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BETTER POLICIES FOR BETTER LIVES

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Table of contents

Tables

Figures

This Survey *is published on the responsibility of the Economic and Development Review Committee of the OECD, which is charged with the examination of the economic situation of member countries.*

The economic situation and policies of Canada were reviewed by the Committee on 2 May 2012. The draft report was then revised in the light of the discussions and given final approval as the agreed report of the whole Committee on 24 May 2012.

The Secretariat's draft report was prepared for the Committee by Alexandra Bibbee, Calista Cheung and Shahrzad Mobasher-Fard under the supervision of Peter Jarrett. Research assistance was provided by Françoise Correia.

The previous Survey *of Canada was issued in September 2010.*

BASIC STATISTICS OF CANADA, 2011

THE LAND

Area (thousand sq.km.)	9 976
Agricultural area (2000, per cent of total area)	6.7

Population of major cities (thousands)

Montreal	3 909
Toronto	5 839

THE PEOPLE

Population	34 437 424
Number of inhabitants per sq. km	3.5
Population, annual net natural increase (average 2007-11)	136 421
Natural increase rate per 1 000 inhabitants (average 2007-11)	4.1
Labour force	18 143 200
Employment in agriculture	305 600
Immigration (annual average 2007-11)	253 117
Average annual increase in labour force (2006-11, per cent)	1.1

THE PRODUCTION

GDP (million of Canadian dollars)	1 718 685
GDP per capita (Canadian dollars)	49 908
Gross fixed investment per capita (Canadian dollars)	11 272
Gross fixed investment (per cent of GDP)	22.6

Origin of gross domestic product (per cent of total)

Agriculture, forestry, fishing and hunting	2.4
Mining and oil and gas extraction	4.5
Manufacturing	12.7
Finance and insurance, real estate and renting and leasing and management of companies and enterprises	20.9
Public administration	6.0
Other	53.5

THE GOVERNMENT

Government current expenditure on goods and services (per cent of GDP)	21.4
Government gross fixed capital formation (per cent of GDP)	3.9
Federal government current revenue (per cent of GDP)	14.3
Federal direct and guaranteed debt (per cent of current expenditure)	223.1

Composition of Parliament (2 May 2011)

	Number of Seats	
	House of Commons	Senate
Conservative Party	165	59
New Democratic Party	101	. .
Liberal Party	35	41
Bloc Québécois	4	. .
Independent/other	2	2
Progressive Conservative	. .	1
Green Party	1	. .
Vacant	. .	2

THE FOREIGN TRADE

Exports

Exports of goods and services (per cent of GDP)	31.1
Main goods exports (per cent of total)	
Agricultural and fish products	9.0
Energy products	25.4
Forestry products	5.1
Industrial goods and material	25.6
Machinery and equipment	16.3
Automotive products	12.8
Other goods	5.8
Main customers (per cent of commodity exports)	
United States	73.7
European Union	8.9
Japan	2.4

Imports

Imports of goods and services (per cent of GDP)	32.4
Main goods imports (per cent of total)	
Agricultural and fish products	7.3
Energy products	11.8
Forestry products	0.6
Industrial goods and material	21.7
Machinery and equipment	28.0
Automotive products	16.0
Other goods	14.6
Main suppliers (per cent of commodity imports)	
United States	49.5
European Union	11.7
Japan	2.9

THE CURRENCY

Monetary unit: Canadian dollar

Currency units per USD

Year	0.989

Executive summary

The economy withstood the global economic crisis thanks to a timely macroeconomic policy response and a solid banking sector. Although strong profits in the mining and oil sectors have supported business investment, employment growth slowed in the autumn and winter, and confidence weakened, largely reflecting temporary factors. The latest indicators suggest the economy is picking up, and the outlook is for continued moderate output growth and inflation in 2012-13. However, record low mortgage rates have pushed house prices up substantially in some cities, and boosted household indebtedness, which poses an increasing risk.

Monetary policy remains appropriately accommodative given persistent global headwinds and associated risks and the withdrawal of fiscal stimulus, but it should stand ready to react to signs of a pickup in inflation. Price pressures are evident in housing and sectors related to mineral extraction, while core inflation is running at about 2%. To moderate growth in house prices, macro-prudential measures such as stricter standards for government-backed mortgage insurance have been implemented and may have to go further. The 2012 federal budget features significant public spending cuts designed to achieve budget balance by 2015-16. Even larger efforts are being made in some provincial budgets, notably Ontario's. This tightening is necessary to reduce the debt overhang resulting from the past recession and stimulus measures, but the authorities should slow the pace of consolidation if significant downside risks to growth materialise.

Boosting innovation can raise historically weak productivity growth to sustain living standards. Indeed, innovation is high on the government's agenda. While Canada has made great strides in macroeconomic and structural policy settings, and its academic research is world class, the pay-off in terms of business innovation and productivity growth has not been large. Business R&D is particularly low, despite significant policy support, suggesting substantial scope for improvement. Competitive pressures, which spur innovation, have recently intensified because of the high exchange rate, but further market opening in sheltered sectors like network industries and professional services would be beneficial. Reforms are needed to improve knowledge flows to business and strengthen the process of commercialisation. Government support to R&D should focus more on sharpening incentives and raising performance; the higher current tax subsidy rate for small domestic firms should be unified at the lower large firm rate to encourage firms to attain the scale needed to adopt innovations. Savings could be used to keep capital costs in the eligible base to avoid creating distortions across different technologies.

Improvements in tertiary education will also be critical to support socially inclusive growth in a knowledge-driven economy. While the tertiary system generally performs well, generating high attainment among the working-age population, participation at the tertiary level will need to continue growing to maintain the supply of highly skilled labour as the population ages. Further improving equity of access by reducing non-financial

barriers and increasing targeted need-based financial assistance – funded by reduced education tax credits where public finances are constrained – and by fostering a more flexible system that facilitates lifelong learning along a diverse range of student pathways is a priority. Efforts should be increased to recruit foreign tertiary students and integrate them into the workforce upon graduation. Universities make strong contributions to research, but teaching relies increasingly on large class sizes and sessional lecturers. Governments should consider greater differentiation across institutions as regards research *versus* teaching. Greater integration of technical, business, communications and industry training within tertiary programmes could contribute to innovation and improving graduate skills.

Assessment and recommendations

Overview

Canada weathered the global economic crisis well, mainly reflecting sustained growth in domestic pending, and the economy is continuing to grow despite the persistence of international turbulence, most recently stemming from the euro zone sovereign debt crisis. In Canada's case, several factors are acting in its favour. Federal fiscal plans are seen by markets as credible, favouring low borrowing costs. The banking system is sound and required no taxpayer bailouts during the 2008-09 crisis. Comparatively strong growth among emerging market economies has shifted global purchasing power to commodity exporters like Canada *via* both higher export prices and stronger currencies. Nevertheless, uncertainty regarding the global situation and risk-averse financial markets are a drag on business confidence and investment, while prolonged low interest rates could push mortgage-debt and house prices higher from already elevated levels, at least in some large cities.

Canada enjoys strong institutions and policy credibility, but for many years its economic growth has relied mainly on increasing labour and capital inputs. By contrast, growth of multi-factor productivity (MFP) has been weak and declined further in the past decade. Innovation indicators such as business R&D and patenting rates are poor. Boosting innovation is an important and well established way of raising MFP growth, which is in turn needed to sustain rising living standards, especially as the population ages.

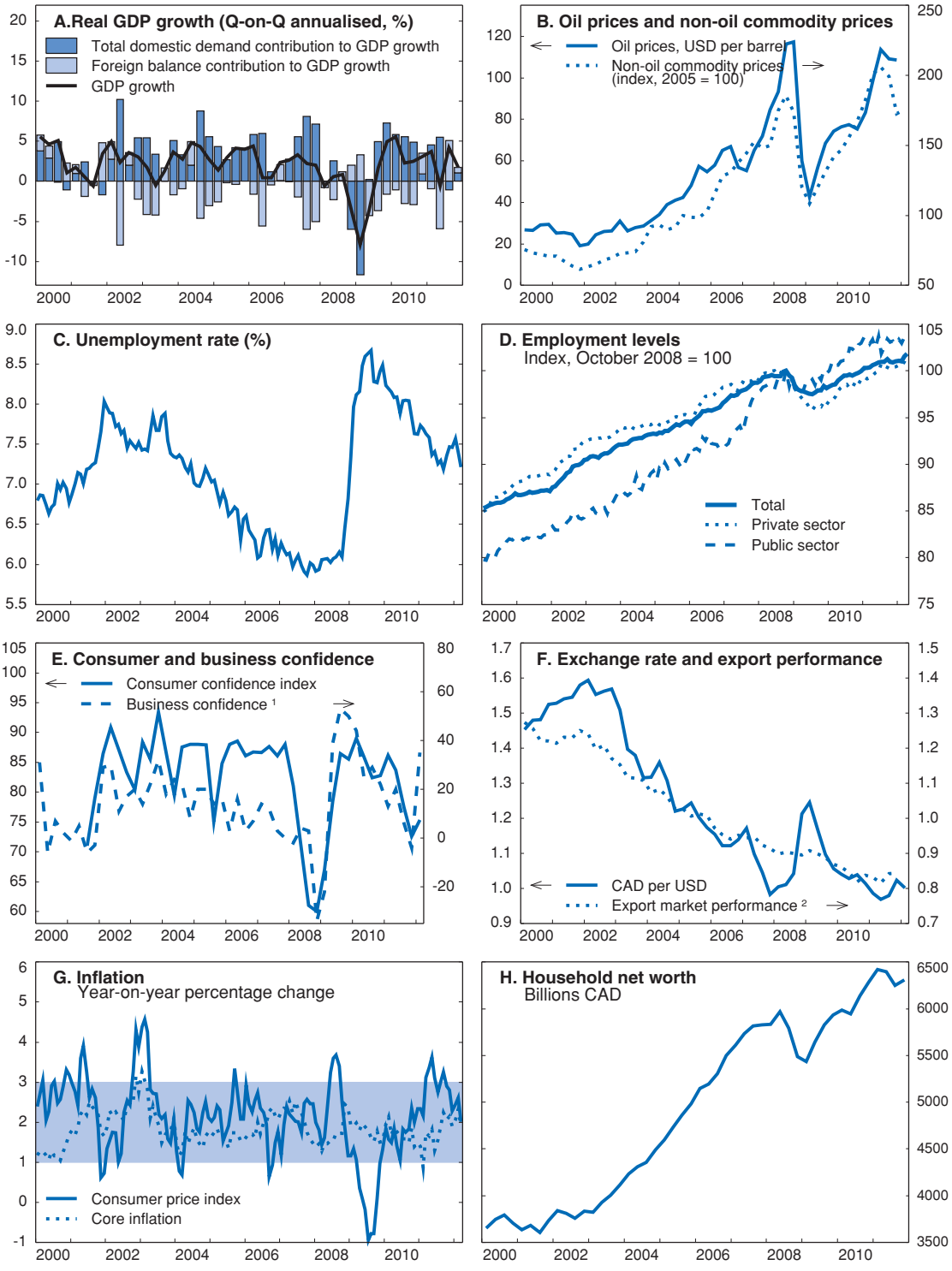
The overarching theme of this *Survey* is improving the policy framework for innovation, including in particular by strengthening the role of the tertiary education sector. Chapter 1 considers how to raise business innovation and concludes that increased service-sector competition and better design of public support, including less reliance on tax credits, would help. Chapter 2 considers policies to expand the supply of highly skilled workers and enhance the performance of Canada's many tertiary education institutions to better meet the economy's skill needs for innovation and growth.

