2003 (confirmed by the official estimates of labour productivity) is more surprising than in 2006. The economy then was recovering from the near-recession in 2001 caused by the hangover from the bursting of the high-tech bubble and the shock of the September 11 attacks. Normally, the initial recovery from a cyclical slump in the economy generates large productivity gains, as previously under-utilized resources are put back to work. The situation in 2006 was the opposite; an economy operating at near full employment, especially in western Canada where growth was concentrated, would be more likely to show weak productivity growth.

It is worth recalling the many transitory factors that helped depress GDP growth in 2003, including the SARS epidemic, the discovery of mad cow disease, the power blackout in Ontario, fires in B.C., Hurricane Juan in Nova Scotia and the start of the Iraq war. Altogether, these events resulted in almost no growth in GDP in the middle two quarters, when output growth trailed employment.

Comprehensive labour productivity data by industry are available for 2003. Interestingly, many of the same goods-producing industries whose productivity sagged in 2006 also struggled in 2003. Oil and gas saw productivity fall 7%, even as prices began to climb sharply. Manufacturing productivity was flat as firms were faced with the beginning of the sharp appreciation of the exchange rate. The sluggishness of productivity was widespread in manufacturing in 2003, just as it was last year.

Services contributed more to the productivity slowdown in 2003 than in 2006. Travel-related services such as accommodation and food obviously were severely affected by the SARS crisis in the first half of 2003, but did not cut their staff by the same degree as demand warranted (a phenomenon economists call labour hoarding).

Nor is it unusual for Organisation for Economic Co-operation and Development (OECD) countries to experience two (or more) years of little productivity growth. Just since 2000, 10 of the 29 OECD countries for which data are available experienced such an episode. Interestingly, Norway and Australia are both currently experiencing little or no growth in output per employee; like Canada, both have large natural resource bases which, as will soon be shown, is the source of much of the productivity slowdown in Canada.¹

It is unclear if the slowdown of output per employee late in 2006 is more than a transitory phenomenon. Some of the attention paid to the recent slump in output per employee may be because of concerns about a repeat of the 2002-2003 episode which lasted two years. But it could be also a transitory event, with productivity growth quickly resuming as occurred in 1998. Analyzing the trend in productivity by industry last year is the first step in understanding the reasons behind the slowdown.

1. Even in the U.S., where productivity rose 2% in 2006, its slowdown from earlier this decade led the Federal Reserve Board to observe that "the recent slowdown in labour productivity may be at least in part a temporary cyclical response... rather than a meaningful downshift in the longer-run trend", p. 26, Monetary Policy Report, Feb. 14, 2007.

Industry trends

Most of the downturn in output per employee in 2006 originated in goods-producing industries (see Figure 3), down 1.9% between December 2005 and November 2006. The drop largely reflected output in these industries switching from 3.3% growth late in 2005 to a decline of 1.9% during 2006.

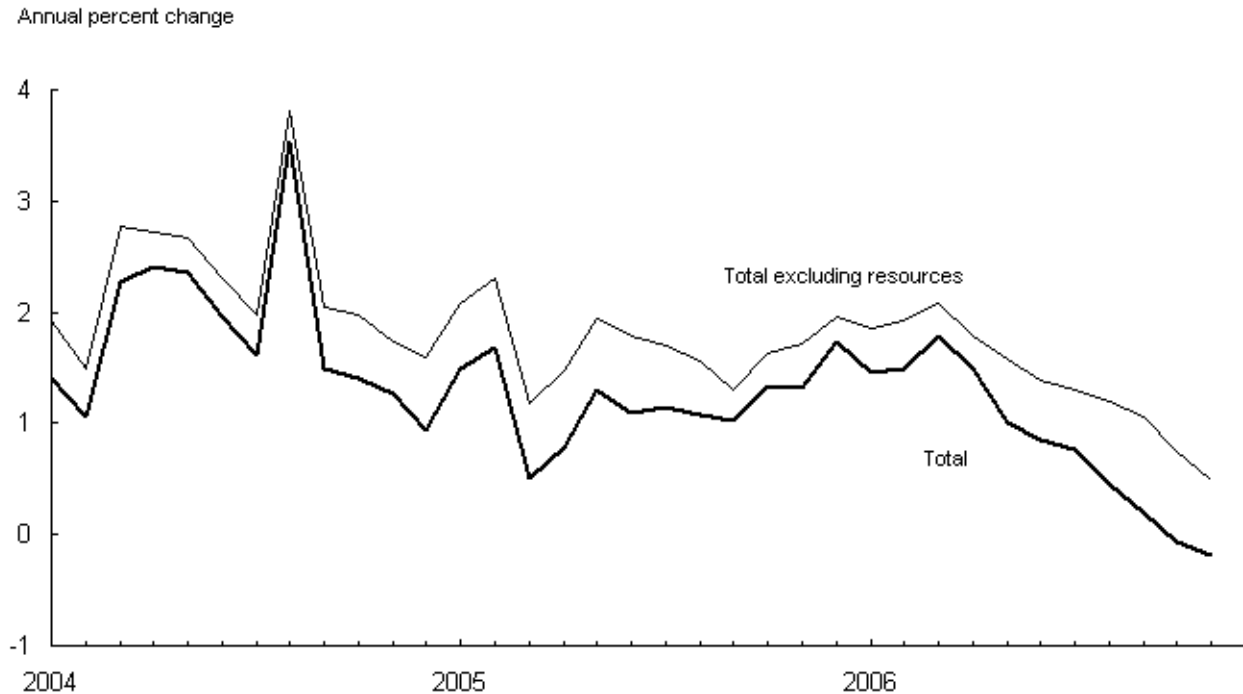
Figure 3 Output per employee in goods



Natural resources

A more detailed analysis of the industries within the goods-producing sector shows almost all posted lower productivity during the first three quarters of 2006. Output per hour worked declined by nearly 10% in the resource sector, by itself shaving a full 1% from productivity growth last year, Figure 4. Mining led this drop, as output grew slowly while employment raced ahead by over 10%, the most of any industry in 2006.

