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- LITERACY AND EMPLOYABILITY
- GDP AND EMPLOYMENT GROWTH

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Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
p	preliminary
r	revised
x	confidential
E	use with caution
F	too unreliable to be published

Highlights

In this issue

Literacy and employability

- The functional literacy scores of both men and women who dropped out of high school were significantly below those of graduates. In addition, dropouts reported a weaker attachment to the labour market and lower average incomes than their more educated counterparts.
- Among both graduates and non-graduates, literacy scores were consistently higher for women than for men in all employment categories.
- Having learning difficulties as a child increased the probability of leaving high school early by 19 percentage points for both sexes. The likelihood of dropping out was also significantly higher for Aboriginal persons—14 points higher for men and 13 for women.
- Having a disability did not directly influence the employability of men who had dropped out of high school, but it had a significantly adverse effect on women in terms of current and full-time employment, as well as the number of weeks worked.
- Among men, increased literacy exerted a strong positive effect on incomes for both graduates and dropouts, while the number of years of education was highly significant for dropouts only. For women, the effect of literacy was significant for graduates but not dropouts, while the return to years of education was highly significant for both.

GDP and employment growth

- Typically, output growth exceeds employment growth by over 1%, reflecting the generally upward trend of productivity. But what happened in 2006 was a slowdown in output and an increase in employment.
- Several transitory factors (such as weather, unusual events, production disruptions) help explain this convergence of growth in output and employment —a phenomenon that is hardly unique to 2006.
- Most of the downturn in output per employee originated in goods-producing industries, almost all of which 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. Mining, oil and gas led this drop, as output grew slowly while employment raced ahead by over 10%, the most of any industry in 2006.
- As well, oil production was hampered by a number of disruptions. But given the shortage of labour in the oil patch, firms kept their workers on the payroll during these interruptions.
- With tight labour markets and shortages, employers had to turn to the youngest and oldest workers—who are the least productive—and spend more time training them. In Alberta, people with no more than high school education accounted for over half of all employment growth in 2006.

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Literacy and employability

Ross Finnie and Ronald Meng

Since the early 1990s, the technology-driven 'knowledge-based' economy has captured the attention and affected the lives of virtually all Canadians. This phenomenon has been of particular interest to researchers and policy makers, not to mention business owners, long-time workers, and students permanently entering the job market following graduation or, more troubling, after dropping out of high school. One concern is how those lacking the technical skills, experience and necessary education—beginning with the three Rs—may be left behind in dead-end jobs as their peers pursue more dependable and lucrative career paths.

While the economic effects of educational attainment have been examined in many studies,[1] the role of literacy and numeracy skills in determining the economic well-being of individuals also provides valuable insights. Previously, most investigations of the relationship between education and labour market outcomes ignored these basic skills, or simply assumed that they were captured in conventional education measures.

But more recent studies[2] have demonstrated that literacy and numeracy skills influence labour market performance and income in specific ways other than educational attainment, which is at best an imperfect proxy for these abilities.[3] In this paper, Statistics Canada's Survey of Literacy Skills Used in Daily Activities (LSUDA) was used, including actual test scores measuring literacy and numeracy as opposed to commonly used self-reported competency levels.[4] The goal is to shed light on the relationship between these skills and various employment outcomes of high school dropouts (see *Data source and methodology*).

Identifying the effects of literacy and numeracy test scores on the employment outcomes of dropouts allows important questions relating to their economic future to be addressed. If early school leavers are confined to 'bad' jobs (low earnings, few or no benefits, reduced working hours) where language and numeracy skills have little or no effect on economic well-being (Doeringer and Piore 1971), then these skills should play only a minor role in explaining employment patterns or incomes. If, alternatively, literacy and numeracy skills have significant effects on these outcomes, the finding would have implications for public policy relating to high school curricula as well as adult education and re-training programs, not to mention researchers in this field.

This article investigates the effects of literacy and numeracy skills—or the lack thereof—on the employability and incomes of high school dropouts, in conjunction with traditional educational attainment measures. Descriptive information is presented on both dropouts and high school graduates,[11] followed by an examination of socio-economic background characteristics deemed to be associated with premature school departure (such as parental education). The dropout population is then analyzed in terms of broad employment characteristics based on a number of binary outcomes, such as whether a person who dropped out had a disability or whether they lived in a particular province. Finally, income functions are estimated for both dropouts and graduates. In all cases, the focus is on cognitive skills measured in terms of literacy and numeracy test scores.

Ross Finnie is with the School of Policy Studies at Queen's University and the Business and Labour Market Analysis Division at Statistics Canada. He can be reached at 613-533-6000, ext. 74219. Ronald Meng is with the Department of Economics at the University of Windsor. He can be reached at 519-253-4232, ext. 2371. Both authors can be reached at perspectives@statcan.ca. *The research paper* The Importance of Functional Literacy: Reading and Math Skills and Labour Market Outcomes of High School Drop-outs *from which this article is adapted is available on the Statistics Canada Web site at http://www.statcan.ca/english/research/11F0019MIE/11F0019MIE2006275.pdf.*

Data source and methodology

This article is based on the October 1989 **Survey of Literacy Skills Used in Daily Activities** (LSUDA). The survey had two components. The first asked about socio-demographic and employment characteristics, family background, and experience related to literacy and numeracy skills (reading, writing and arithmetic). The second asked respondents to perform a series of tasks to directly measure their literacy and numeracy skills (Statistics Canada 1991).

The LSUDA sample was selected from dwellings that had recently participated in the Labour Force Survey, which excludes persons living on Indian reserves, residents of the territories, full-time members of the Armed Forces, and people living in institutions (for example, nursing homes or prisons).

The full LSUDA file consists of a weighted sample of 9,455 respondents aged 16 to 69 in 1989. The analysis was restricted to Canadian-born men and women aged 21 to 54 who were not attending school at the time of the interview—2,318 men and 2,806 women of whom 851 and 872 respectively had left high school before graduating.[5]

The LSUDA measures of literacy and numeracy are based on item response theory.[6] The resulting measures are continuous variables ranging from 0 to 500. Individuals with a literacy score below 160 have difficulty dealing with any printed material, that is, they are fundamentally illiterate. Those with a numeracy score below 200 "have very limited numeracy abilities which enable them to, at most, locate and recognize numbers in isolation or in a short text" (Statistics Canada 1991, 19); in other words, they are effectively innumerate. Unfortunately, reading and numeracy are so closely related[7] that it is often difficult to separate the independent effects of each on employment, income, and other labour market indicators.[8]

To deal with this problem, some researchers have used only literacy in their analyses (Rivera-Batiz, 1990a, 1990b), others have used only numeracy (Rivera-Batiz, 1992), while still others have used both. However, taking the simple average of the two variables yields the best results and is easier to interpret in a context where it is difficult to identify their separate effects (Charette and Meng 1998; Pryor and Schaffer 1999; Green and Riddell 2001). In this article, the literacy and numeracy scores have been averaged to form one composite variable called **functional literacy**, a term initiated by Pryor and Schaffer.