Macroeconomic developments

The Canadian economy recovered from the 2008-09 global economic crisis relatively quickly thanks to timely monetary and fiscal stimulus, a sound financial system and high commodity prices (Figure 1, Panel B). Unemployment has fallen substantially since the recession peak and is now near its long-term average rate as well as OECD estimates of its structural rate (Panel C), and real business investment and corporate profit margins have been restored to pre-crisis levels. The economic expansion experienced a soft patch in late 2011 and again early in 2012, largely reflecting temporary factors. Employment

Information on data for Israel: *http://dx.doi.org/10.1787/888932315602*.

Figure 1. **Economic indicators**



1. Measured as the percentage of firms expecting higher future sales growth over the next 12 months minus the percentage expecting less, from the Bank of Canada's Business Outlook Survey.
2. Ratio of export volumes to the size of export markets (defined as the trade-weighted average of trading partners' imports).

Source: Thomson Reuters; OECD, *OECD Economic Outlook 91 Database*; OECD calculations.

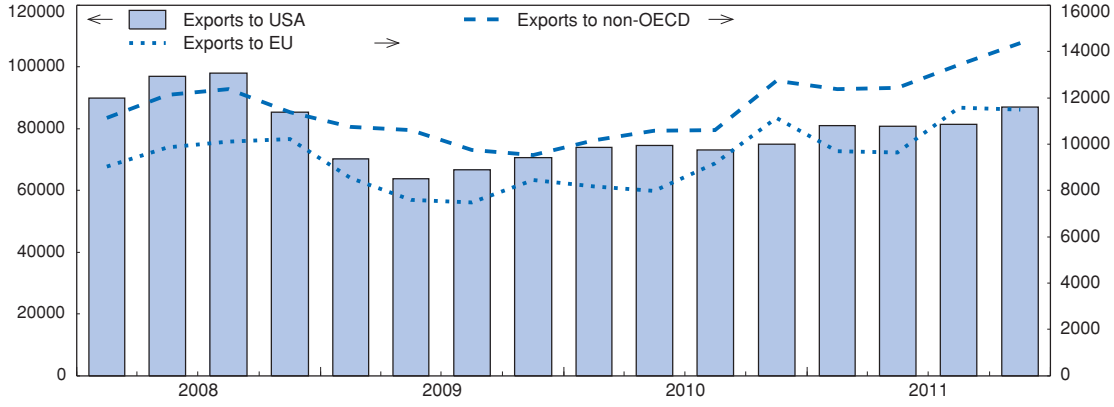
StatLink http://dx.doi.org/10.1787/888932617607

stagnated from summer 2011 for about six months, with particular weakness in the public sector (Panel D), unemployment crept up, and heightened uncertainty in global financial markets surrounding the European sovereign debt crisis eroded confidence (Panel E). But high frequency indicators and fairly easy business credit conditions point to somewhat stronger economic growth going forward.

Merchandise exports to the United States have recovered about 75% of their decline since the 2008 peak, and those to emerging market economies have far surpassed their pre-crisis levels (Figure 2). Moreover, robust growth in emerging market economies has propelled a large part of the surge in demand for Canadian commodity exports over the past decade. Goods sold to non-OECD countries now account for almost 10% of the total value of merchandise exports, up from 5% in 2000, whereas the US share has shrunk from about 84% to 72% over the same period. The Canadian dollar has appreciated significantly in the past 10 years and remains strong both against the US dollar and on a trade-weighted basis. This appears to be largely explained by sharp increases in commodity prices, especially for energy (Cayen *et al.*, 2010). The appreciation has contributed to a worsening of the current account balance from a surplus of around 2% of GDP in the early 2000s to a deficit of near 3% of GDP in recent years.

Figure 2. **Merchandise exports by region**

Millions CAD



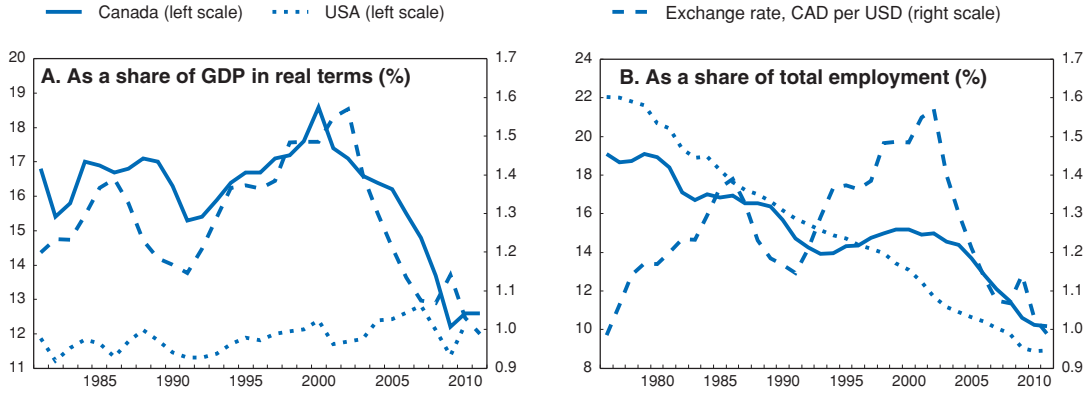
Source: Statistics Canada.

StatLink http://dx.doi.org/10.1787/888932617626

The economy continues to undergo structural adjustments due to these persistent relative price movements since the early 2000s. The export-oriented manufacturing sector had by 2011 shrunk sharply to only 12.6% of total value added, down from a peak of 18.6% in 2000. Its share of employment has also fallen substantially over the past decade (from 15.2% to 10.2%), and somewhat more than in the United States (Figure 3). Both outcomes have been clearly correlated with exchange-rate developments. Regional growth disparities – based on a real disposable income per capita measure – mirror these divergences in sectoral activity: the resource-rich provinces of Alberta, Saskatchewan, and Newfoundland and Labrador have enjoyed the largest per capita income gains during the past decade (Figure 4), whereas growth has been more sluggish in the manufacturing centre of Ontario. Much of Alberta's strength has been attributable to population increases due to employment opportunities. Alberta remains the most affluent province, thanks to its energy wealth. Strong prices for energy and other primary commodities are likely to persist, given the gradual recovery in world growth and continuing turmoil in the Middle East.

Figure 3. **The share of manufacturing in the Canadian economy is heavily influenced by the exchange rate**

Canada *versus* the United States



Source: Bureau of Economic Analysis; Bureau of Labor Statistics; Statistics Canada; and OECD calculations.

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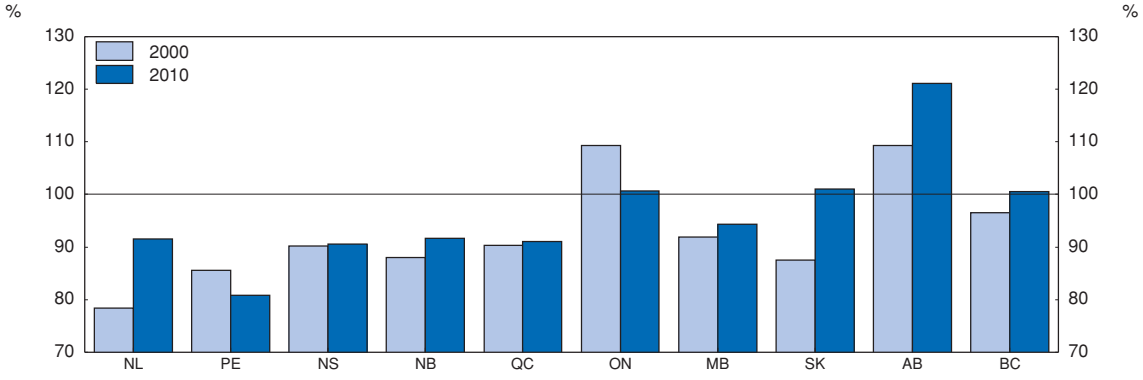
Figure 4. **The shifting pattern of real per capita incomes across the provinces**[1]

Share of the national average



1. Nominal disposable income per capita by province deflated by the consumer price index of each province.

Source: Statistics Canada.

StatLink http://dx.doi.org/10.1787/888932617664

The short-term outlook is for relatively moderate economic growth at just above potential rates and a slight upward tilt as external demand becomes increasingly supportive (Table 1). The fragile US recovery and problems in the euro area, along with the strong Canadian dollar, will limit export growth, although high commodity prices should continue to bolster corporate profits in the energy sector, which, together with the low cost of capital, should support business investment. Planned fiscal consolidation will be beneficial for market confidence and for longer-term sustainability but could weaken domestic demand. Household net worth has declined with weak equity prices (Figure 1, Panel H), which is, along with the moderate pace of job creation and projected tighter lending conditions, likely to restrain private consumption growth. Nevertheless, private consumption and investment will continue to be the main drivers of growth.