Figure 4 Output per employee



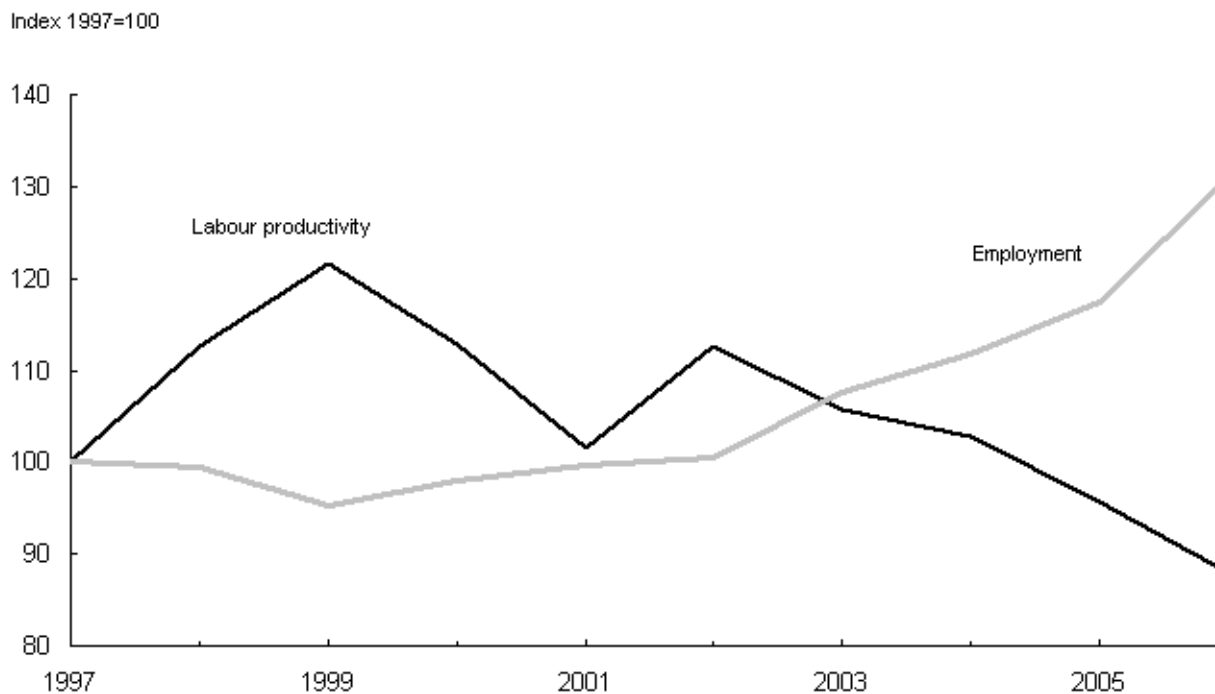
More generally, the drop in output per employee in mining is symptomatic of the industry rotating to fields that are less productive. The National Energy Board has documented how the productivity of new discoveries of conventional oil and gas has fallen in recent years.² This reflects the industry moving from the easiest to exploit fields in the west to less productive wells.

Still, exploiting conventional oil and gas wells has not been enough to meet our growing demand for energy. As a result, the industry has increasingly shifted to non-conventional sites offshore, in the oilsands or to coalbed methane. Output in non-conventional oil projects, for example, now accounts for nearly half of all the barrels of oil produced in Canada; as output from non-conventional sources has risen, output per employee in oil and gas has fallen sharply.

2. The initial productivity of gas wells in western Canada has fallen by almost two-thirds since 1996; p. 23 National Energy Board, "Short-term Canadian Natural Gas Deliverability 2006-2008", October 2006. For oil, the NEB characterized western Canada "as a maturely explored basin, with diminishing finding rates and relatively high costs. Most of the large pools have been discovered and smaller fields are increasingly difficult and costly to find", p. 17 "Short-term outlook for Canadian Crude Oil to 2006", Sept. 2005.

Last year's drop in mining productivity was part of a long-term downward trend. The declining productivity of conventional wells and the shift to lower-productivity output from the oilsands is reflected in a 28% drop in labour productivity in mining since its peak in 1999 (Figure 5). Most of this reflects a 60% hike in employment in the oil and gas sector, almost all in Alberta. The employment increase in mining was led by the oilsands, which hired thousands of workers on mega-projects that will not begin producing oil for years, given the long time required to build an oilsands plant (which requires removing the overburden, building the crushers and extractors to remove the bitumen, and constructing basins to recycle the water, even before upgrading and refining; in situ recovery is even more complicated).³ These employees are involved in logistics, management and recruiting; those actually building the plant are classified in construction.

Figure 5 Mining



Events specific to the last two years aggravated this long-term downward trend in productivity in mining. Oilsands output was depressed in 2005 by a major fire, which halted production at the largest producer for nearly nine months. The resumption of production at this plant helped boost oilsands output in 2006. Because productivity in the oilsands is below the average for other oil sources, this see-saw movement in production in 2005 and 2006 contributed to lower productivity growth last year (because of the increased share of low-productivity oil output in 2006 after a decline in 2005).

While the shift from conventional oil fields to the less-productive oilsands has depressed output per employee in the short-run, this is likely to be a short-lived effect. As the oilsands gear up production, output per employee will increase, even if the level is not as high as from conventional fields. More generally, it is to be expected that the extraction of oil from the oilsands will become more efficient over time. Oilsands technology today is more advanced than a decade ago, and advances in 'in situ' production promise further gains. Oilsands production today is dominated by the mining method of extraction, which concentrates on the relatively labour-intensive removal by shovel of the bitumen in the top 75 meters. This will soon be well-developed, and the long-run expansion of the oilsands will rely on in situ technology, which involves capital-intensive techniques (mostly involving steam) to extract the bitumen from further below the ground.

3. See "An Overview of Canada's Oil Sands Industry" by the Canadian Energy Research Institute.

This highlights one of the pitfalls in looking at short-run movements in productivity. Conceivably, productivity could be rising within every component industry, but these gains could be masked by a shift from industries with high-productivity to those with lower productivity, leading to an overall drop in measured overall productivity.

As well, oil production last year was hampered by a number of production disruptions. These included accidents at the relatively high productivity Hibernia and Terra Nova platforms offshore from Newfoundland, which cost months of production. Understandably, given the shortage of labour in the oilpatch, firms kept their staff during these interruptions of production.

Mining outside of oil and gas is also increasingly located in remote parts of the country or requires digging deeper into the earth's crust. The best example is diamond mining, which currently is located almost exclusively in the Northwest Territories. The logistical problems for these mines were compounded by the warm winter of early 2006, which shortened the season for the ice road used to supply these mines to just 42 days (compared with an average of 75 days). This forced one firm to bring in the world's largest and most expensive helicopter to transport equipment to their mine, while boosting the cost of fuel for all by \$1 per litre.⁴

Some of the drop in productivity in metal mines reflects the exhaustion of the most productive sources, just as was the case for conventional oil and gas. The most obvious example is gold mining, where annual output has fallen steadily since 2001, including a 25% drop over the last two years (despite higher prices).