The variables used in the analysis can be grouped into three categories. The first deals with employment and income—whether the respondent was employed at the time of the survey or at any time within the past 12 months, whether the employment was mostly full-time (30 hours or more per week), number of weeks worked in the last year, and the logarithm of income.

The second group of variables provides measures of socio-economic background—mother's and father's years of education, whether the parents were immigrants, province of birth, Aboriginal status, first spoken language,[9] presence of a disability,[10] and any learning difficulty as a child.

The third group captures demographic characteristics and circumstances at the time of the survey—age, years of education, province of residence, city size, the first (or preferred) language used in adulthood, marital status, and presence of at least one child.

A probit model was used to calculate the probabilities of dropping out of school, depending on the binary outcomes of some of the explanatory variables above. Estimates based on a two-stage probit-OLS (ordinary least squares) procedure were also calculated to establish the positive or negative impacts of selected variables on employment outcomes.

Graduates have higher functional literacy

As expected, the functional literacy scores of both men and women who dropped out of high school were significantly below those of graduates (Table 1).[12] In addition, dropouts reported a weaker attachment to the labour market and lower average incomes than their more educated counterparts.

The parents of high school graduates tended to be more educated than those whose offspring had dropped out, the differences varying from 2.4 to 2.9 additional years of schooling. The children of immigrants stayed in school longer than those of native-born Canadians. Higher-than-expected proportions of dropouts were born in the Atlantic provinces and Quebec (particularly women in this province), were Aboriginal persons, spoke French in childhood, reported a disability, and had experienced learning difficulties in childhood.

In terms of demographic characteristics and circumstances, male dropouts were 4.5 years older, on average, than those who had graduated; female dropouts were almost five years older. Male and female dropouts tended to have five years less education, and a disproportionately high number lived in the Atlantic provinces. Disproportionately high numbers of female dropouts were also found in Quebec and Ontario. Dropouts were much more likely to be living in small cities and towns with a population under 30,000 and in rural areas. They were also more likely to speak French as adults, be married, and have children.

Table 1 Characteristics of high school dropouts and graduates

	Men		Women	
	Dropouts	Graduates[1]	Dropouts	Graduates[1]
Functional literacy scores[2]	238.8	271.3	236.4	275.3
Age[2]	38.1	33.6	38.3	33.5
Years of education[2]	9.3	14.4	9.3	14.4
Number of weeks worked in the past 12 months	41.5	47.1	26.4	38.8
Log of income[2]	10.08	10.27	9.20	9.73
Mother's years of education	7.9	10.5	8.1	10.5
Father's years of education	7.6	10.5	7.6	10.3
			%	
Employed, October 1989	82	92	50	77
Employed at any time in the past 12 months	91	97	63	87
Mostly full time[3]	88	91	44	66
Immigrant mother	9	14	11	15
Immigrant father	10	15	11	16
Born in				
Atlantic	16	10	15	12
Quebec	32	31	40	30
Ontario	30	35	25	30
Prairies	17	18	18	19
British Columbia	5	6	3	9
Aboriginal persons[2]	5	2	6	3
Language spoken as a child				
English	58	64	54	66
French	37	30	43	29
Other	4	6	3	6
With a disability[2]	12	6	12	7
Learning difficulties as a child	17	10	16	9
Province of residence[2]				
Atlantic	12	8	11	10
Quebec	29	29	31	27
Ontario	35	36	36	32
Prairies	15	18	16	19
British Columbia	9	9	6	12
City size[2]				
100,000 or more	40	63	49	62
30,000 to 99,999	11	11	9	11
Under 30,000[4]	49	26	42	27
First language as an adult[2]				
English	68	73	67	73
French or other	32	27	33	27
Married[2]	73	66	76	69
With at least one child[2]	58	50	65	55

1 Includes those with postsecondary education.
2 Averages used in the income equations.
3 During periods of employment.
4 Includes rural areas.
Source: Survey of Literacy Skills Used in Daily Activities, 1989

The average functional literacy scores of men and women were calculated according to various employment characteristics (Table 2). The differences between the scores are striking, not only between male and female graduates and non-graduates, but also between those in and out of the labour force. For example, among men who worked mostly full time (when employed) in the 12 months preceding the survey, the test score difference between graduates and non-graduates was 29.4; the corresponding difference among women was 30.5. Yet as poor as the scores were for dropouts with jobs, they were significantly higher than the scores for those not in the labour force.[13] Among both graduates and non-graduates, literacy scores were consistently higher for women than for men in all employment categories.

The odds of dropping out

A probit model was used to calculate the probabilities of dropping out of school depending on various explanatory variables (Table 3).[14] As a result of cohort effects, age is positively associated with the probability of dropping out of school, since all those leaving school did so when relatively young. For every additional year of age, the probability of leaving school early is almost 1 percentage point higher for men, while for women it is 0.77 of a point higher (the marginal effect[15]).

Interestingly, the province of birth effects for men are not as significant as the raw data suggest—except for those born in Quebec, who are significantly less likely to have dropped out than those born in the Atlantic provinces (the omitted category).[16] Among women, place of birth is much more important, with those born in Quebec, the Prairie provinces, and British Columbia having significantly lower probabilities of dropping out than those born in Atlantic Canada.

Having experienced learning difficulties as a child increased the probability of leaving school early

Table 2 Functional literacy scores and employment characteristics

	Men			Women		
	Total	Dropouts	Graduates[1]	Total	Dropouts	Graduates[1]
Employed, October 1989	261.9	244.7	271.8	267.5	247.2	276.6
Employed at any time in the past 12 months	261.0	242.3	271.8	266.6	244.6	276.5
Mostly full time[2]	261.8	243.2	272.6	266.3	245.3	275.8
Not in the labour force	219.4	203.5	253.9	242.3	222.4	267.3

1 Includes those with postsecondary education.
2 During periods of employment.
Source: Survey of Literacy Skills Used in Daily Activities, 1989

by 19 percentage points for both men and women. Aboriginal persons also had a notably higher dropout rate (14 points for men and 13 points for women).