Although strong gains in world food and energy prices, and the effect of the introduction of the Harmonized Sales Tax (HST) in Ontario and British Columbia in the third quarter of 2010, held headline year-on-year inflation near the 3% upper limit of the

Table 1. **Short-term projections**

Annual percentage change, volume (chained 2002 Canadian dollars)

	2008	2009	2010	2011	2012	2013
Demand and output						
GDP at market prices	0.7	–2.8	3.2	2.5	2.2	2.6
Private consumption	3.0	0.4	3.3	2.2	2.4	2.9
Government consumption	4.4	3.6	2.4	1.2	0.2	–0.5
Gross fixed capital formation	2.0	–13.0	10.0	6.9	3.9	5.0
Public	8.1	8.6	18.2	–3.0	–7.1	–0.5
Private residential	–3.3	–7.8	10.1	2.3	3.7	2.6
Private non-residential	3.7	–20.8	7.3	13.7	7.1	7.2
Stockbuilding[1]	–0.2	–0.7	0.6	0.2	–0.3	0.0
Total domestic demand	2.8	–2.8	5.2	3.2	2.0	2.7
Export of goods and services	–4.7	–13.8	6.4	4.4	5.2	6.2
Imports of goods and services	1.5	–13.4	13.1	6.5	4.3	6.3
Net exports[1]	–2.2	0.0	–2.0	–0.8	0.2	–0.1
Prices and employment						
GDP deflator	4.1	–1.9	2.9	3.3	2.2	1.8
Consumer price index	2.4	0.3	1.8	2.9	2.3	2.2
Underlying price index	1.7	1.8	1.7	1.7	2.1	2.0
Total employment	1.7	–1.6	1.4	1.5	1.1	1.1
Unemployment rate	6.1	8.3	8.0	7.5	6.9	6.6
Memorandum items:						
General government financial balance[2]	–0.4	–4.9	–5.6	–4.5	–3.5	–2.4
Cyclically adjusted government primary balance[2]	–0.9	–3.0	–4.2	–3.7	–2.9	–2.1
General government gross debt[2]	71.2	82.4	84.0	83.8	84.5	81.4
General government net debt[2]	22.8	28.5	30.6	33.3	35.3	36.3
Short-term interest rate	3.5	0.8	0.8	1.2	1.3	2.1
Current account balance[2]	0.3	–3.0	–3.1	–2.8	–2.4	–2.3
Output gap (per cent of potential GDP)	1.1	–3.1	–1.5	–1.1	–1.0	–0.6

1. Contributions to changes in real GDP (percentage of real GDP in previous year).
2. As a percentage of GDP.

Source: OECD, *Economic Outlook* 91, May 2012.

Bank of Canada's target range for much of 2011, inflation expectations have remained anchored at close to the 2% midpoint. Headline inflation has eased since the end of 2011, while core inflation has edged up to around 2%, and the wedge between the two has been eliminated (Figure 1, Panel G).

Monetary and financial-market policies

A delicate balancing act for monetary policy

To support the economic recovery, the Bank of Canada has appropriately maintained a highly accommodative stance by keeping its policy rate at 1.0% since September 2010. While the Bank has indicated that some modest withdrawal of the present monetary stimulus may become appropriate, the prolonged period of low interest rates raises concerns about the risks it presents for the financial system. The stance of monetary policy in the quarters ahead will have to balance the relatively strong cyclical position of the Canadian economy, compared to the United States and most of Europe, and the income effects of the favourable terms of trade against the predominance of downside risks to activity in the short term resulting from fiscal consolidation and the strong dollar. This balance of risks, in a context of moderate inflation and apparently well anchored inflation expectations, suggests that for now policy can afford to remain supportive of activity. However, as the year 2012 wears on,

and if the downside risks fail to materialise, consideration will have to be given to withdrawing more stimulus by raising policy rates. The need for such actions, conditional on continued reduction in economic slack, will increase as time goes by.

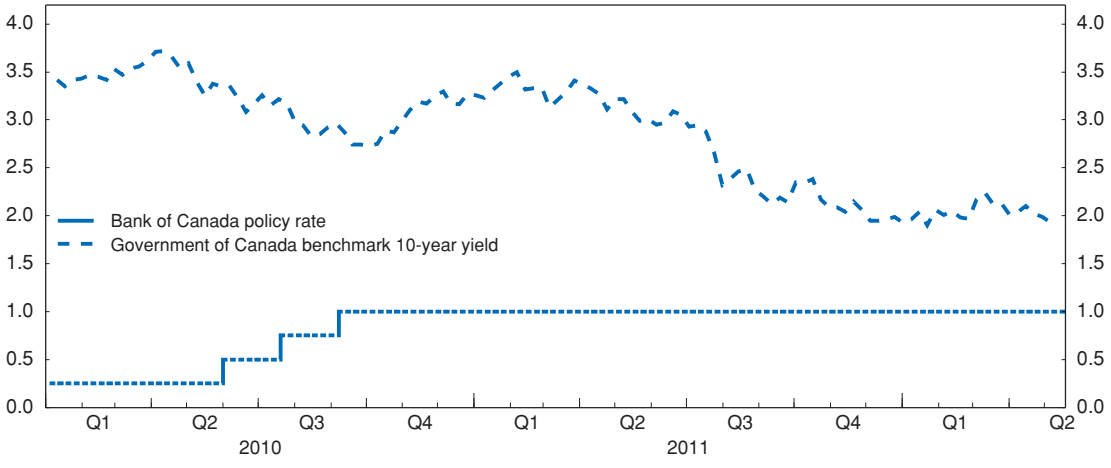
The inflation-targeting framework has proven effective

At the end of 2011, the Bank of Canada together with the federal government renewed the inflation-targeting framework for an additional five years, maintaining the target at 2%. This monetary framework enjoys a high degree of credibility, and inflation has remained close to the target of 2% since 1995. Among other reasons, the 2010 OECD *Economic Survey of Canada* had argued that a significant regime shift to price-level targeting could add to market uncertainties and would thus be undesirable in the context of still rising government debt and precarious global economic prospects.

Slowing global growth and, more particularly, the European sovereign debt crisis are additional factors that have amplified risks to financial stability. Though Canadian banks have little direct exposure to the vulnerable euro area countries, a major shock could have detrimental indirect effects through lower equity prices and higher funding costs. Wholesale funding is an important component of bank funding in Canada (about 30%), though this share has decreased somewhat in recent years (Bank of Canada, 2011). Fears over credit risk may reduce access to such funding, as occurred during the 2008-09 financial crisis, and lead to a renewed tightening of credit availability. Such developments could depress economic activity and generate increasing loan losses in a negative feedback loop.

Long-term interest rates have declined markedly since spring 2011 (Figure 5), which is putting strains on institutional investors. The solvency of Canadian pension funds has been pushed towards all-time lows (Bank of Canada, 2011). Life insurance companies, which like pension funds have fixed liabilities, also suffer from low interest rates. This may result in imprudent risk-taking behaviour as financial institutions seek to boost investment returns, although reduced risk appetite in financial markets engendered by uncertainties in the global economy may act as a mitigating force. Nonetheless, greater vigilance will be needed to ensure pension reserves are sufficient to counter solvency risks.

Figure 5. **Interest rates**



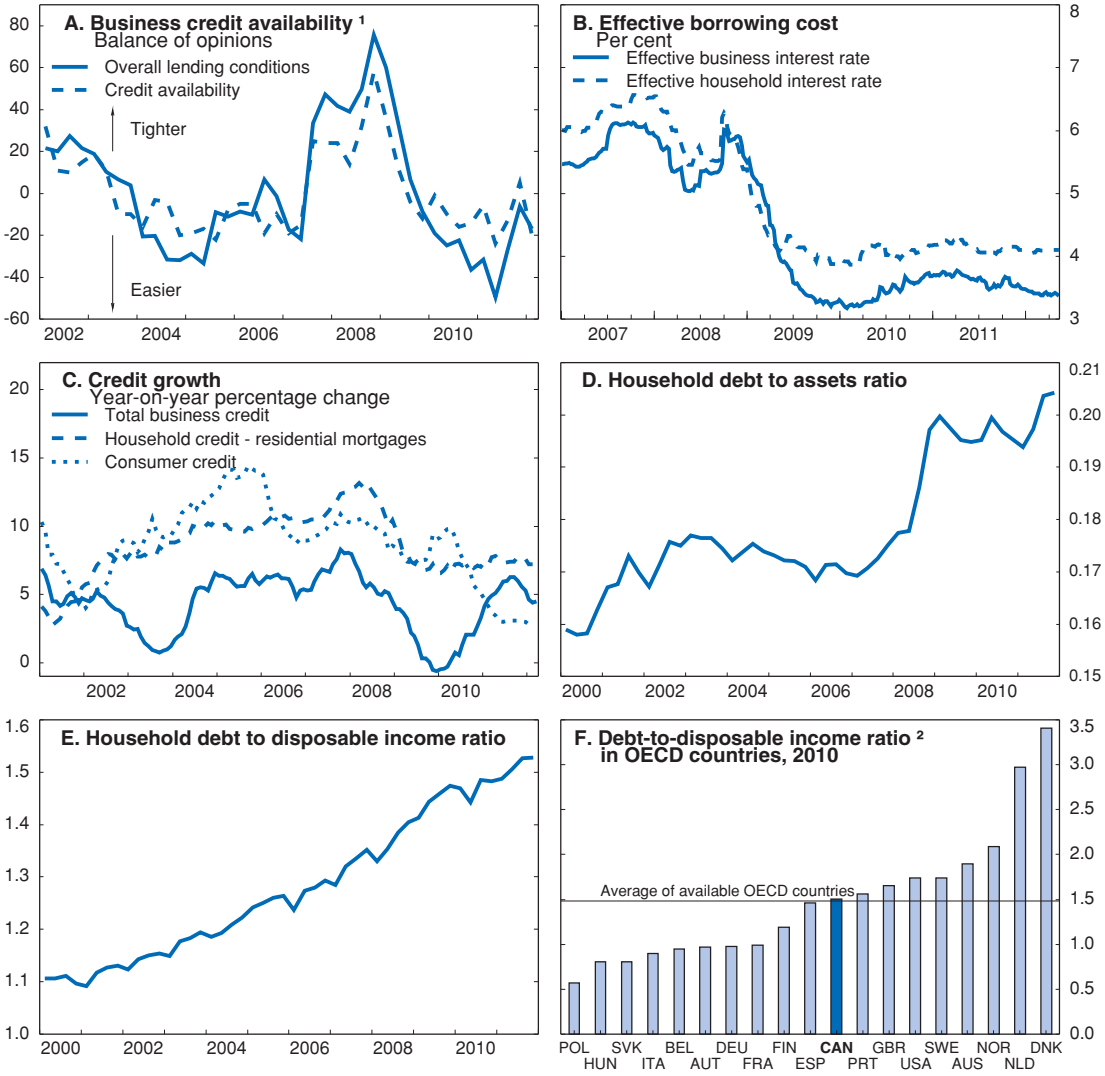
Source: Statistics Canada and Bank of Canada.