Several of the largest mining industries experienced production difficulties last year. Strikes reduced output of nickel and copper in the fall: since the LFS counts strikers as still employed, this lowers output per employee (hours worked captures this effect, so labour input in the productivity measures is not affected). Potash output was curtailed during protracted contract negotiations with buyers in China.⁵ Work stopped on the world's largest uranium project at Cigar Lake due to flooding in October, delaying sales for years.⁶ As with oil and gas, shortages of labour induced employers to keep workers on the payroll when production was temporarily disrupted.

None of these problems have recurred so far in 2007, so some recovery in productivity can be expected. Potash producers signed deals with Chinese buyers early in the year, new labour agreements averted a strike in the nickel industry and the ice road to mines in the North posted its second-earliest opening date.

Productivity fell in utilities last year. Mild winter weather depressed demand for electricity and gas at both the start and the end of the year. Not surprisingly, utilities did not lay off staff, as they had no way of knowing when demand would jump (as the recent bout of cold weather illustrated).

4. See "Ice is now thick enough on road to riches: Vital winter route to North's diamond mine opens" by David Finlayson, E1, Edmonton Journal, January 31, 2007.

5. "In 2006, potash production was idled at a number of Saskatchewan mines while producers waited for the Chinese government to settle on a pricing regime. As a result, large-scale shipments of Saskatchewan potash didn't begin until August." Quoted from "Potash producers reach early Chinese pricing deal" in the Financial Post, Feb. 9, 2007.

6. See "Cameco extends delay over flooded mine" p. B4 in The Globe and Mail, Feb.8, 2007.

Table 1 Year over year growth of labour productivity

	First quarter 2005	Second quarter 2005	Third quarter 2005	Fourth quarter 2005	First quarter 2006	Second quarter 2006	Third quarter 2006
Goods-producing industries	0.1	0.7	1.9	2.6	1.7	0.3	-1.7
Agriculture, forestry, fishing and hunting	8.7	5.4	2.2	-0.4	0.8	-2.3	-7.8
Mining and oil and gas extraction	-8.9	-8.1	-5.4	-4.9	-5.4	-10.6	-9.6
Utilities	2.2	2.5	3.5	0.0	-2.4	-1.0	-2.6
Construction	-2.2	-2.0	0.2	1.3	0.8	3.3	1.5
Manufacturing	1.8	3.2	4.1	5.4	3.8	0.8	-1.2
Services-producing industries	1.8	2.7	3.3	2.7	3.3	2.8	1.8
Wholesale trade	4.6	8.0	8.2	8.7	10.0	7.8	6.9
Retail trade	3.8	2.4	2.0	1.2	3.2	4.7	4.3
Transportation and warehousing	1.9	2.7	5.7	5.6	3.5	2.9	0.2
Information and cultural industries	0.6	0.9	8.6	8.2	7.0	4.8	-0.3
Finance, insurance and real estate	-0.7	-1.1	-2.3	-3.6	-2.4	-1.9	0.0
Professional, scientific and technical services	1.8	2.1	1.5	1.0	0.8	0.7	-0.3
Administrative and waste management services	-0.9	0.5	2.1	2.0	1.4	1.6	0.5
Arts, entertainment and recreation	-0.6	4.3	5.1	5.9	4.3	4.7	-0.1
Accommodation and food services	-1.1	2.5	3.4	3.8	4.6	0.3	-0.1
Other services	1.6	2.8	3.0	2.0	4.1	3.3	2.3
Business sector	1.4	2.0	2.6	2.3	2.3	1.6	0.4

Productivity in agriculture, forestry and fishing fell steadily throughout 2006. A poor grain crop helped dampen farm output. Nevertheless, agricultural employment rose slightly during the year. Interestingly, all of the increase originated in central Canada, led by southwestern Ontario. There, many people who had farms but worked in factories lost their primary job: as a result, they then reported farming as their primary job, raising employment in agriculture. This is a good example of how events can produce unusual movements in industry output per worker in the short-term.

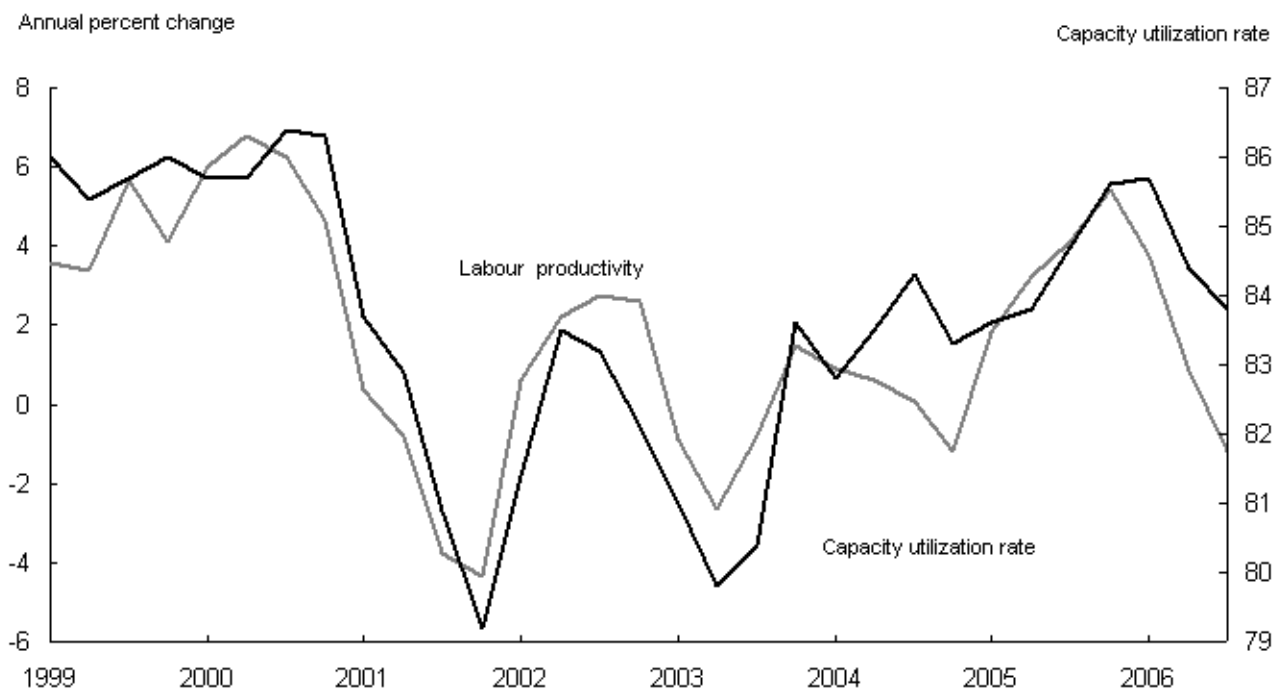
Forestry experienced one of the largest swings in the growth of output per worker between 2005 and 2006, from double-digit increases to double-digit declines. The rapid increase in 2005 reflected the consolidation of output in large, more efficient mills in B.C., and the ramping up of output as the U.S. housing market peaked. The severe slump in U.S. housing demand last year depressed output, compounded by the closing of many small mills in eastern Canada late in the year when Quebec lowered its harvesting quota for timber by 20% and the softwood lumber agreement with the U.S. took effect.