Parental education exerted a strong influence on a child's educational attainment. A 2.5-year increase in a mother's and father's education[17] reduced the odds of dropping out by about 15 points for both men and women.[18] While the evidence is not overwhelming, mothers appear to have a greater impact on a daughter's educational attainment than a son's, while fathers have a greater impact on a son's. A similar parent-child influence is seen in the significant impact an immigrant mother has on a daughter's chances of dropping out of school (a 12% probability reduction).[19]

Factors affecting employment among dropouts

Among high school dropouts of both sexes, functional literacy had a significant, positive impact on being employed at the time of the survey, having been employed at any time in the previous 12 months, and having worked mostly full time when employed (Table 4).[20] In contrast, the formal education variable (years of education) was not at all significant for male dropouts and significant only for female dropouts who worked mostly full time. For men, a one-standard-deviation increase in the functional literacy score increased the probability of the outcomes

Table 3 Probit model determinants of dropping out of school

	Men		Women	
	Coefficients	Marginal effects[1]	Coefficients	Marginal effects[1]
		%-point change		%-point change
Age	0.027	0.95***	0.024	0.77***
Born in				
Quebec	-0.224	-7.86**	-0.224	-7.27**
Ontario	-0.072	-2.54	-0.074	-2.38
Prairies	-0.031	-1.10	-0.151	-4.89*
British Columbia	-0.035	-1.22	-0.359	-11.63***
With a disability	0.075	2.62	0.096	3.11
Learning difficulties as a child	0.531	18.63***	0.591	19.12***
Mother's years of education	-0.080	-2.81***	-0.105	-3.41***
Father's years of education	-0.091	-3.20***	-0.088	-2.84***
Immigrant mother	-0.125	-4.39	-0.369	-11.96***
Immigrant father	-0.122	-4.30	-0.015	-0.48
Aboriginal persons	0.409	14.36**	0.406	13.14***
Language spoken as a child				
English	-0.135	-4.75	-0.165	-5.36*
French or other	0.125	-4.39	-0.023	-0.74
Constant	0.328	...	0.604	...

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.
1 See Note 15.
Source: Survey of Literacy Skills Used in Daily Activities, 1989

Table 4 Determinants of selected employment characteristics of dropouts

	Men			Women		
	Employed, October 1989	Employed at any time in the past 12 months	Mostly full time[1]	Employed, October 1989	Employed at any time in the past 12 months	Mostly full time[1]
Functional literacy scores	0.004***	0.006***	0.005***	0.006***	0.005***	0.004***
Age	0.247***	0.159**	0.125**	0.011	-0.007	0.000
Years of education	0.032	-0.027	0.007	0.016	0.038	0.083**
With a disability	0.153	-0.005	0.050	-0.472***	-0.713	-0.546***
Aboriginal persons	-0.262	-0.031	-0.104	-0.024	-0.017	-0.439**
Province of residence						
Atlantic	-0.354*	-0.103	-0.130	-0.686***	-0.312*	0.077
Quebec	-0.463*	-0.261	-0.316	-0.712***	-0.495**	-0.285
Prairies	0.138	-0.027	-0.241	-0.342**	-0.088	-0.024
British Columbia	0.299	-0.031	-0.215	-1.136***	-0.889***	-0.476**
City size						
100,000 or more	-0.235*	-0.494**	-0.202	0.248**	-0.062	0.022
30,000 to 99,999	-0.013	-0.189	-0.042	0.271	-0.055	-0.216
First language as an adult: English	-0.424*	-0.275	-0.246	0.068	0.117	0.048
Married	0.352**	0.651***	0.264*	0.350***	0.357***	0.160
With at least one child	-0.072	-0.316*	-0.005	-0.214*	-0.231*	-0.467***
Constant	-5.330***	-2.708*	-2.488*	-1.638	-0.740	-0.908
ρ	0.651***	0.681***	0.641***	0.026	-0.081	-0.333**

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.
1 During periods of employment.
Source: Survey of Literacy Skills Used in Daily Activities, 1989

between 1.4 and 4.3 percentage points. For women, the effects were all substantially greater, from 8.6 to 10.4 points (data not shown).

The parameter estimates for the other explanatory variables indicate further differences between men and women. The relationship between age and employment was non-linear for men, peaking at 37.8 years for those working at the time of the survey, 38.3 years for those working mostly full time in the 12 months preceding the survey, and 44.8 years for those who had been employed at any time in that period (data not shown). In the case of women, however, no clear age–employment relationship was seen.

Having a disability did not directly influence the employability of men who had dropped out of high school, but it had a significant, adverse effect on women in terms of current or full-time employment. In general, the employment patterns of Aboriginal persons were not significantly different from their non-Aboriginal counterparts once the other variables in the models were taken into account.[21] However, a strong negative association between Aboriginal women and full-time work was evident. The province of residence was in many cases significant for women, but rarely so for men. While marriage had a positive impact on both sexes, the presence of children had a significant, negative impact on full-time employment for women.

As expected, literacy significantly increased the number of weeks worked for both sexes. Years of education also had a positive effect, but this finding was significant for men only (Table 5).[22]

The other independent variables generally behaved as noted earlier. Age positively affected the number of weeks worked by men but not women, while having

Table 5 Determinants of weeks worked by dropouts

	Men	Women
Functional literacy scores	0.055***	0.091***
Age	2.290***	0.277
Years of education	0.877**	0.920
With a disability	0.053	-10.393***
Aboriginal persons	-7.762***	-7.463**
Province of residence		
Atlantic	-8.709***	-15.686***
Quebec	-4.332	-8.365**
Prairies	1.870	-1.877
British Columbia	0.207	-18.498***
City size		
100,000 or more	-2.295*	2.607
30,000 to 99,999	0.460	1.462
First language as an adult:		
English	-4.448	1.746
Married	6.416***	5.706***
With at least one child	-0.768	-4.188**
λ (inverse Mill's ratio adjustment)	7.444***	-4.186*
Constant	-27.826**	-0.546
F	11.4	11.5

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.
Source: Survey of Literacy Skills Used in Daily Activities, 1989

a disability strongly reduced them for women but not men. Aboriginal persons of both sexes reported significantly reduced weeks of employment, as did people living in the Atlantic provinces; however, living in British Columbia had a negative impact only for women. Finally, marriage had a strong positive association with weeks worked for both men and women, while the presence of children reduced the number of weeks worked for women only.