StatLink http://dx.doi.org/10.1787/888932617683

Housing-related debt presents risks to financial stability

Although Canada's household indebtedness is close to the OECD average, it is high by historical standards, making households vulnerable to a possible decline in real estate prices. Growth in consumer credit has moderated since mid-2010 (Figure 6, Panel C). However, households have continued to increase borrowing at a faster pace than the rise in their disposable incomes, as they have done over the last 10 years, reflecting cheap mortgage rates and appreciating property prices. As a result, household debt has accumulated to record levels (Panels D and E). Low interest rates are for now keeping mortgage debt-servicing affordable for most (Panel B), but the share of indebted households spending more than 40% of their income on interest payments remains above the 2000-10 average (Bank of Canada, 2011).

Figure 6. **Credit indicators**



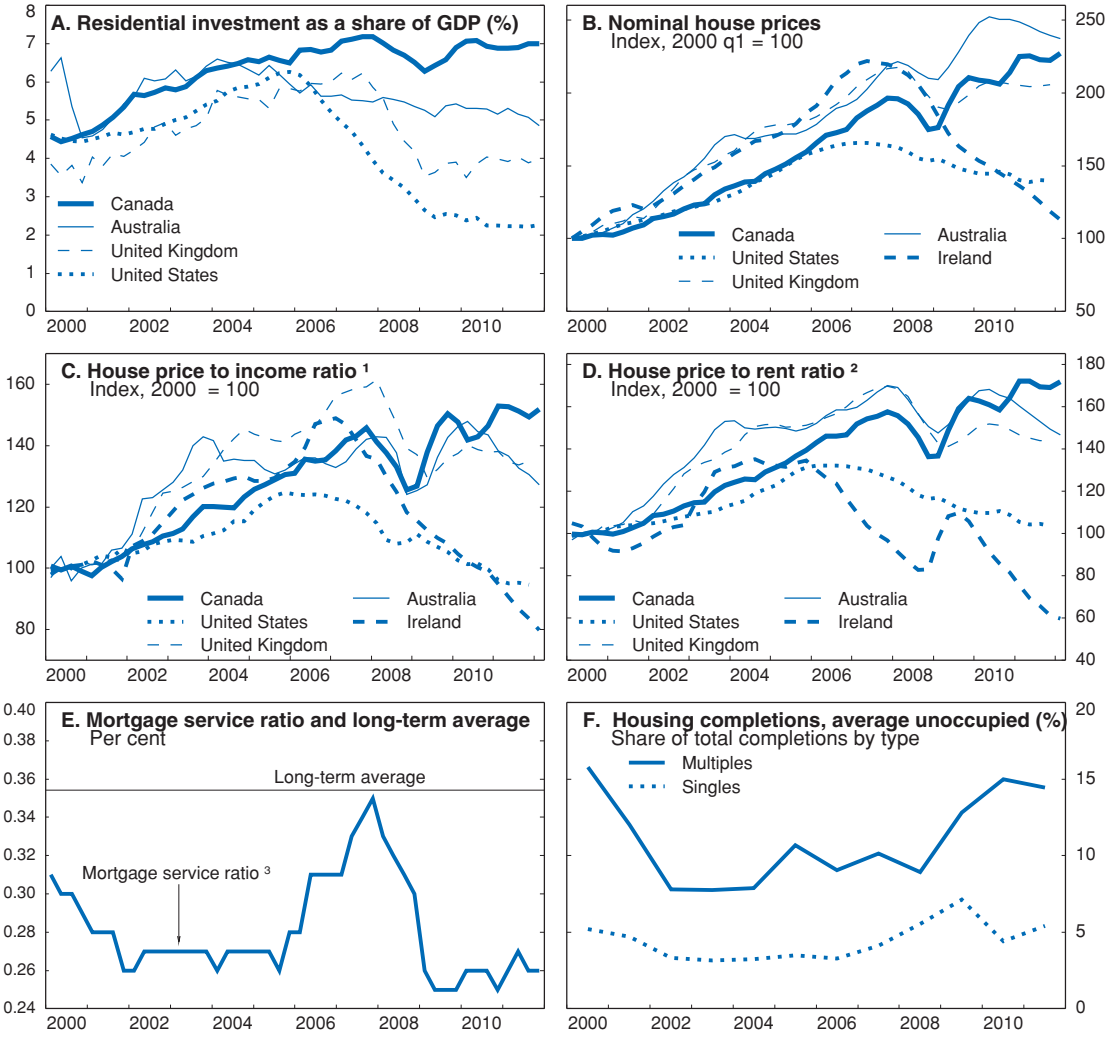
1. Percentage of financial institutions reporting tightened conditions/availability, minus percentage reporting eased conditions/availability.
2. Household and unincorporated business.

Source: Panel A: Bank of Canada, Overall lending conditions from Senior Loan Officers Survey and credit availability from Business Outlook Survey; Other panels: Statistics Canada, *Cansim Database*; Bank of Canada; Thomson Reuters.

StatLink http://dx.doi.org/10.1787/888932617702

Canada experienced a significant increase in house prices in the run-up to the 2008 crisis, but unlike in many countries with a similar experience, notably the United States, Canadian house prices have continued to rise (Figure 7, Panel B). Residential investment declined only slightly as a share of output during the global financial crisis and has since rebounded to close to the pre-recession peak (Figure 7, Panel A) and looks set to rise further, at least over the short term, given the latest figures on housing starts. Indeed, the absence of a real estate collapse is an important reason for Canada's relatively good economic performance during the crisis. While there are some signs of market imbalances, they do not appear to be widespread but are concentrated in certain segments of the market (*i.e.* condominiums) and certain locations (Toronto and Vancouver). In particular, the stock of unoccupied multiple units has swelled (Figure 7, Panel F), even after accounting for increases in multiple units in the market.

Figure 7. **Housing indicators**



1. Nominal house prices divided by nominal disposable income per head.
2. Nominal house prices to rents.
3. The proportion of average personal disposable income per worker that goes towards mortgage payments on a quarterly basis based on current house prices and mortgage rates.

Source: Bank of Canada; CMHC, *Housing and Market Information*; Thomson Reuters; OECD, *OECD Economic Outlook 91 Database*; OECD calculations.

StatLink http://dx.doi.org/10.1787/888932617721

Residential mortgages, including mortgage securitisations, accounted for about 52% of Canadian banks' total domestic-currency loans and asset securitisations at the end of 2011, up slightly from 48% at the end of 2007, as the former strong uptrend tapered off in recent years. While bank loan losses and non-performing loans remain low at 0.3% and 2% of the total stock, respectively, a negative shock to employment or economic growth, or an increase in interest rates, would impair households' ability to service their debts (FSB, 2012). Fortunately, the majority of mortgages are still held on originating banks' books rather than securitised, giving them strong incentives to employ sound underwriting standards.

Approximately seventy per cent of the residential mortgage market in Canada is backed by government guarantees in the case of default. Federally regulated financial institutions must purchase insurance on all mortgages with a loan-to-value (LTV) ratio above 80%, either from the Canada Mortgage and Housing Corporation (CMHC, an agency owned by the federal government) or a private insurer; and 90% of the value of privately insured mortgages is guaranteed by the federal government. Insuring high-LTV ratio mortgages through CMHC lowers their capital risk weight on banks' books from 35% to zero. If insurance is bought from a private insurer, the risk weight is only slightly higher (5%), given the 90% government guarantee. Government backing of a large portion of bank assets helped importantly to maintain the system's stability during the crisis but also implies that the public finances may be exposed in the event of a major shock to housing markets.

CMHC operates on a commercial basis with pricing set to generate commercial rates of return and to cover expected default rates. At the end of 2011, CMHC reported insurance in force totalling CAD 567 billion (34% of GDP). This makes CMHC one of Canada's largest financial institutions. Given its current legislated limit of CAD 600 billion, CMHC indicated in early 2012 that portfolio (bulk) mortgage insurance for low ratio mortgages (*i.e.* mortgages with down payments of 20% or higher) was being rationed due to unexpected requests for large amounts of coverage, a possible sign of perceived risks of substantial price declines by lenders. According to the government, this rationing should ensure that CMHC continues to operate within the limit on its mortgage insurance in force without constraining the availability of high LTV ratio mortgage insurance for qualified homebuyers.

CMHC recently reported that almost 90% of the high-LTV borrowers insured had a high credit score, indicating a strong ability of a great majority of borrowers to manage their debt. Measures were recently announced as part of the 2012 federal budget to strengthen the governance and oversight framework of CMHC. Proposed legislative measures include authority for the Office of the Superintendant of Financial Institutions (OSFI) to review and monitor the safety and soundness of CMHC's commercial activities. This change is likely to bolster the credibility of both CMHC and Canadian prudential regulation.

In recognition of the risks to financial stability posed by the housing sector, between October 2008 and April 2011 the federal government implemented a series of macro-prudential measures to tighten regulations of government-backed mortgage insurance. First, the maximum amortisation period for new mortgages was reduced in stages from 40 to 30 years. Maximum LTV ratios needed to qualify for government guarantees were lowered. Government-backed insurance was also withdrawn on home equity lines of credit, and requirements were imposed on minimum credit scores and loan

documentation. Government-backed insurance also defines minimum qualifying interest rates which must be used in determining borrower eligibility for all variable rate loans and fixed rate loans under five years. These changes have helped to moderate household borrowing and cool the housing market. However, further measures may be needed – possibly targeted on certain market segments – if imbalances persist. Indeed, OSFI just issued draft detailed guidelines for prudent residential mortgage underwriting by all federally regulated financial institutions.