Manufacturing

Output per employee declined in manufacturing in 2006, following two years of growth. Factories so far this decade have not come close to matching their stellar productivity gains during the high-tech boom in the late 1990s.

The downturn in manufacturing productivity this year reflects a slump in output, which lowered capacity utilization (the main determinant of productivity in the short-term). Manufacturing output fell 4.8% in the first 10 months of the year (it recovered slightly at year-end) and, as Figure 6 shows, productivity typically falters during contractions. While the rising dollar has given manufacturers a strong incentive to boost productivity every year since 2003, this was easier to achieve in 2004 and 2005 when output was rising 1.9% and 0.7%, respectively. When factory output fell in 2001 and 2002, manufacturers also saw productivity retreat.

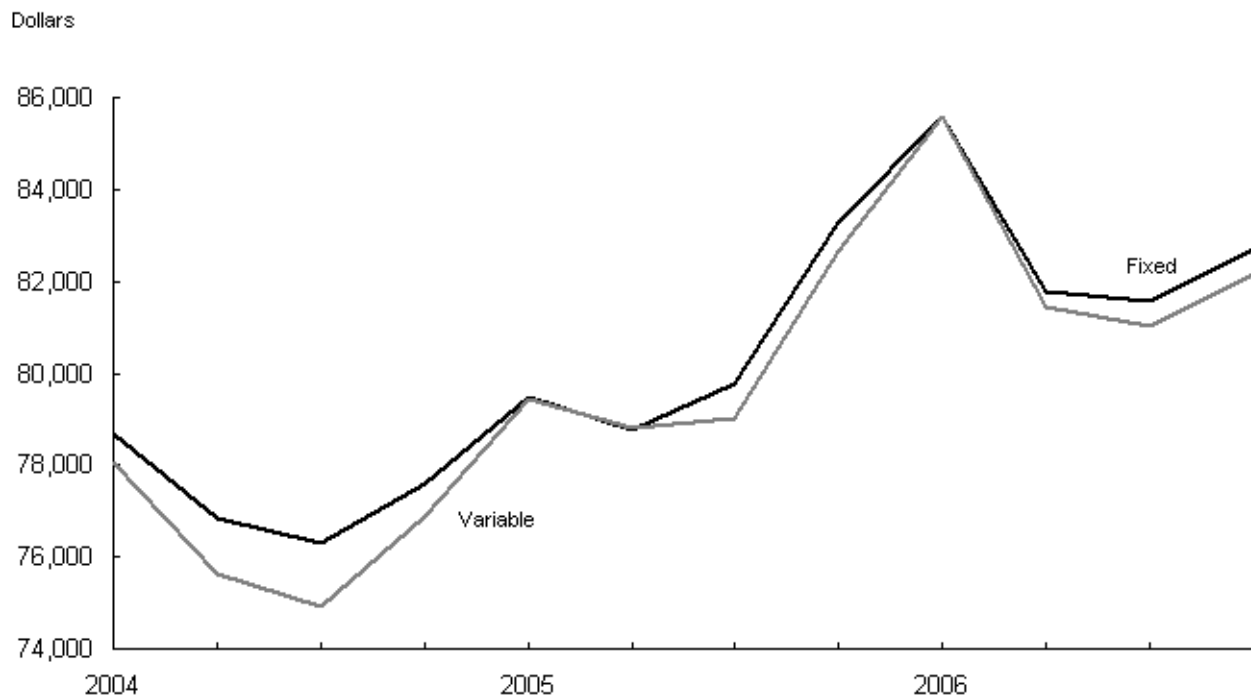
Figure 6 Manufacturing



What of the argument that the re-structuring of industries, especially in manufacturing, should transfer resources from low- to high-productivity plants? The economy in 2006 saw many factories close in low-productivity sectors such as textiles, clothing, furniture and even autos. Meanwhile, growth continued in high-productivity and capital-intensive industries such as petroleum refining. Surely this could be expected to boost overall productivity?

A statistical test of this theory that employment, on balance, was being transferred to more productive industries was conducted by constructing a Laspeyres (fixed-weighted) index of output in manufacturing. In layman's terms, this holds the weight of each industry constant at its 2003 share of employment. The results in Figure 7 show that there was almost no difference from the Fisher current-weighted index used in actual GDP. This surprising result is because, while labour productivity was higher in some industries whose share of output was higher, their productivity was nevertheless falling throughout 2006. As well, output fell in some industries with high productivity, notably primary metals and computers and electronics.

Figure 7 Manufacturing productivity



These results are consistent with past research showing that inter-industry shifts do not have a large impact on overall productivity growth in the short-term. Productivity ultimately depends on actual gains within specific industries, not shifts between industries with different productivity levels. Productivity in manufacturing last year was sluggish across almost all industries, swamping the effect of inter-industry shifts. Falling productivity in industries such as aerospace, primary metals, paper and petroleum may reflect specific industry events such as supply disruptions or strikes. It may also reflect the natural human inclination, when presented with sudden great wealth such as occurred in metals and petroleum, to temporarily relax close scrutiny of costs.⁷

7. Similar results were found for economy-wide Laspeyres versus Fisher indices of productivity at the 2-digit level, using detailed employment data from the Survey of Employment, Payrolls and Hours.