Income of dropouts

Among men, increased literacy exerted a strong positive effect on incomes for both graduates and dropouts (Table 6).[23] Interestingly, the number of years of education was highly significant for male dropouts only, which may reflect a somewhat diminishing marginal economic return to education and a strong correlation between functional literacy and education for school leavers (reducing the statistical significance of both measures).[24] For women, the effect of literacy was significant for graduates but not dropouts, while the return to years of education was highly significant for both. The remaining variables included in the models generally behave as expected, although the flatter age–income profiles seen for dropouts is of particular interest.

For graduates, in three of the four income regressions, the Aboriginal variable is positive and significant, albeit only at the 10% level. This finding suggests that while Aboriginal persons have significantly higher dropout rates than the rest of the population, their employment and income patterns are not much different once the observables controlled for in the models are taken into account.[25]

Conclusion

Literacy and numeracy skills undoubtedly contribute to economic and social well-being. It is, however, unclear whether this holds for everybody, including those at the bottom end of the labour market, or only those with higher levels of education, who are more likely to be plugged into today's knowledge economy. The findings in this study suggest that among high school dropouts, who tend to have much lower functional literacy scores than their graduate counterparts, enhanced literacy and numeracy skills can significantly improve labour market outcomes—independently of the impact of formal education. Indeed, in some cases, the effects of functional literacy appear to be substantially greater than the number of years of education.

A study of literacy rates in 21 countries, including the United States, the United Kingdom and many European countries, found that Canadians in the top 25% of the literacy scale had overall scores well above many industrialized countries; however, the scores for the bottom 25% compared poorly with the lowest scores of other countries. Moreover, Canadians ranked 15th in literacy inequality (Tuijnman 2001).[26] Nevertheless, this article illustrates that although the literacy scores of Canadian high school dropouts are low compared with more educated Canadians or persons living in a selection of other countries, the acquisition of higher skill levels can have significant effects on their labour market success.

A trend to overqualification has been noted in the case of many North American jobs in recent years (Pryor and Schaffer 1999, among others). University graduates are often found doing work that high school graduates could do, while the latter are starting to per-

Table 6 Determinants of income

	Men				Women			
	Dropouts		Graduates[1]		Dropouts		Graduates[1]	
Functional literacy scores	0.002***	0.002***	0.001***	0.001**	-0.001	0.000	0.002***	0.002***
Age	0.037*	0.058***	0.143***	0.144***	0.057*	0.039	0.121***	0.123***
Years of education	0.075***	0.058***	0.024*	0.012	0.129***	0.098***	0.106***	0.103***
With a disability	-0.094	-0.053	-0.097*	-0.060	0.130	-0.126	-0.033	-0.021
Aboriginal persons	-0.103	0.037	0.098	0.198*	-0.073	-0.129	0.199*	0.217*
Province of residence								
Atlantic	-0.050	-0.032	-0.200***	-0.175***	-0.139	-0.178	-0.174**	-0.168**
Quebec	0.079	0.021	0.002	-0.011	0.141	0.042	-0.131	-0.135
Prairies	-0.076	-0.101	-0.152***	-0.155***	0.064	0.064	-0.158***	0.158***
British Columbia	0.069	0.054	-0.127***	-0.142***	0.062	0.074	-0.142**	-0.148**
City size								
100,000 or more	0.083*	0.071	0.130***	0.123***	0.248***	0.284***	0.192***	0.189***
30,000 to 99,999	0.112	0.082	0.044	0.047	0.023	0.065	-0.016	-0.017
First language as an adult:								
English	0.077	0.050	0.117*	0.094	0.067	0.055	0.040	0.027
Married	0.048	0.074	0.333***	0.331***	-0.338***	-0.285***	0.007	0.008
With at least one child	0.156***	0.134***	-0.073**	-0.070**	-0.158*	-0.184**	-0.256***	-0.256***
λ_1 (see note)	-0.111	...	0.011	...	-0.226	...	0.002	...
λ_2 (see note)	...	0.300***	...	-0.215***	...	-0.368***	...	-0.067
Constant	7.571***	6.928***	6.447***	6.681***	7.456***	8.161***	5.276***	5.347***
F	13.7	14.9	44.1	45.1	4.7	5.3	20.3	20.4

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.
1 Includes those with postsecondary education.
Note: Two different sets of variables were used for selecting persons who were employed at any time in the past 12 months. The first set consists of the explanatory variables listed in Table 4, as well as the years of education of both parents and whether they are immigrants (λ_1). The second set of explanatory variables is listed in Table 3 (λ_2).
Source: Survey of Literacy Skills Used in Daily Activities, 1989

form jobs previously held by dropouts. The results of this paper, however, suggest that those at the bottom end of the economic ladder are not completely trapped in a secondary labour market with few available options. Indeed, skills matter, and helping individuals increase their literacy and numeracy capabilities could be important for improving their labour market opportunities.

Perspectives

Notes

1 See Card (1999) for a review of the literature.

2 See Rivera-Batiz (1990a, 1990b, 1992); Charette and Meng (1994, 1998); Murnane, Willett and Levy (1995); Pryor and Schaffer (1999); Green and Riddell (2001); and Finnie and Meng (2001, 2002b, 2005).

3 In virtually all the studies cited here, the inclusion of literacy or numeracy measures reduces the magnitude of the effects and statistical significance of the education variables in conventional human capital earnings models. That said, education is clearly related to literacy and numeracy skills in a causal fashion, but the full set of relationships has not been investigated to any degree (Finnie and Meng 2002a).

4 See Finnie and Meng (2005) on the comparison of test scores versus self-reported skill levels and their effects in employment and income models.

5 Immigrants were excluded from the analysis because the relationships between literacy, numeracy, education, and labour market outcomes are different for them than for native-born Canadians (Finnie and Meng 2002b). Older individuals (55 to 69) were excluded to avoid issues related to pre-retirement. Persons born in one of the territories but living in a province at the time of the survey were also omitted.

6 Item response theory (IRT) is an iterative statistical procedure used to summarize the pattern of answers on a test in a manner that accounts for task difficulty, tasks not attempted, guesses and random errors. IRT calculates an estimate of each task's difficulty and an estimate of an individual's ability to solve it using the same numerical scale, commonly ranging from 0 to 500 (Statistics Canada 1991).