Reforms to financial supervision are in progress

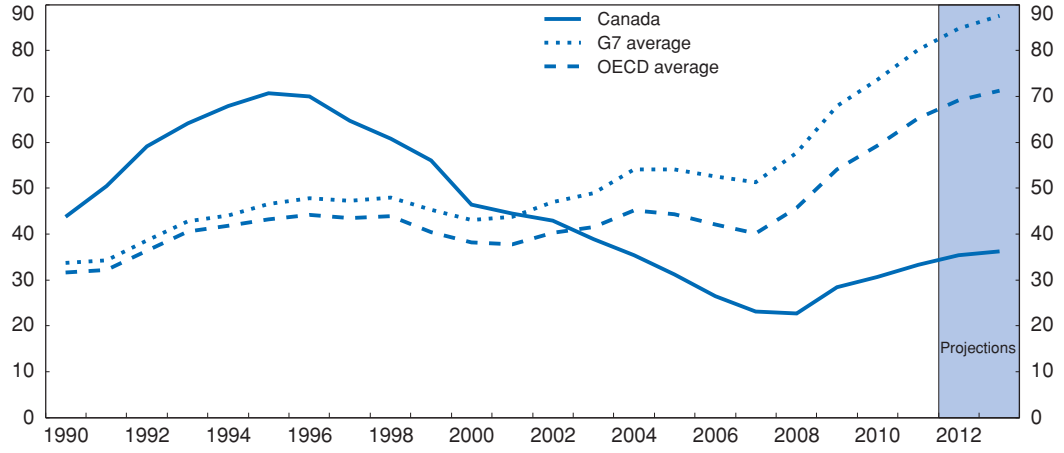
The Canadian authorities have taken welcome steps to address vulnerabilities in the financial system, while actively participating in international efforts to strengthen macro-prudential regulation through the Basel Committee on Banking Supervision of the BIS and the Financial Stability Board (FSB) of the G20. Canada's big six banks are expected to meet the Basel III requirements for a 7% common equity Tier 1 risk-adjusted capital ratio, including the capital conservation buffer, by 2013 (FSB, 2012). Canada will also implement a countercyclical capital buffer as required. Other measures include the expansion of OSFI resources for supervision and on-site inspections and implementation of regular system-wide joint stress testing by OSFI and the Bank of Canada. Accountability has been improved through revisions to the intervention and resolution regime, with recovery plans for the big six banks expected to be finalised in 2012. Implementation of Basel III requirements for minimum loss absorbency in Tier 1 capital should ensure banks fully absorb losses before taxpayers. Progress has also been made in restructuring asset-backed commercial paper and structured finance markets – which were severely impaired during the crisis – to enhance transparency and disclosure. Furthermore, regulation has been drafted to strengthen internal controls on credit rating agencies, which include procedures to identify conflicts of interest and prohibit the issuance of ratings where such conflicts exist.

In securities markets, the federal government has made substantial efforts to create a single national securities regulator, consistent with recommendations made in the 2010 OECD *Economic Survey of Canada*. Progress was halted at the end of 2011, however, when the Supreme Court determined that the proposed legislation was not constitutionally valid under the general branch of the federal power to regulate trade and commerce. The Court also indicated that "[t]he common ground that emerges is that each level of government has jurisdiction over some aspects of the regulation of securities and each can work in collaboration with the other to carry out its responsibilities". It recognised that federal jurisdiction could include the management of systemic risk and ensuring fair and efficient national capital markets. The federal government has since indicated that it is consulting with provinces and territories, and that a number of them have reaffirmed their interest in working on a cooperative basis towards establishing a common securities regulator. Moving in this direction would generate efficiency gains and improve the attractiveness of listing in Canada, as it would lead to a reduction in duplication and unnecessary regulatory burdens on market participants. Indeed, the ¨passport system¨, adopted by all provinces except Ontario, has provided savings by allowing market participants to use one principal regulator for approval in all jurisdictions. However, the current structure of securities regulation remains fragmented and may imply gaps in the co-ordination of policy development and enforcement across borders, as noted by the FSB (2012).

Fiscal policies to support strong and inclusive long-term growth

The economic downturn and resulting injection of stimulus (worth about 4% of GDP at the federal level) drove up gross and net government debt levels significantly. The general government balance deteriorated from a surplus of 1.4% of GDP in 2007 to a deficit of 4.5% of GDP in 2011 (Table 1). As a result, general government gross debt expanded by about 20 percentage points of GDP to reach 85% of GDP by the end of 2011. Some of this rise was related to a non-budgetary transaction: the issuance of new federal debt to finance the acquisition of government-backed mortgage insurance bonds from the CMHC under the Insured Mortgage Purchase Program; progressive liquidation of these assets will, conversely, act to reduce the gross debt by CAD 2.4, 41.9 and 10.6 billion in 2012-13, 2013-14 and 2014-15, respectively. While the gross debt-to-GDP ratio is projected to fall to around three quarters of the OECD average, net debt as a share of GDP may remain a little more than half of the OECD average by 2013 (Figure 8). This reflects the existence of relatively large general government financial assets: as at end 2011, the federal government held assets amounting to 15% of GDP; provincial and local governments; 35% of GDP; and the Canada/Quebec Pension Plan, 11% of GDP. Over 40% of total government financial asset holdings were claims largely in the form of equity and loans to commercial Crown corporations (*e.g.* CMHC, Farm Credit Canada and Business Development Bank of Canada).

Figure 8. **Net government debt as per cent of GDP**



Source: OECD, *OECD Economic Outlook 91 Database*.

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Federal fiscal consolidation is underway

The federal government has begun to eliminate its deficit and expects to return to a balanced budget or better by 2015-16, based on reasonable economic assumptions (growth averaging 2.3% per year) and protected by CAD 3 billion in annual downward revenue adjustments to account for negative risks (Table 2). The result is that its projection for the federal net debt-to-GDP ratio peaks at 33.9% in 2012-13 and then falls by some six percentage points in the following four fiscal years. The speed of this consolidation is reasonable unless serious downside risks to growth materialise. If they do, Canada's low indebtedness and well earned reputation for fiscal probity allow it room to respond by slowing the pace of consolidation as needed.

Table 2. **The 2012 federal budget outlook**

CAD billions

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Budgetary revenues	**237.1**	**248.0**	**255.0**	**270.4**	**285.5**	**300.0**	**312.5**
Per cent change	–2.1	1.0	1.4	1.7	1.8	3.1	2.6
Per cent of GDP	14.6	14.4	14.3	14.6	14.7	14.8	14.8
Total expenditures	**270.5**	**272.9**	**276.1**	**280.6**	**286.9**	**296.6**	**304.7**
Per cent change	–1.3	0.9	1.2	1.6	2.2	3.4	2.7
Per cent of GDP	16.7	15.9	15.5	15.1	14.8	14.6	14.4
of which:							
Major transfers to persons	68.1	68.5	72.2	75.5	78.1	81.0	84.0
Major transfers to other levels of government	53.0	56.9	58.4	60.3	62.8	65.6	68.5
Direct programme expenses	118.5	116.5	114.7	113.7	113.0	115.1	116.1
of which:							
Operating expenses	77.2	77.6	76.8	76.5	76.7	79.2	80.0
Public debt charges	30.9	31.0	30.8	31.1	33.0	34.9	36.1
Budgetary balance	**–33.4**	**–24.9**	**–21.1**	**–10.2**	**–1.3**	**3.4**	**7.8**
Per cent of GDP	–2.1	–1.4	–1.2	–0.5	–0.1	0.2	0.4
Federal debt[1]	**550.3**	**581.3**	**602.4**	**612.5**	**613.9**	**610.4**	**602.6**
Per cent of GDP	33.9	33.8	33.9	33.0	31.6	30.1	28.5

1. This measure of debt is the federal government's accumulated deficit, which is a measure of its net worth, as it includes the value of federal non-financial as well as financial assets.

Source: Government of Canada, Budget 2012 and Finance Canada updates.

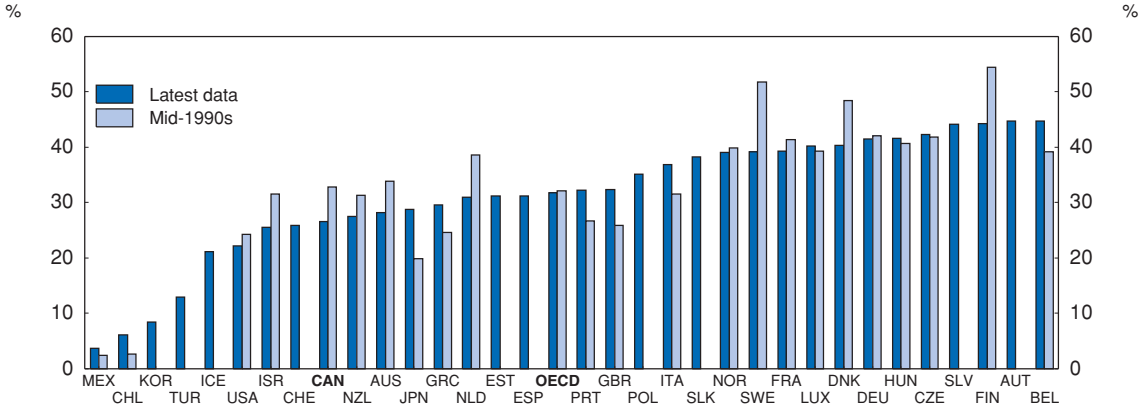
The deficit-elimination strategy outlined in the 2012 budget continues to rely largely on spending cuts (some 82% of the cumulative savings of CAD 58.6 billion over seven years in the three latest budgets), without raising tax rates or cutting transfers to individuals or other levels of government. This involves curbing direct programme spending from 7.3% of GDP in 2010-11 to 5.5% in 2016-17, through near-zero increases in real terms for the five-year planning period) including unwinding stimulus measures. Departmental budgets will be cut by a total of some CAD 21 billion in the next five years culminating in CAD 5.2 billion in 2015-16. This represents 1.9% of total programme spending and will reduce federal employment by 19 200 (about 4.8% of the total, compared to 14.4% realised in the 1990s downsizing episode). The budget also proposed raising the retirement age to 65 for new federal employees as of 2013 and boosting the employee share of pension contributions to 50%.

Revenues are expected to rise by around 4.7% per year, only slightly faster than GDP. Part of the increase is cyclical, and part results from the semi-automatic increase in employers' and employees' Employment Insurance contribution rates that is required to balance that account following the recession-induced deficit incurred in recent years, even though the government decided to slow the uptrend in such rates (at a budgetary cost of CAD 2.6 billion over five years).