Services

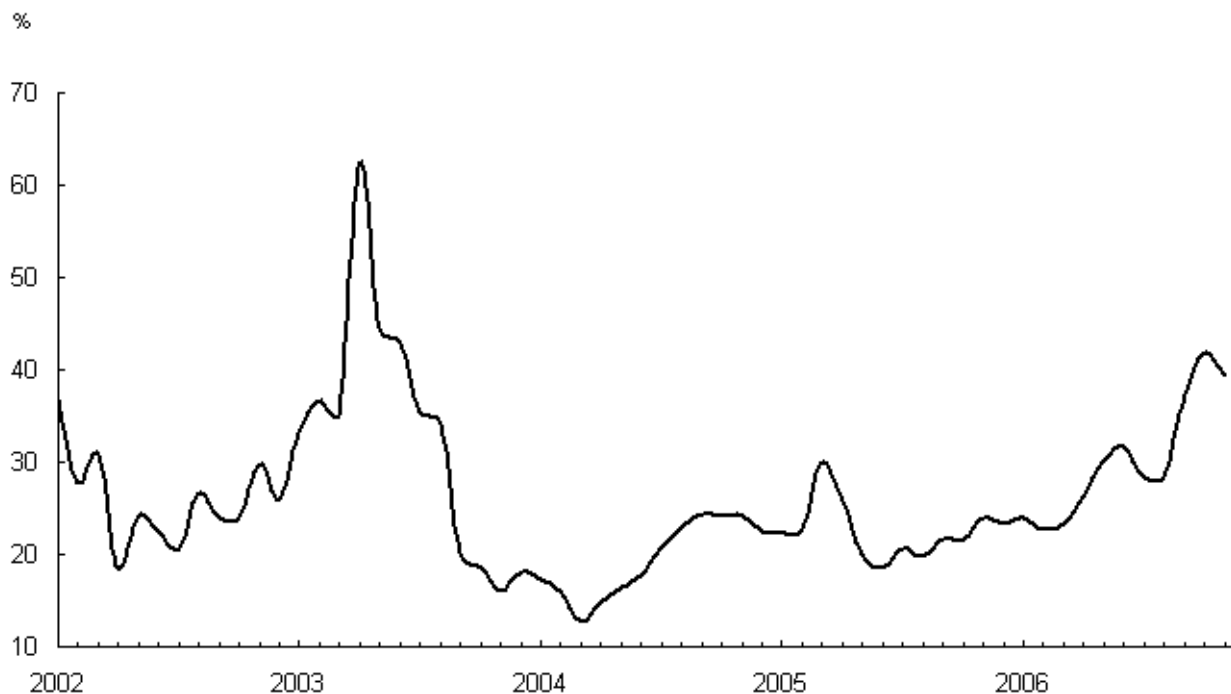
Overall, output per employee in services escaped the large deceleration recorded for goods. Figure 8 shows that output per employee in services continued to grow at about its long-term average, and well-above the SARS-induced slump in 2003. Several industries posted solid gains, notably consumer-related industries, which benefited from strong demand. Still, growth was restrained by a shift to public and business services, where productivity growth is limited by definition.

Figure 8 Output per employee in services



Nearly 40% of monthly GDP growth in services industries is estimated using employment. For most of these, largely in the public sector, this is because of the conceptual difficulty in measuring output. Since no market price exists for the output of these services, Canada follows the same accounting practice as in the U.S. GDP of using labour input growth (adjusted in some industries for changes in the quality of the labour force) as the proxy for real output growth. As a result, productivity growth in these industries by definition is limited. For this reason, the non-business sector is excluded from the official measure of labour productivity, but it does affect GDP per employee, and hence has influenced the current debate.

Output growth in 2006 was heavily concentrated in industries where employment is used as the proxy of output growth in monthly GDP. As of November, year-over-year growth in industries whose output is estimated from employment growth was 2.1%, compared with 1.3% in the rest of the economy. This is a reversal from both 2004 and 2005, when industries whose output is estimated with labour inputs grew at only half the rate of other services. Figure 9 shows that these industries accounted for about 40% of the year-over-year growth of total GDP by the end of 2006, double their contribution at the start of the year. This reflects both increased activity in these industries and slower GDP growth in other industries.

Figure 9 Contribution to annual GDP growth by industries projected from employment

The increase of nearly 20 points in the share of GDP growth occurring in industries where measured output per employee by definition cannot change significantly had the effect of reducing overall output per employee by 0.1 points during 2006. The expansion of these industries was led by more spending on health care services outside hospitals. As well, demand picked up for religious and charitable organizations. These gains outweighed a sharp slowdown for education and recreation services.

Output in some business services is also projected on a monthly basis using employment growth. This is most common for industries with no other source for monthly data, such as professional, scientific and technical services.⁸ These industries grew faster than the rest of the economy. However, because they are not as large as the public sector, they had little impact on overall productivity growth.

Excluding the non-business sector, the year-over-year growth of labour productivity in services rose by 1.8% in the third quarter, down from 2.7% at the end of 2005. Growth was led by wholesale and retail trade, continuing a trend of large productivity gains in these industries since 2002. Wholesalers and retailers have benefited from lower import prices since the dollar began to rise in 2003, while the shift to big-box stores also boosted productivity.

8. Also, these industries are ultimately benchmarked to data not based on labour input (such as tax data that capture all costs and revenues) and then deflated with a market price index. Based on the historical relationship between labour inputs and these final measures of output, the monthly estimates of growth are modified to minimize the possible revision. Interestingly, the last time that the contribution to growth from such industries was as large as last year was in 2003. At that time, their contribution to growth also peaked at over 40%, partly due to stepped up demand for health services during the SARS crisis. Not surprisingly, this helped pull down output per worker that year. It is also noteworthy that this did not signal a new trend, as productivity growth quickly rebounded in 2004 and 2005.

Some services have seen productivity growth slow during 2006. Not all these decreases are necessarily a negative development. For example, the accommodation and food industry saw productivity decline slightly as it started to resolve the labour shortages that hampered its growth (but boosted measured productivity) in 2005. The biggest turnaround was in Alberta, where a 12% year-over-year drop in accommodation and food jobs in December 2005 was followed by a 9% gain during 2006. Similarly, the transportation industry was able to find more labour in 2006 after employment fell in 2005. Transportation output has grown steadily in recent years, reflecting the turnaround in the airlines industry (after severe losses due to September 11th and SARS) and the boom in shipping commodities and containers by rail and water (much of them destined to and from Asia).

Productivity was little changed in most other services, which include finance, administrative services, and arts and recreation. In finance, productivity has been chronically weak since 2002.

The calculation of industry output per employee sometimes is impossible, for definitional reasons. The best example is owner-occupied housing. The National Accounts follows standard international practice and treats homeowners as renting from themselves. This estimate, totalling \$90 billion last year, is driven by changes in the stock of housing. Since there is no employment in this industry, productivity is undefined (this is one reason that output per employee in the non-business sector can grow or shrink over time). After several years of double-digit growth, the stock of housing growth is starting to moderate, reflecting the slowdown in the housing market. This will trim real GDP growth in the future, while having no impact on employment.