7 The sample correlation between literacy and numeracy for both men and women in this study is 0.77.

8 Apart from people who are illiterate also tending to be innumerate, the numeracy questions in the LSUDA were embedded in a subset of reading tasks to simulate ways arithmetic is used on a daily basis. This means that a respondent had to first understand the written instructions in a question before attempting to perform the required arithmetic.

9 Very few adults (about 0.6% of the population) claim a first (or preferred) language other than English or French. For simplicity, those reporting speaking other languages as children were included with the French language group.

10 Although the presence or absence of a disability is treated as a background variable, no information is available on when a disability occurred—at birth, in childhood, or later in life.

11 High school graduates also include those who continued their schooling at a university, college or other postsecondary institution.

12 Difference-in-means tests for the functional literacy scores yield t-statistics of 17.8 for men and 23.2 for women, both of which are significant at the 1% level.

13 As Pryor and Schaffer (1999) conclude when looking at somewhat similar U.S. results: "[the functional literacy averages] hardly seem consistent with active participation in the heralded 'information age' " (p. 23).

14 White's technique was used to control for heteroskedasticity.

15 Marginal effects indicate how much a given unit rise in a particular variable will increase or decrease the probability of an event occurring.

16 This indicates that province is correlated with other explanatory variables included in the models.

17 This is roughly equal to the differences in mean parental education levels seen in Table 1 for both graduates and non-graduates.

18 This was calculated by adding the marginal effects associated with both parents' years of education and multiplying the total by 2.5. For example, the calculation for men was as follows: [(-2.81) + (-3.20)] x 2.5 = -15.0%.

19 Several interaction variables were added to capture additional cohort and other cross effects: age x parent's education, mother's years of education x father's years of education, and age squared. None of the estimated coefficients were statistically significant.

20 To control for the joint circumstances of dropping out of school and having been employed, a two-stage procedure was carried out, which first involved estimating a bivariate probit that jointly determined the probability of dropping out of school (i.e., DROP = 1) with each of the binary variables examined. The determinants of dropping out are the variables listed in Table 3, while the determinants of each of the other outcomes are shown in Table 4. The resulting sample selection term was then included in the non-linear OLS dropout models. This approach is similar to that developed by Abowd and Farber (1982). Table 4 indicates that for men the estimates for the adjustment term (ρ) are highly significant, while for women the variable is significant in just one of the three equations (Greene 1990, 692).

21 Aboriginal persons tend to have lower levels of education and functional literacy. And those living on Indian reserves or in the territories were not included in this study.

22 Evaluated at the sample means, the elasticity of weeks worked with respect to literacy scores and years of education is 0.31 and 0.19 respectively for men, and 0.81 and 0.31 for women. These elasticities are quite high for women, and functional literacy has a greater impact on their labour supply than men's. Rivera-Batiz (1992) reports similar results in his study on the effects of quantitative literacy (numeracy) on the labour supply of men and women.

23 Total income includes earnings (income from employment), pension income, transfer payments, investment income, and other income. Although it may have been preferable to use earnings or wage rates in these calculations, the LSUDA database does not contain this information. Moreover, since earnings constitute the greatest part of income, particularly among working-age individuals, and similar analytical results are obtained using earnings or income, the latter was deemed to produce good results for the purposes of this study.

24 Adding a 'squared years of education' term generally drove both the linear and quadratic terms to non-significance, so the simpler linear measure was retained. Larger sample sizes might allow these effects to be better delineated.

25 It should be remembered that data were not collected for persons living on Indian reserves or in the territories.

26 Inequality was measured in terms of the variance in the distribution of literacy scores.

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GDP and employment growth

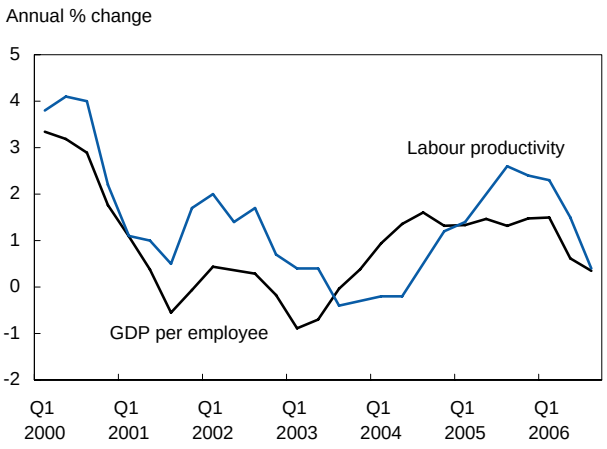
Philip Cross

A major economic development in 2006 was a slowdown in output growth but continued steady gains in employment. Over the long term, output growth 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.

Output per employee and labour productivity are often treated as interchangeable concepts. However, the two have differences that can cause these series to diverge at times (Chart A). Most importantly, official labour productivity covers 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 per employee. Hours worked are affected by changes in multiple jobholding, the mix of full- 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 come from the Labour Force Survey (LFS), while total output is aggregate real GDP, including both the business and non-business sectors.

The paper focuses on factors that contributed to the slowdown of both output per employee and productivity in 2006. Over the long run, productivity growth depends on population 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.

Chart A Output per employee and productivity can diverge at times



Sources: Statistics Canada, Labour Force Survey; Income and Expenditure Accounts

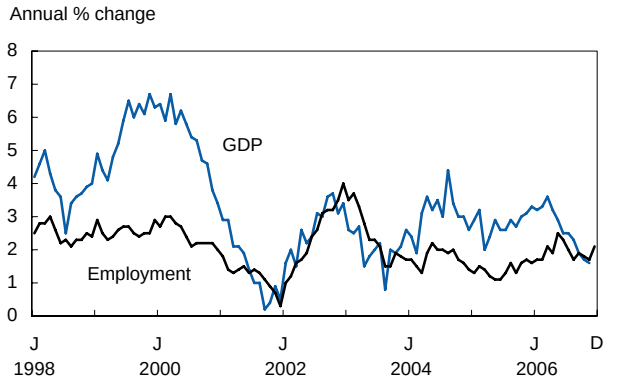
The cyclical setting

Output growth often slows relative to employment growth for short intervals during recessionary periods as firms hoard some labour while cutting output. As recently as 2002 and 2003, output growth fell further below job growth and for a longer period than in 2006.