The focus on achieving consolidation largely on the spending side is appropriate. Studies have shown that fiscal consolidation tends to be more effective when expenditure restraint is used rather than measures to raise government revenues (Guichard *et al.*, 2007). Nevertheless, care will need to be taken to ensure that adequate social supports remain in place for vulnerable segments of society. At the aggregate level, the Gini coefficient suggests that market income inequality rose from the mid-1990s to the early 2000s and has remained relatively unchanged since then. While these inequalities are partially offset through the redistributive role of the tax and benefit system, OECD (2011c) finds that this

effect has declined through time with roughly one-quarter of market income inequality being offset by redistribution, down from about one-third in the mid-1990s (Figure 9). And relative to its OECD counterparts, Canada's tax and benefit system is less redistributive. This is mainly due to the reduced role of means-tested benefits and transfers, and an increased emphasis on in-work incentives, rather than changes to the income tax system. The result is that after-tax, after-transfer income has become much more unequal, with, for example, the top 1% accounting for 10% of all income in 2007, up from only 6 to 7% up to the mid-1990s. Nevertheless, the share of Canadians living below the nation's low-income cut-off has fallen sharply, such that basic needs are being met for most.

Figure 9. **Share of market-based income inequality offset by the tax and transfer system in OECD countries**[1]



1. Difference between pre- and post-tax and transfer Gini coefficients as a share of the pre-tax and transfer Gini coefficient for the entire population in per cent.

Source: OECD.stat, *Income distribution Database*. StatLink http://dx.doi.org/10.1787/888932617759

Eliminating untargeted and ineffective tax expenditures should be considered as a way to expand fiscal space at both federal and provincial levels, while improving the efficiency and fairness of the tax system, as recommended in the chapter on taxation in the 2008 *OECD Economic Survey of Canada*. The federal government reports over 150 tax expenditure items, though its definition of what constitutes a tax expenditure is quite broad. These include beneficial tax credits for pension savings plans and the like, but also measures which tend to benefit wealthier households, such as the deduction for employee stock options, and favoured investors, such as flow-through shares for mining firms. The 2012 federal budget seeks to make a few changes in this vein that would save approximately CAD 2 billion in the next five years, primarily on the corporate side.

Promoting longer-term sustainability and inclusive growth

Long-term demographic trends imply lower per capita GDP growth and increased spending pressure for health care, social services and income support for the elderly. The first pillar of the pension system – Old Age Security (OAS) and the Guaranteed Income Supplement (GIS) – is not likely to pose as significant a fiscal problem as in some other OECD countries, but spending, at 4½ per cent of GDP, is nevertheless projected to rise in the coming decades to 6¼ per cent of GDP (Whitehouse, 2010). The rationale behind the federal government's decision in the recent budget to programme a gradual rise in the eligibility age for OAS and GIS benefits to 67 between 2023 and 2029 was to ensure that social programmes remain

sustainable over the long term and reflect demographic realities. The policy change also introduced the option to defer take-up of the OAS pension for up to five years and receive a higher, actuarially adjusted, pension. This option will be available starting in July 2013, and the adjusted pension will be calculated on an actuarially neutral basis. It is clear that Canadians are being encouraged to work longer and save more themselves for their retirement.

Provincial governments face a more difficult task. Some face large structural deficits and still rising net debt to GDP ratios that will require resolute reforms to overcome (Table 3). While most intend to balance their budgets over the next several years, relying entirely on spending control, concerns over the Ontario government's debt levels prompted a downward revision to the outlook for its credit rating at the end of 2011. Given lacklustre growth prospects, the government-appointed Commission on the Reform of Ontario's Public Services (2012) reported that maintaining current fiscal policies could drive net debt to 51% of provincial GDP by 2017-18. It went on to identify 362 potential savings.

The Ontario government responded to the report in its 2012 budget with CAD 22 billion in deficit reduction over the next three years, about 80% of which would be achieved through spending restraint. Much of that will rely on wage freezes for civil servants, doctors and teachers, along with delaying the planned cut in corporate tax, freezing social assistance rates and slowing the rate of investment. The deficit – 2.4% of provincial GDP in 2011-12 – will be eliminated only in 2017-18 (and even that relies on spending increases being held below 1% per year in the final two years of the planning horizon), but Ontario's net debt is expected to peak at 41.6% of its GDP in 2014-15 before falling back.

Table 3. **Aggregate provincial and territorial fiscal indicators**
2012 budget estimates (Provincial public accounts basis)

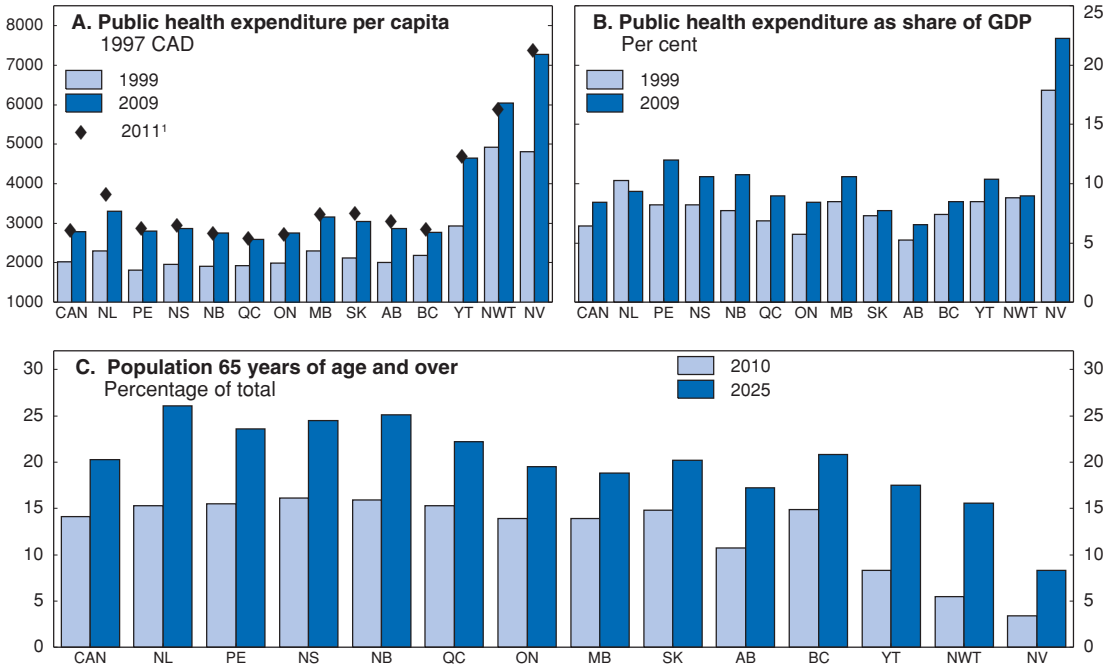
	Actual	Forecast			
	2010-11	2011-12	2012-13	2013-14	2014-15
	Billions CAD				
Revenue	**299**	**310**	**320**	**334**	**349**
of which:					
Total own-source revenue	231	244	254	n.a.	n.a.
Federal transfers	68	66	65	n.a.	n.a.
Expenditure	**322**	**332**	**339**	**345**	**352**
Other factors	2	–1	–1	–1	–1
Surplus/Deficit(-)[1]	–21	–23	–19	–12	–4
Net debt	435	480	517	504	521
	Per cent of GDP				
Total own-source revenue	14.2	14.2	13.9	n.a.	n.a.
Federal transfers	4.2	3.9	3.6	n.a.	n.a.
Total revenue	18.4	18.0	17.6	17.6	17.6
Total expenditure	19.8	19.3	18.7	18.2	17.7
Surplus/Deficit(-)[1]	–1.3	–1.3	–1.1	–0.6	–0.2
Net debt	26.8	27.9	28.5	n.a.	n.a.
Memorandum items:					
GDP (billions CAD)[2]	1 625	1 719	1 818	1 899	1 985
Annual per cent change[2]		5.8	5.7	4.4	4.5

1. Surplus/deficit is not equal to revenue minus expenditure because of small other factors not reported in the table.
2. Average private sector forecast surveyed by the Department of Finance Canada for 2012 budget.
Source: Finance Canada and OECD calculations.

Provinces also face substantial longer-term challenges because they are responsible for health spending, which already accounts for a sizeable share of provincial output (Figure 10) and nearly half of provincial government spending. Containing these costs in the years ahead will not be easy. The federal government recently announced plans to continue its payments to provinces for health care – the Canada Health Transfer (CHT) – past the expiry date of current legislation on 31 March 2014 (Box 1). From 2014-15 to 2016-17, the CHT will continue to grow at its current rate of 6% annually. However, this pace could not have been sustained in the longer term. Hence, beginning in 2017-18, the CHT will rise in line with a three-year moving average of nominal GDP growth, with a minimum guaranteed increase of 3% annually. The Parliamentary Budget Office (PBO) estimates that the new formula could reduce the federal share of provincial and territorial health spending from 20.4% in 2010-11 to an average of 13.8% over the 25-year period starting in 2036 under a scenario where average health care spending growth (at more than 5% per year) is assumed to outpace nominal GDP increases over the period (Matier, 2012).

The move to a transparent, stable and ultimately less generous formula for the CHT hardens the budget constraint for provincial and territorial governments. They will have to respond by slowing health-care outlays: Ontario, for example, is aiming to limit its annual

Figure 10. **Health-care expense indicators**



1. CIHI projections.

Source: CIHI (2011), *National Health Expenditure Trends, 1975 to 2011* and Statistics Canada.

StatLink http://dx.doi.org/10.1787/888932617778

Box 1. **Federal government's major transfers to provinces and territories**

The federal government provides financial support to provincial and territorial governments primarily through four transfer programmes: the Canada Health Transfer (CHT), the Canada Social Transfer (CST), the Equalization Program and the Territorial Formula Financing (TFF). In 2012-13, these transfers amount to CAD 59 billion or 24 per cent of the federal government's total programme spending.

Box 1. **Federal government's major transfers to provinces and territories** *(cont.)*

Canada Health Transfer

The CHT is the largest federal transfer programme to provinces and territories. The CHT is composed of an equal per capita cash and tax point transfer. Provinces and territories must fulfil the conditions stipulated in the *Canada Health Act* to receive the full federal CHT cash contribution.