Employment

Income growth in GDP has been driven by labour income, up 5.3% in 2006. This increase was boosted by the strong gains in employment. This strength was captured in both measures of labour input — the Labour Force Survey (LFS) and the hours worked used for labour inputs in the productivity estimates.

There are important conceptual differences between LFS employment and the hours worked used in the productivity estimates. The LFS treats multiple job holders as just one employed person, while labour input captures them through hours worked. Productivity excludes important sectors of the economy, such as the non-business sector.

Accepting that the slowdown in labour productivity in 2006 is apparently a real and pervasive phenomenon, what broad economic factors affecting all industries could explain it? The next section looks at macroeconomic events that could explain why output per employee and productivity growth decelerated so sharply after two years of increases.

The most obvious place to start this analysis is the cyclical state of the Canadian economy. The 16-year long expansion of employment accelerated in 2006, with most of the growth in full-time positions. This sent the unemployment rate to its lowest level in the 30-year history of the current Labour Force Survey. Many industries struggled with labour shortages, notably in Alberta and B.C., but even the Atlantic provinces were affected by year-end (manufacturers there reported more shortages of skilled and unskilled labour than in central Canada).

Labour shortages and quality

Tight labour markets and shortages can often lead to slower productivity growth. Employers increasingly search out and hire workers who are less-productive, either because they have less experience, fewer skills or less training. When the U.S. labour market tightened at the peak of the high-tech boom in 1999 and 2000, for example, productivity growth slowed over a full point.

Several measures show declining labour quality, especially in western Canada where employers faced severe shortages. Employment rose faster last year for the youngest and oldest segments of the population — the least productive — than workers in their prime (between 25 and 54 years old). For the young, this below-average productivity reflects less experience and training; for older workers, eroding skills, a new career and less attachment to the labour force.⁹ While neither of these trends was new last year, their growth accelerated sharply.

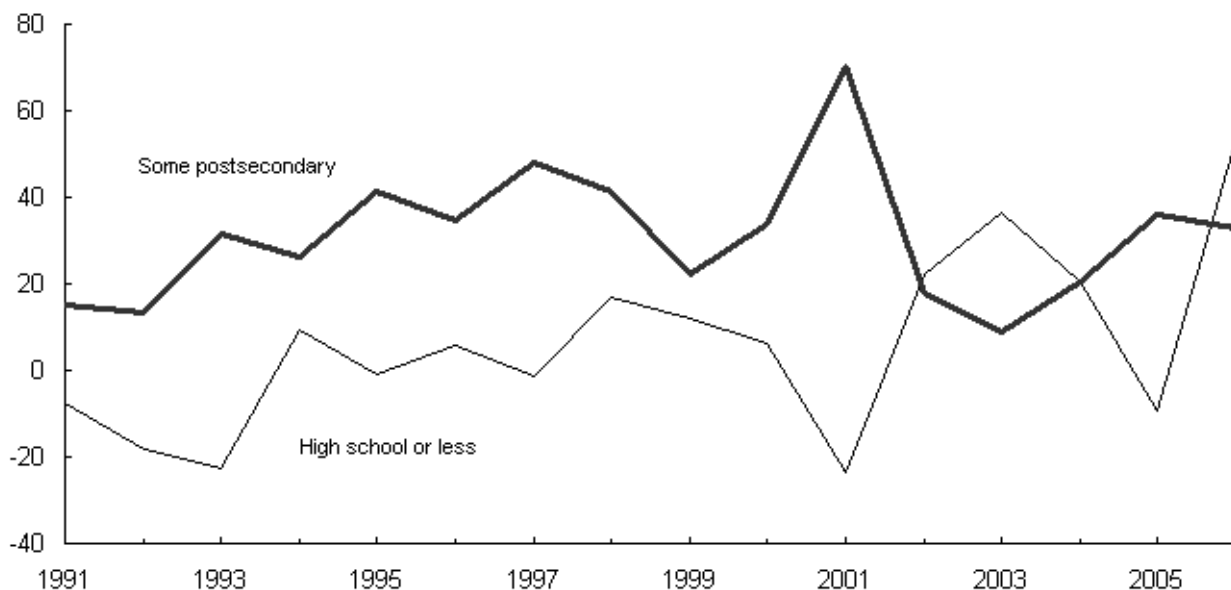
Nation-wide, employment rose faster for people 55 years and older (6.7%) and youths (1.5%) than for middle-age workers (1.4%). As a result of increased demand, the unemployment rate for youths hit a record low of 9.7% by last December and both the employment and labour force participation rates of people 55 and over also hit record highs.

Shortages induced employers in Alberta and B.C. to turn the most to the youngest and oldest to fill jobs. In Alberta, the increase was most pronounced for youths, where jobs rose 5.6%, boosting their employment rate from 64.1% to 65.3% from December 2005 to December 2006. B.C. was more reliant on older workers: while employment growth for prime-aged workers slowed to 0.9% during 2006, it rose 12.6% for older workers (including those 65 and over, up 1.7 points to 8.3%), twice the increase during 2005.

In Alberta, people with high school education or less accounted for over half of all employment growth in 2006. This was by far the most ever, and a marked change from the 1990s when employers showed a marked preference for people with more than high school education (Figure 10).

Figure 10 Alberta employment by education

First difference (000's)



B.C. saw a similar shift to hiring less-educated people last year, although it was less pronounced than in Alberta. Still, shortages in B.C. are severe enough that its Business Council warned that shortages led it to lower its forecast for GDP growth in 2007.¹⁰

It is worth noting that the decline in the education level of workers was symptomatic of the tightness of the labour market, not of a deterioration in the quality of work available. In other words, the lower quality at the margin was driven by the supply of workers, not the demand of employers (who clearly would have preferred hiring people with better skills).

9. An ageing labour force can significantly lower productivity. One recent study estimated that the impact on Canada peaks in the 2001-2006 period, with annual losses in productivity of 0.2 percentage points (p. 598, J. Tang and C. MacLeod, "Labour force ageing and productivity performance in Canada." *Canadian Journal of Economics*, Vol. 39, No. 2, May 2006.

10. See "B.C. Outlook" by Jack Finlayson, Business Council of British Columbia, February 2007.

Not all measures of labour quality deteriorated last year. Employment of youths aged 15 to 24 slowed during the year outside of Alberta. And the ranks of the self-employed fell during 2006, despite a brief rally at year-end (the productivity of the self-employed is less than for employees).