In fact, a narrowing of the gap has been the rule, not the exception, ever since the economy began to recover from a stall late in 2001 (Chart B). Year-over-year growth in output per employee was below 1% in

Philip Cross is with the Current Economic Analysis Division. He can be reached at 613-951-9162 or perspectives@statcan.ca. *The research paper* Recent Trends in Output and Employment *from which this article is adapted is available on the Statistics Canada Web site at http://www.statcan.ca/english/research/13-604-MIE/13-604-MIE2007054.pdf.*

Chart B The gap between employment and GDP changes often narrows



Sources: Statistics Canada, Income and Expenditure Accounts

44 of the last 69 months, and negative for 16 of the 26 months between July 2001 and August 2003. Output growth struggled to keep up with employment growth most 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 output and employment late in 2006 is hardly new.

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 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 underutilized resources are put back to work. The situation in 2006 was the opposite. An economy operating at almost full employment, especially in Western Canada where growth was concentrated, would be more likely to show weak productivity growth.

Many transitory factors 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 growth.

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 faced the beginning of a sharp appreciation in the exchange rate. The sluggishness of productivity was widespread in manufacturing in 2003, just as it was in 2006.

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 they did not cut their staff to the degree warranted by demand (called labour hoarding).

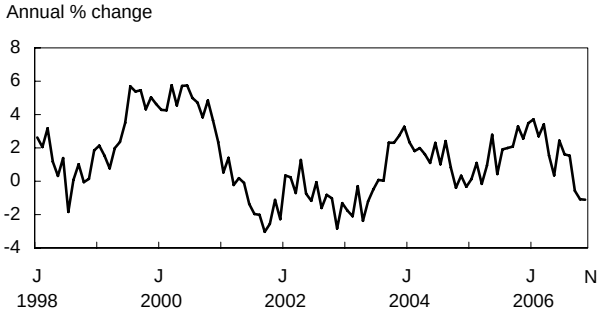
Nor is it unusual for Organisation for Economic Co-operation and Development (OECD) countries to experience two (or more) years of little productivity growth. Just since 2000, 10 of the 29 OECD countries with data available experienced such an episode. Interestingly, Norway and Australia are both currently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

Some of the attention paid to the slowdown of output per employee late in 2006 may be due to concerns about a repeat of the 2002–2003 episode, which lasted two years. But the 2006 episode could also be transitory, with productivity growth quickly resuming as in 1998. Analyzing the 2006 trend in productivity by industry is the first step in understanding the reasons behind the slowdown.

Industry trends

Most of the 2006 downturn in output per employee originated in goods-producing industries (Chart C), 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.

Chart C The 2006 downturn in output per employee was driven by goods production



Sources: Statistics Canada, Labour Force Survey; Income and Expenditure Accounts

Last year's drop in productivity in mining, oil and gas was part of a long-term downward trend. The declining productivity of conventional wells and the shift to lower-productivity output from the oil sands is reflected in a 28% drop in labour productivity in the industry since its peak in 1999 (Chart E). Most of this reflects a 60% hike in employment in the oil and gas sector, almost all in Alberta. The employment increase was led by the oil sands, which hired thousands of workers on megaprojects that will not begin producing oil for years. These employees are involved in logistics, management and recruiting; those actually building the plant are classified in construction.

Events specific to the last two years aggravated this long-term downward trend. Oil sands 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

Within the goods-producing sector, almost all industries posted lower productivity during the first three quarters of 2006 (Table). Output per hour worked declined by nearly 10% in the resource sector, shaving a full 1% from overall productivity growth (Chart D). Mining and oil and gas extraction led this drop, as output grew slowly and employment raced ahead by over 10%, the most of any industry.

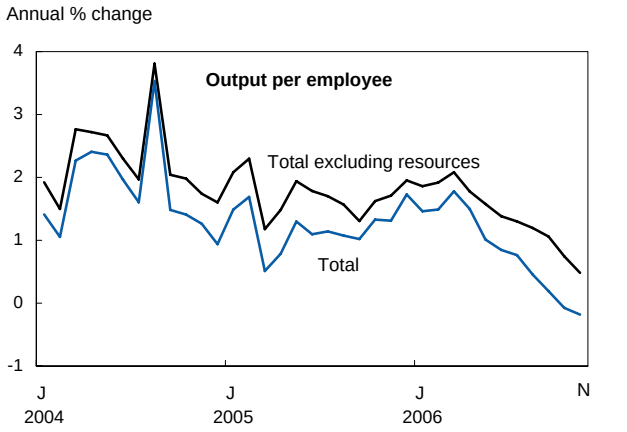
In recent years, the productivity of new discoveries of conventional oil and gas has fallen as the industry moved from easy-to-exploit fields in the west to less-productive sources.[2] Output in non-conventional oil projects, for example, now accounts for nearly half of the oil produced in Canada. And, as output from non-conventional sources has risen, output per employee in oil and gas has fallen sharply.

Table Labour productivity by industry

	2005				2006		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	Year over year growth						
Goods	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	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 culture	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	1.8	2.1	1.5	1.0	0.8	0.7	-0.3
Business, building and other support 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	-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

Sources: Statistics Canada, Income and Expenditure Accounts; Labour Productivity Measures

Chart D The resource sector cut overall productivity growth



Sources: Statistics Canada, Labour Force Survey; Industry Measures and Analysis

boost oil sands output in 2006. Because productivity in the oil sands is less than 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). As the oil sands gears up production, output per employee will increase, even if the level is not as high as from conventional fields. More generally, the extraction of oil from the oil sands will likely become more efficient over time.

This situation 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 a drop in overall productivity.

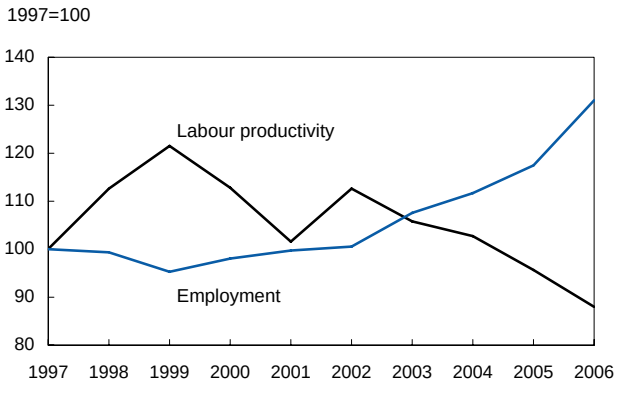
As well, oil production last year was hampered by a number of disruptions. These included accidents at the Hibernia and Terra Nova platforms offshore from Newfoundland where productivity is relatively high, costing months of production. Understandably, given the shortage of labour in the oil patch, firms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

Mining outside of oil and gas is 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. Some of the drop in productivity in metal mines reflects the exhaustion of the most productive sources, just as with conventional oil and gas. The most obvious example is gold mining, where annual output has fallen steadily since 2001.