In 2007, the federal government amended the legislation such that the cash transfer component of the CHT be distributed on an equal per capita basis starting in 2014-15. In the 2012 budget, the federal government confirmed that it will provide protection such that no jurisdiction receives less than its 2013-14 CHT cash allocation in subsequent years as a result of the move to equal per capita cash transfers.

In December 2011, the federal government announced that the CHT will continue to grow at 6% annually until 2016-17. Starting in 2017-18, the CHT will grow in line with a three-year moving average of nominal GDP growth, with funding guaranteed to increase by at least 3% per year.

Canada Social Transfer

The CST is a federal block transfer to provinces and territories in support of tertiary education, programmes for children and other social programmes. These funds are transferred on an equal per capita basis, and provincial and territorial governments have the responsibility to design and deliver programmes, and are accountable to their citizens and legislatures for outcomes achieved and dollars spent. In order to receive their full contribution under the CST, provinces and territories must not impose minimum residency requirements for receiving social assistance.

Total CST levels are legislated to grow by 3% annually until 2013-14. In December 2011, the federal government announced that the CST will continue to grow at its current rate in 2014-15 and beyond.

Equalization Program

The Equalization Program addresses fiscal disparities across provinces. Equalization payments allow less prosperous provincial governments to provide their residents with public services that are reasonably comparable to those provided in other provinces at reasonably comparable levels of taxation.

Equalization entitlements are determined by measuring a province's ability to raise revenues if it were to impose national average tax rates (commonly referred to as fiscal capacity). Before any adjustments, a province's per capita Equalization entitlement is equal to the amount by which its fiscal capacity is below the average fiscal capacity of all provinces (known as the 10-province standard). In order to provide provinces with a net fiscal benefit from their natural resources, the calculation does not fully take their revenues from this source into account but limits this benefit to ensure fairness among provinces. The Equalization formula ensures that the transfer grows consistently with a three-year moving average of nominal GDP growth.

Territorial Formula Financing

The Territorial Formula Financing (TFF) programme enables the three territorial governments to provide a range of public programmes and services to their residents that are comparable to those offered by provincial governments with comparable levels of taxation. TFF is based on the difference between a proxy of the territory's expenditure requirements (known as the Gross Expenditure Base) and the territory's capacity to raise its own revenues.

average health-care expense growth to 2.1% between 2011-12 and 2014-15, about a third of the ten-year historical average. At the same time, greater budget predictability enhances provincial and territorial governments' ability to manage and invest in their health-care systems, while respecting the *Canada Health Act* as the sole condition for receipt of the CHT. Provincial and territorial governments are required to uphold the five principles of the *Canada Health Act*: universality, comprehensiveness, portability, accessibility and public administration, as well as provisions relating to prohibiting extra billing and user charges.

Planned changes to the CHT are also likely to widen regional inequalities. Currently, the CHT is allocated to provinces based on population and includes both cash and tax point transfers. The inclusion of corporate and personal income tax point transfers from the federal government to provincial and territorial governments in 1977 provided an implicit interprovincial redistributive element. The 2007 budget announced that, starting from 2014, the CHT will be allocated to provinces based on population through a cash transfer exclusively. Since per-capita health spending is on average six times higher for Canadians over the age 65 than for others this favours provinces with younger populations, at the expense of those which are ageing more quickly, such as British Columbia, Québec and the Atlantic provinces (Figure 10, Panel C). The federal equalisation system is designed to deal with regional disparities directly or indirectly, and the pressures due to widening health-care cost disparities may eventually require this system to be enriched.

Strengthening the fiscal framework through well designed and transparent fiscal rules can help achieve consolidation goals and long-term sustainability at all levels of government, as discussed in OECD (2010a). Establishing a target debt-GDP ratio would anchor fiscal policy in the long term and help to prevent divergences over time (25% had been adopted in 2004). Multi-year indicative budgeting would increase transparency and improve planning, and a spending ceiling would provide a transparent mechanism to enforce the fiscal path. The PBO could be usefully charged with evaluating budgets and budget outcomes relative to the path chosen by the government.

Box 2. **Recommendations for macroeconomic and financial policies**

Priority recommendations:

- Maintain the current level of interest rates for the time being in light of good inflation outcomes and significant downside risks to the global economy. Tightening may well become necessary late this year, so long as downside risks do not materialise by then.
- Continue to closely monitor developments and risks in housing markets and household debt. If imbalances continue to widen, the government should respond with further tightening of macro-prudential measures.
- Implement fiscal consolidation plans as budgeted, but slow the pace of tightening should economic prospects weaken significantly. Implement the rise in the pension age as planned. Continue with federal and provincial structural spending reforms, particularly in health care and in provinces with large structural deficits, to move towards long-term fiscal sustainability. Eliminate inefficient tax expenditures, especially those that are regressive, such as those for stock options.

Other recommendations:

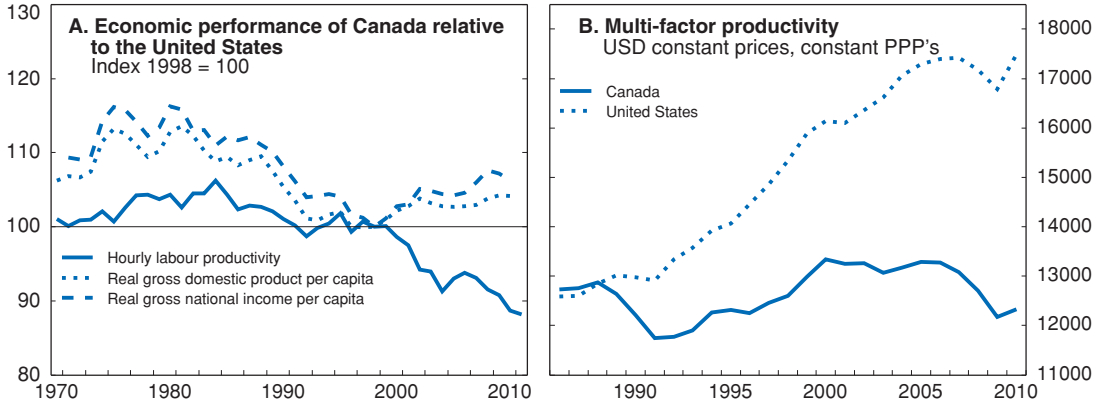
- Strengthen the fiscal framework by adopting a long-term debt ratio target with associated multi-year budgeting and spending ceilings**.**
- Improve securities market regulation by implementing as comprehensive a securities regulator as possible, consistent with the Supreme Court decision.

Canada's key long-term challenge is to boost productivity growth

Over the past few decades, multifactor productivity (MFP) in Canada has been stagnant, and it has even fallen since 2002 (Figure 11). Per capita income growth has nevertheless held up thanks to increasing factor utilisation and, since 2003, robust terms-of-trade gains. Regarding the former, and reflecting earlier tax and benefit reforms, female participation has risen strongly, and the share of the population working is now 4 percentage points higher in Canada than in the United States. Capital intensity is also slightly higher in Canada, although it is heavily weighted toward engineering structures to the detriment of machinery and equipment, particularly, in the form of information and communication technologies (ICT). The composition of output can also affect measured productivity, but weak productivity appears to be spread widely across sectors and therefore controlling for composition still leaves most of the puzzle to be explained (Chapter 1).

Figure 11. **Productivity in Canada relative to the United States**

Total economy



Source: Centre for the Study of Living Standards (2011), *Aggregate Income and Productivity Trends, Canada vs. United States – www.csls.ca/data/ipt1.asp*; calculations from Johansson, A. *et al.* (2012), "Long-term growth scenarios", *OECD Economics Department Working Papers*, forthcoming; OECD *Annual National Accounts Database*.

StatLink http://dx.doi.org/10.1787/888932617797

MFP is a "black box" residual, but as an empirical matter it captures the main sources of rising living standards over the long term. There is some evidence that it is the product of investments in human capital and innovation (Jones, 2002; Jaumotte and Pain, 2005; Hall *et al.*, 2010). Indeed, MFP growth is sometimes used as a direct measure of innovation (National Economic Council, 2011). Canada's expert panel on business innovation concluded that the long-term average growth of MFP is the best comprehensive indicator of innovation, the latter defined to include advances arising from not only science and technology (R&D), but also improvements in business models and processes of all kinds (CCA, 2009). Intensified innovation should, therefore, boost MFP growth.

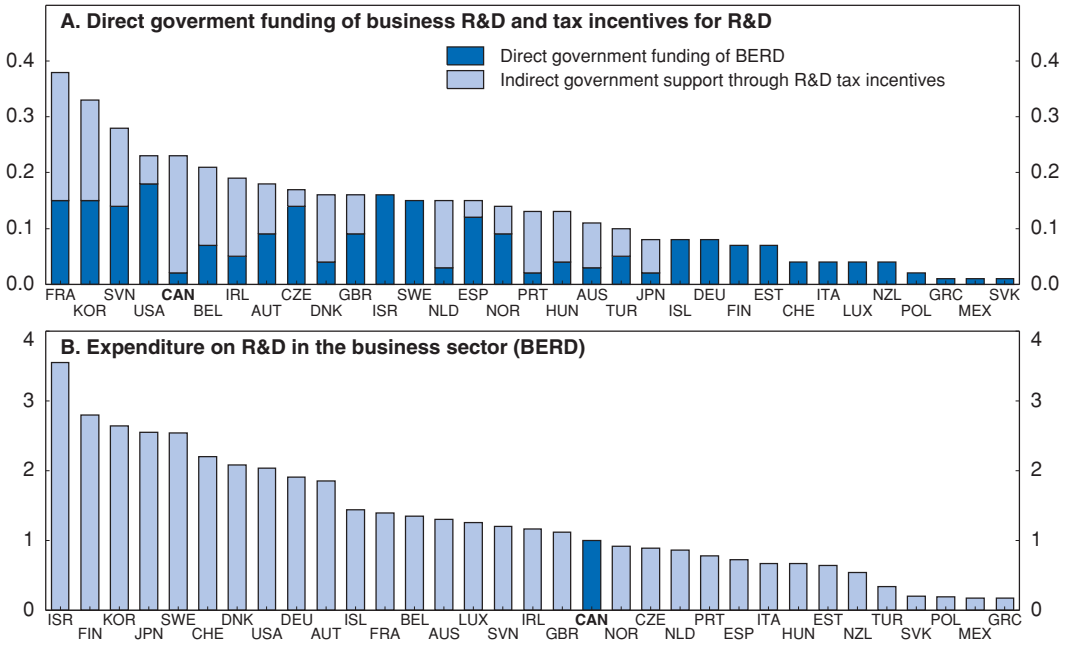
Fostering business innovation

Innovation is an exceedingly complex, lengthy and risky process. It can be promoted by multiple enabling factors in the broader economy and society itself. Efficient resource allocation, characterised by the fluid entry and growth of innovative firms and exit of less productive ones, magnifies the benefits of innovation (OECD, 2012a). Canada possesses

many of these assets, notably macroeconomic stability, a good regulatory framework and a well educated workforce. However, disadvantages include uneven (though relatively low) capital taxation, limited capital markets for funding innovation, insufficiently strong competitive pressures in certain sectors, and weak "connective tissue" that links research to commercialisation. Also, with relatively abundant labour and low relative labour costs, at least until recently, Canadian firms have been under less pressure to innovate than firms in other countries. One result is very low business R&D (BERD) by OECD standards (Figure 12). Government policies in support of R&D investment and regarding aspects of tertiary education should be re-examined, particularly in light of weak commercialisation of ideas.