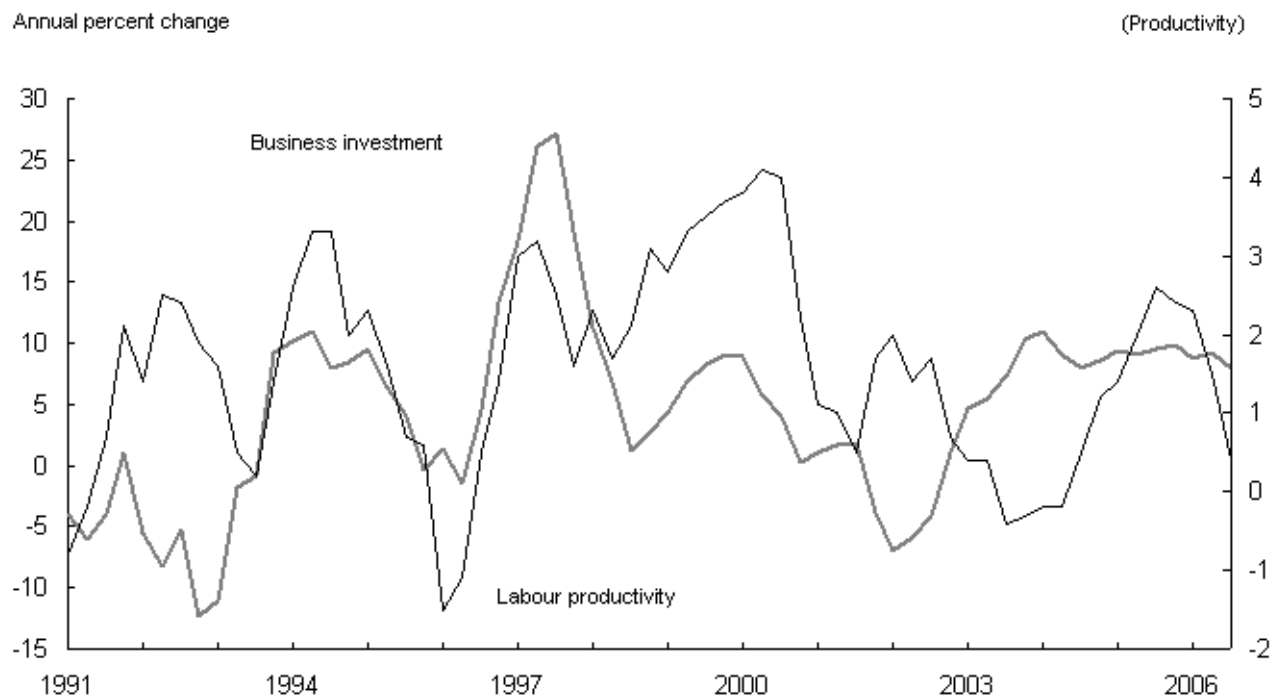
These were concrete signs that employers were reacting to the lower skill level of employees by stepping up training. Detailed employment estimates show employment in business schools and computer and management training institutes rose sharply last year, a marked departure from the previous five years.

Besides hiring less productive workers, employers faced with shortages may change their behaviour in ways that lower productivity. Supply interruptions from other industries or of output can occur due to strikes, bad weather, etc. Employers could be more reluctant to lay off workers temporarily in a tight labour market for fear that these workers will get jobs elsewhere and not return. Similarly, firms may hoard labour in anticipation of large projects coming onstream later (reports say this is already occurring in the oilsands).¹¹

Business investment points to better productivity growth. Fuelled by record high profits, firms have stepped up investment outlays by a steady 10% in each of the last three years. The increased competitive pressure on firms caused by the sharp rise in the exchange rate since 2003 would be a major incentive for firms to spend more. Similar pressures in the U.S. early this decade led to a sharp improvement in productivity.

Figure 11 shows that it is rare for productivity to slump for an extended period when investment is expanding. This is encouraging for a rebound in productivity growth in the short run, holding out some prospect that the current slump will not be as prolonged as in 2002-2003. One factor that may explain the divergence of investment and productivity in 2006 was that so much of investment was driven by the energy sector, where the pay-off in higher output will not materialize until later. Manufacturing, the sector with the largest incentive to invest in productivity-enhancing machinery and equipment, reined in such spending (presumably reflecting the intense pressure on profit margins) after a 10% gain in 2005 helped boost productivity that year.

11. For example, the Long Lake consortium said that Phase 1 of the project was delayed by a 20% shortfall of labour productivity due to worker inexperience. It also said it was moving up work on Phase 2 for fear of losing employees as well as their position in the growing queues for supplies and equipment. See "Nexen project in oil sands on budget and on time: But worker inexperience causes problems" by Dave Ebner, B5, *The Globe and Mail*, April 28, 2006.

Figure 11 Productivity and investment

Conclusion

Several economic and statistical reasons explain why productivity slowed last year. Nationally, growth shifted to industries where productivity declined, notably mining. Many industries, especially in western Canada, are struggling with labour shortages. Employers hired less-skilled labour and spent more time training employees. More generally, the shift of resources between industries, and increasingly regions, implies resources will not be productive during the transition. Finally, more industries were affected by one-time events last year, such as disruptions in the mining sector and a record warm winter that curtailed production.

The major question at the moment is not whether a slowdown in output relative to employment is occurring, but whether this slowdown is transitory due to temporary factors (related to events such as weather, or other production disruptions or the sudden shift of resources to new industries and regions) or represents the beginning of a longer-term slump in productivity due to labour shortages, an ageing labour force or structural changes in the economy. Most of the variables studied in this paper point to transitory factors dominating in the short-term. One exception was labour shortages in western Canada, partly due to the development of the oilsands.

One lesson to retain from 2006 is that large irregular movements are more likely to occur in an economy where natural resources are a growing part of output. Monthly output in mining has the most variability of any sector of the economy. Since this sector employs relatively few workers, contradictory short-term movements in output and employment could easily recur in the future. The best practice in such situations is to not place too much emphasis on short-term movements in productivity, and put them in the context of previous periods of growth when productivity temporarily sagged.

Technical series

The Income and Expenditure Accounts Division Technical Series (13-604) provide background information as well as in depth analysis on data reported in any of the following accounts: Income and Expenditure Accounts, Provincial Economic Accounts, Financial Flow Accounts, National Balance Sheet Accounts, Labour Income and the National Tourism Indicators. A list of the papers currently available is presented below. These papers are available on our website at www.statcan.ca, by contacting us at (613) 951-3810, by email to lead-info-dcrd@statcan.ca or by writing to Client Services, IEAD, Statistics Canada, 21st floor R.H. Coats Building, 100 Tunney's Pasture Driveway, Ottawa, Ontario, K1A 0T6.