Several of the largest mining industries experienced production difficulties in 2006 as strikes reduced output of nickel and copper in the fall. Since the LFS counts strikers as still employed, output per employee is lowered. (Hours worked reflects the strike absences, so labour input in the productivity measures is not affected.) Potash output was curtailed during protracted contract negotiations with buyers in China.[3] Work stopped on the world's largest uranium project at Cigar Lake in October because of flooding, delaying sales for years (Hoffman 2007). 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.

Chart E The drop in mining productivity reflects sharp employment growth



Sources: Statistics Canada, Survey of Employment, Payrolls and Hours; Income and Expenditure Accounts

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 since they had no way of knowing when demand would jump (as the recent bout of cold weather illustrated).

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.

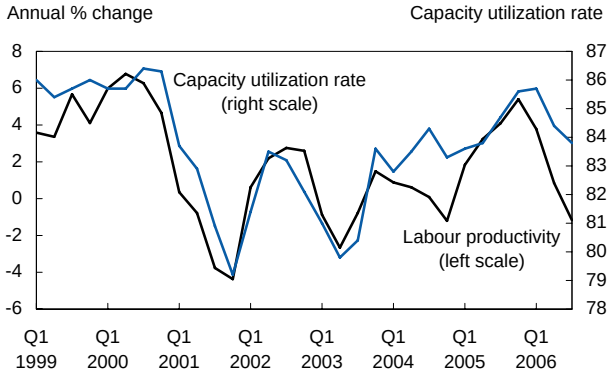
Forestry experienced one of the largest swings in the growth of output per worker between 2005 and 2006, from double-digit increases to double-digit declines. The rapid increase in 2005 reflected the consolidation of output in large, more efficient mills in B.C. and the ramping-up of output as the U.S. housing market peaked. The severe slump in U.S. housing demand last year depressed output. This was 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 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, recovering slightly at year-end, and productivity typically falters during contractions (Chart F). 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 rose 1.9% and 0.7% respectively. When factory output fell in 2001 and 2002, manufacturers saw productivity also retreat.

Chart F The downturn in manufacturing productivity reflects a slump in output



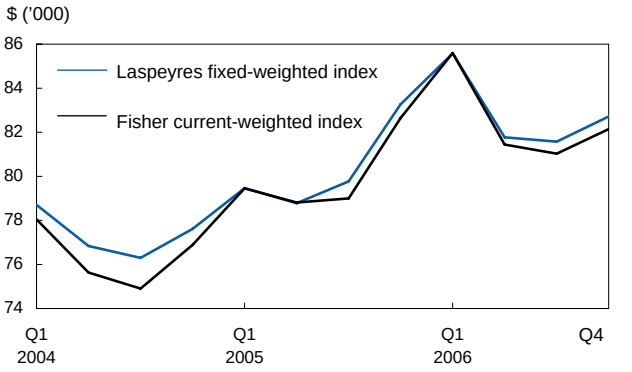
Sources: Statistics Canada, Income and Expenditure Accounts; Labour Productivity Measures

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 industries such as textiles, clothing, furniture and even autos. Meanwhile, growth continued in high-productivity and capital-intensive industries such as petroleum refining. Surely this should have boosted overall productivity?

A statistical test of the 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. Almost no difference from the Fisher current-weighted index currently used was seen (Chart G). This surprising result arises 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.

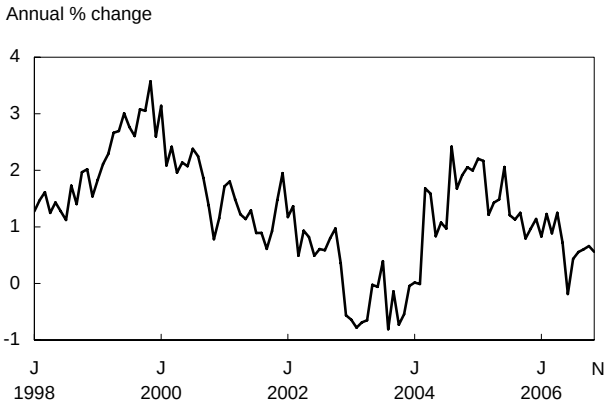
These results are consistent with past research showing that inter-industry shifts do not have a large impact on overall productivity growth in the short term. Productivity ultimately depends on actual gains within specific industries, not shifts between industries with

Chart G Shifts in manufacturing employment had little impact on overall productivity



Sources: Statistics Canada, Income and Expenditure Accounts; Labour Productivity Measures

Chart H Output per employee in services continued to grow at its long-term average



Sources: Statistics Canada, Labour Force Survey; Income and Expenditure Accounts

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 a natural inclination to temporarily relax close scrutiny of costs when presented with sudden great wealth, such as occurred in metals and petroleum.[4]

Services

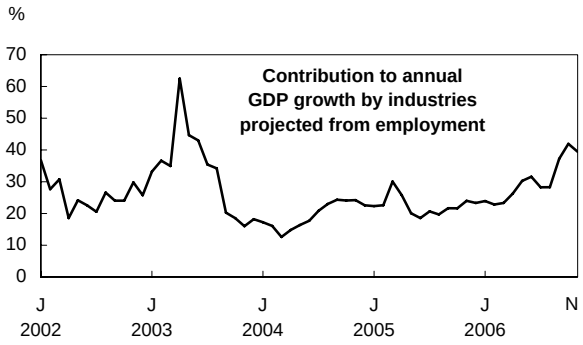
Overall, output per employee in services escaped the large deceleration recorded for goods, continuing to grow at about its long-term average, and well above the SARS-induced slump in 2003 (Chart H). Several industries posted solid gains, notably consumer-related industries, which benefited from strong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

Nearly 40% of monthly GDP growth in services is estimated using employment. For most, largely in the public sector, this is due to the conceptual difficulty in measuring output. Since no market price exists for the output of these services, Canada follows the same accounting practice as the U.S. 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. While the non-business sector is excluded from the official measure of labour productivity, 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 for output growth. As of November, year-over-year growth in these industries was 2.1%, compared with 1.3% in the rest of the economy. This is a reversal from both 2004 and 2005 when they grew at only half the rate of other services. Such industries accounted for about 40% of the year-over-year growth of total GDP by the end of 2006, doubling their contribution at the start of the year (Chart I). This reflects both increased activity in these industries and slower GDP growth in other industries.