1. "Laspeyres, Paasche and Chain Price Indexes in the Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, fourth quarter 1988.
2. "Technical Paper on the Treatment of Grain Production in the Quarterly Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, first quarter 1989.
3. "Data Revisions for the Period 1985-1988 in the National Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, first quarter 1989.
4. "Incorporation in the Income and Expenditure Accounts of a Breakdown of Investment in Machinery and Equipment", reprinted from *National Income and Expenditure Accounts*, third quarter 1989.
5. "New Provincial Estimates of Final Domestic Demand at Constant Prices", reprinted from *National Income and Expenditure Accounts*, fourth quarter 1989.
6. "Real Gross Domestic Product: Sensitivity to the Choice of Base Year", reprinted from *Canadian Economic Observer*, May 1990
7. "Data Revisions for the Period 1986-1989 in the National Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, first quarter 1990.
8. "Volume Indexes in the Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, first quarter 1990.
9. "A New Indicator of Trends in Wage Inflation", reprinted from *Canadian Economic Observer*, September 1989.
10. "Recent Trends in Wages", reprinted from *Perspectives on Labour and Income*, winter 1990.
11. "The Canadian System of National Accounts Vis-à-Vis the U.N. System of National Accounts", reprinted from *National Income and Expenditure Accounts*, third quarter 1990.
12. "The Allocation of Indirect Taxes and Subsidies to Components of Final Expenditure", reprinted from *National Income and Expenditure Accounts*, third quarter 1990.
13. "The Treatment of the GST in the Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, first quarter 1991.
14. "The Introduction of Chain Volume Indexes in the Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, first quarter 1991.
15. "Data Revisions for the Period 1987-1990 in the National Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, second quarter 1991.
16. "Volume Estimates of International Trade in Business Services", reprinted from *National Income and Expenditure Accounts*, third quarter 1991.
17. "The Challenge of Measurement in the National Accounts", reprinted from *National Income and Expenditure Accounts*, fourth quarter 1991.
18. "A Study of the Flow of Consumption Services from the Stock of Consumer Goods", reprinted from *National Income and Expenditure Accounts*, fourth quarter 1991.

19. "The Value of Household Work in Canada, 1986", reprinted from *National Income and Expenditure Accounts*, first quarter 1992.
20. "Data Revisions for the Period 1988-1991 in the National Income and Expenditure Accounts", reprinted from *National Income and Expenditure Accounts*, Annual Estimates, 1980-1991.
21. "Cross-border Shopping - Trends and Measurement Issues", reprinted from *National Income and Expenditure Accounts*, third quarter 1992.
22. "Reading Government Statistics: A User's Guide", reprinted from *Policy Options*, Vol. 14, No. 3, April 1993.
23. "The Timeliness of Quarterly Income and Expenditure Accounts: An International Comparison", reprinted from *National Income and Expenditure Accounts*, first quarter 1993.
24. "National Income and Expenditure Accounts: Revised Estimates for the period from 1989 to 1992", reprinted from *National Income and Expenditure Accounts*, Annual Estimates, 1981-1992.
25. "International Price and Quantity Comparisons: Purchasing Power Parities and Real Expenditures, Canada and the United States", reprinted from *National Income and Expenditure Accounts*, Annual Estimates, 1981-1992.
26. "The Distribution of GDP at Factor Cost by Sector", reprinted from *National income and Expenditure Accounts*, third quarter 1993.
27. "The Value of Household Work in Canada, 1992", reprinted from *National Income and Expenditure Accounts*, fourth quarter 1993.
28. "Assessing the Size of the Underground Economy: The Statistics Canada Perspective", reprinted from *Canadian Economic Observer*, May 1994.
29. "National Income and Expenditure Accounts: Revised Estimates for the period from 1990 to 1993", reprinted from *National Income and Expenditure Accounts*, first quarter 1994.
30. "The Canadian National Accounts Environmental Component: A Status Report", reprinted from *National Income and Expenditure Accounts*, Annual Estimates, 1982-1993.
31. "The Tourism Satellite Account", reprinted from *National income and Expenditure Accounts*, second quarter 1994.
32. "The 1993 International System of National Accounts: Its implementation in Canada", reprinted from *National Income and Expenditure Accounts*, third quarter 1994.
33. "The 1995 Revision of the National Economic and Financial Accounts", reprinted from *National Economic and Financial Accounts*, first quarter 1995.
34. "A Primer on Financial Derivatives", reprinted from *National Economic and Financial Accounts*, first quarter 1995.
35. "The Effect of Rebased on GDP", reprinted from *National Economic and Financial Accounts*, second quarter 1996.
36. "Purchasing Power Parities and Real Expenditures, United States and Canada - An Update to 1998", reprinted from *National Income and Expenditure Accounts*, third quarter 1999.
37. "Capitalization of Software in the National Accounts", *National Income and Expenditure Accounts technical series*, February 2002.
38. "The Provincial and Territorial Tourism Satellite Accounts for Canada, 1996", *National Income and Expenditure Accounts technical series*, April 2002.
39. "Purchasing Power Parities and Real Expenditures, United States and Canada", reprinted from *National Income and Expenditure Accounts*, first quarter 2002.

40. "The Provincial and Territorial Tourism Satellite Accounts for Canada, 1998", *National Income and Expenditure Accounts technical series*, June 2003.
41. "Government revenue attributable to tourism, 1998", *National Income and Expenditure Accounts technical series*, September 2003.
42. "Chain Fisher Index Volume Methodology", *National Income and Expenditure Accounts*, November 2003.
43. "Trends in provincial and territorial economic statistics: 1981-2002", *National Income and Expenditure Accounts*, November 2003.
44. "The 1997-2003 Revisions of the National Tourism Indicators", *National Income and Expenditure Accounts*, October 2004.
45. "A study of data revisions to the National Tourism Indicators", *National Income and Expenditure Accounts*, October 2004.
46. "Provincial and Territorial Economic Accounts", *National Income and Expenditure Accounts*, November 2004.
47. "Revisions to the Canadian National Tourism Indicators", *National Income and Expenditure Accounts*, January 2005.
48. "Canadian Tourism Satellite Accounts, 2000", *National Income and Expenditure Accounts technical series*, October 2005.
49. "Trends in Saving and Net Lending in the National Accounts", reprinted from *National Income and Expenditure Accounts*, third quarter 2005.
50. "Recent Trends in Corporate Finance: Some Evidence from the Canadian System of National Accounts", reprinted from *National Income and Expenditure Accounts*, fourth quarter 2005.
51. "Human Resource Module of the Tourism Satellite Account, 1997-2002".