The increase of nearly 20 points in the share of GDP growth occurring in these industries reduced overall output per employee by 0.1 points during 2006. The expansion 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.

Chart I Output growth in 2006 heavily concentrated where GDP projected from employment



Source: Statistics Canada, Income and Expenditure Accounts

Output in some business services is also projected using employment growth. This is most common for industries with no other source of monthly data, such as professional, scientific and technical services.[5] These industries grew faster than the rest of the economy. However, because they are a fraction the size of 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 hit 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.

Some services saw 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 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 airline industry (after severe losses due to September 11th and SARS) and the boom in shipping commodities and containers by rail and water (especially to and from Asia).

The calculation of industry output per employee is sometimes 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 no employment is involved, productivity is undefined (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 has been driven by labour income, up 5.3% in 2006, boosted by the strong gains in employment. This strength was captured by 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 jobholders 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.

If the slowdown in labour productivity in 2006 is a real and pervasive phenomenon, what broad economic factors could explain it? The most obvious place to look first is the cyclical state of the 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 as 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 less productive workers. 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. Employment rose faster last year for the youngest and oldest segments of the population—the least productive. For the young, below-average productivity reflects less experience and training; for older workers, the issues are eroding skills, a new career and less attachment to the labour force.[6] While neither trend was new last year, their growth accelerated sharply.

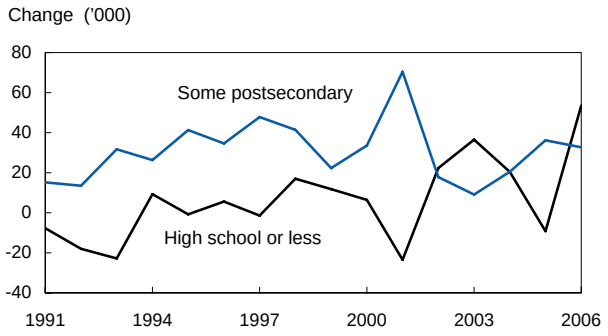
Nationwide, employment rose faster for people 55 and older (6.7%) and youths (1.5%) than for prime-aged workers (1.4%). As a result of increased demand, the unemployment rate for youths hit a record low of 9.7% by last December, and both the employment and labour force participation rates of people 55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

Shortages induced employers in Alberta and B.C. to turn most to the youngest and oldest. In Alberta, the increase was most pronounced for youths, where jobs rose 5.6%, boosting their employment rate from 64.1% to 65.3% between December 2005 and 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 for 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 distinct change from the 1990s when employers showed a marked preference for people with more than high school education (Chart J). B.C. saw a similar but less pronounced shift. Still, the Business Council of British Columbia felt that the shortages were severe enough to lower its forecast for GDP growth in 2007 (Finlayson 2007).

The decline in the education level of workers was symptomatic of the tightness of the labour market, not a deterioration in the quality of jobs 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).

Chart J In Alberta, persons with no more than high school education led employment growth in 2006



Source: Statistics Canada, Labour Force Survey

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

However, employers reacted 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.

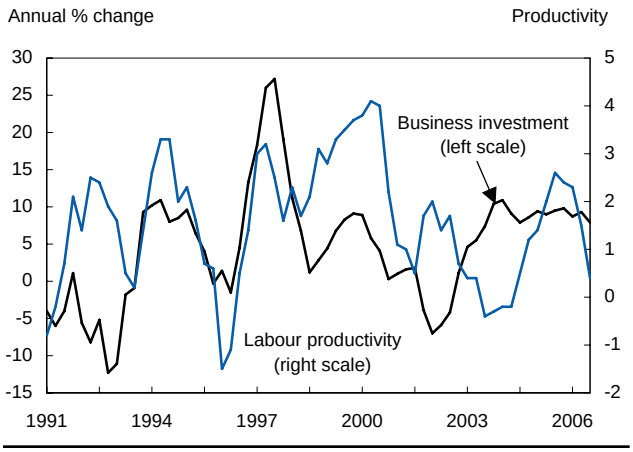
Besides hiring less productive workers, employers may change their behaviour in ways that lower productivity. They could be more reluctant to lay off workers temporarily for fear that they would get jobs elsewhere and not return. Similarly, firms may hoard labour in anticipation of large projects coming onstream later. Reports say this is already occurring in the oil sands.[7]

Business investment points to higher 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 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.

Productivity rarely slumps for an extended period when investment is expanding (Chart K). 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 payoff 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.

Chart K Productivity rarely slumps for long when investment is growing



Sources: Statistics Canada, Labour Productivity Measures; Income and Expenditure Accounts

Conclusion

Several economic and statistical reasons explain why productivity slowed in 2006. 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 related to temporary factors (such as weather or other production disruptions, or a sudden shift of resources to new industries and regions) or signals the beginning of a longer-term slump in productivity caused by labour shortages, an aging 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 caused by development of the oil sands.

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 not to place too much emphasis on short-term movements in productivity and instead look at them in the context of previous periods of growth when productivity temporarily sagged.

Perspectives

Notes

1 Even in the U.S., where productivity rose 2% in 2006, the slowdown earlier this decade led the Federal Reserve Board to observe that "the recent slowdown in labor productivity may be at least in part a temporary cyclical response … rather than a meaningful downshift in the longer-run trend." (BGFRS 2007, 18).

2 According to the National Energy Board (NEB), the initial productivity of gas wells in western Canada has fallen by almost two-thirds since 1996 (NEB 2006, 23). For oil, the NEB characterized western Canada "as a maturely explored basin, with diminishing finding rates and relatively high finding and development costs. Most of the larger pools have been discovered and smaller fields are increasingly difficult and costly to find." (NEB 2005, 17).

3 "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." (Financial Post 2007).

4 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.

5 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 because of 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.

6 An aging labour force can significantly lower productivity. One recent study estimated that the impact on Canada peaked in the 2001-to-2006 period, with annual losses in productivity of 0.2 percentage points (Tang and MacLeod 2006, 598).

7 For example, the Long Lake consortium said 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 (Ebner 2006).

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