Figure 12. **Fiscal support and business R&D investment, 2009**[1]

As a percentage of GDP



1. Or latest available year.

Source: OECD, *OECD Science, Technology and Industry Scoreboard 2011*.

StatLink http://dx.doi.org/10.1787/888932617816

Taxation is becoming more competitive internationally

Cutting corporate income tax (CIT) rates increases the returns to innovation (as to any investment). A lower capital gains tax supports venture capital (VC), since VC investors' returns take that form. Canada's statutory CIT rate has become one of the lowest in the G7, whereas it had been the highest only a few years ago. This should stimulate business innovation in Canada, including by attracting more foreign firms and the technological and managerial know-how that they often bring.

However, marginal effective tax rates on capital remain uneven. Tax breaks to manufacturing and natural resources (abstracting from oil and gas royalties) penalise services, which are a critical emerging area for the knowledge economy. The small business deduction for Canadian controlled private corporations (CCPCs) provides tax

relief to SMEs that is phased out as a corporation grows in size. Indeed, small firms account for a substantially larger share of employment in Canada than in the United States. While the tiny population of innovative start-ups are responsible for a disproportionate amount of breakthrough innovations and net job creation, not all small firms are young, and MFP growth appears to be concentrated at the medium-sized range (ICP, 2012). The reduction in the general federal CIT rate will serve to reduce the disparity in treatment of large and small firms, and to that extent should encourage small innovative firms to expand sales, enter foreign markets and attain the scale needed for successful innovation, competitiveness and high MFP growth.

Innovation support is being rebalanced toward private-sector needs

Support for innovation ranks very high on the list of government priorities, and it has been appropriately protected from the 2012 budget cuts. The federal government supports research in Canada mainly via the National Research Council (NRC) and the three granting councils for the natural, social and health sciences. The 2007 federal science and technology strategy identified four areas of public research focus (energy, environment, health sciences and ICT) and called for an expansion of human capital in STEM subjects (science, technology, engineering and mathematics), backed up by increased funding to public research in all subsequent budgets. To increase the effectiveness of public research, the strategy expanded public-private partnerships, notably in the framework of the networks of centres of excellence. In its recent budget the federal government also refocused the NRC on business-oriented research. The government has commissioned three major reports covering areas of: competition policy (Competition Policy Review Panel, 2008); business innovation strategy (Council of Canadian Academies, 2009); and R&D policy (Independent Panel on Federal Support to R&D, 2011, also known as the Jenkins panel). Many of the recommendations put forward by these reports have been or will be appropriately implemented.

The main federal R&D support programme is the Scientific Research and Experimental Development (SR&ED) tax credit, which is supplemented by provincial credits. SR&ED is one of the most expensive tax expenditures in Canada: CAD 3.6 billion from the federal government and CAD 1.5 billion from the provinces and territories in 2011. The R&D tax subsidy rate (which includes programmes other than SR&ED) is among the highest in the OECD (Figure 12). By contrast, grants are very low.

While this policy mix importantly avoids the need to "pick winners", it is potentially poorly targeted. Even though there is preliminary evidence that tax credits stimulate R&D spending (Lester, 2012), other research suggests that, in the case of level-based credits, much of that may not be incremental, insofar as large firms doing R&D anyway also apply for tax relief (Baghana and Mohnen, 2009). Furthermore, the blunt instrument of tax credits may not always direct resources to areas with the highest social spillovers. These considerations suggest that innovation might be encouraged more effectively, and risks better balanced, by reducing the importance of tax expenditures and relying more on grants.

For small CCPCs, the tax credit is almost double that for large firms. The rate of subsidisation of small CCPCs can go up to 70% including provincial credits and various direct grants (IPFSRD, 2011), which may result in a very high marginal effective tax rate on income when the firm's income passes CAD 500 000, the level at which the tax credit on its R&D is reduced. The small CCPC credit is furthermore refundable up to a limit so long as the firm generates no cash flow. There are substantial fixed compliance costs involved in qualifying for the credits, however.

The Jenkins panel recommended streamlining the SR&ED, notably for small- and medium-sized firms, and using the fiscal savings to boost direct grants to the Industrial Research Assistance Program (IRAP), a large grant programme that provides advice in addition to funding, mostly to small innovating firms (IPFSRD, 2011). The 2012 budget made a number of changes to the SR&ED that will be fully effective by 2014. Capital will be removed from the SR&ED expenditure base for *all* firms. Eligibility for overhead and contract costs is being progressively tightened and administration will be further simplified. The regular (large firm) subsidy rate will be reduced from 20% to 15% in line with the decline in the general CIT rate, while the small firm rate subsidy remains unchanged at 35%. Funding to small and medium-sized businesses through IRAP is being doubled immediately. The proposed rebalancing of business innovation support needs to be carefully implemented and evaluated.

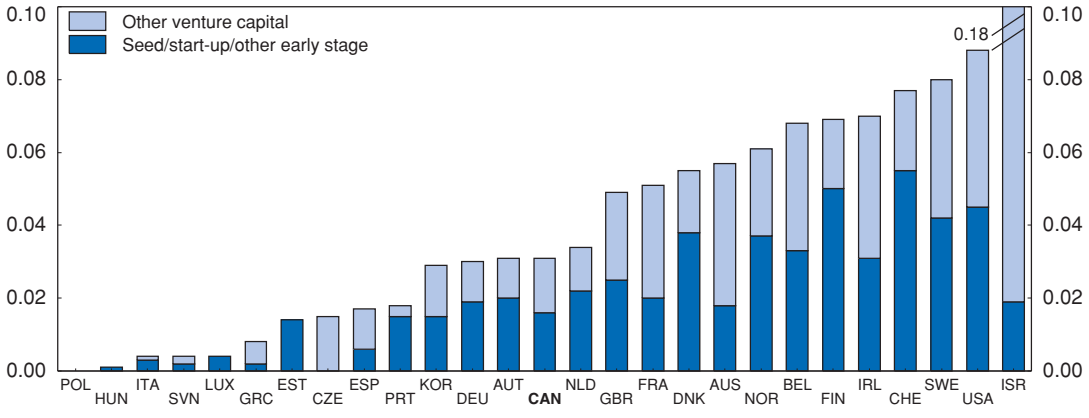
The policy rationale for the enhanced refundable credit is to internalise the positive externalities of R&D performed by CCPCs and to compensate for their constrained access to finance. However, the generosity of the subsidy could result in the allocation of too many resources to small firms. The current level of the SR&ED subsidy for large firms appears to be justified by externalities, net of costs (Parsons and Phillips, 2007). Instead of reducing the SR&ED rate for large firms, it would have been preferable to reduce the differential by lowering the small firm rate toward the large-firm level, while maintaining a broad base, inclusive of capital, to avoid creating distortions in favour of small and/or labour-intensive firms.

Do financial markets allocate funds to innovation effectively?

A well functioning financial system is important for allocating capital to firms and sectors, while pricing risk efficiently. VC and private equity segments of the capital market specialise in innovative start-ups and other high-risk ventures. They rely on close monitoring to reduce informational asymmetries and on buoyant public equity markets for lucrative exit opportunities. Canada's VC market is only about one-third as large relative to GDP as in the United States, though still higher than in a fair number of other OECD countries (Figure 13). Institutional investors (such as pension funds) have shied away from the VC market segment

Figure 13. **Venture capital investment, 2009**

Percentage of GDP



Source: OECD, *OECD Science, Technology and Industry Scoreboard 2011*.

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but are sorely needed to provide it with depth. The lack of a single securities regulator has been identified as giving rise to high transaction costs, inconsistent reporting and accountability standards, and patchy enforcement (FSB, 2012; OECD, 2010a). Greater cross-provincial harmonisation and consistency in securities market regulation would help to deepen capital markets and improve resource allocation across the country.

VC investments are encouraged through the income tax system, in large part through the so-called Labour-Sponsored Venture Capital Corporations (LSVCCs). Indeed, some 50% of the VC market is publicly funded, compared with less than 5% in the United States. However, a large portion of this investment is directed to regional development rather than small firm growth. Canadian enterprises supported by private, as opposed to public, VC appear to have superior performance in terms of value creation and innovation intensity overall. More worrying is evidence of crowding out of private projects by public VC (Brander *et al.*, 2008). Such crowding out, particularly by LSVCCs, has diminished the returns of private VC funds and played a key role in driving pension funds and other furnishers of capital to private funds to the sidelines (MacIntosh, 2012). Following Ontario's lead, federal and provincial tax credits to retail investors in these funds should be phased out.

Stimulating the VC market will prove a challenge, especially as returns have been fairly low and the global financial crisis sharply cut investors' appetite for risk in the United States as well as Canada. Government could help through co-investment funds in which private partners make the investment decisions. Following the recommendation of the Jenkins panel to leverage greater private capital and expertise by means of such co-funding, the 2012 budget boosted direct funding to the VC market significantly. However, the risk remains that these funds will remain forever dependent on public support.

Is competition providing the necessary spur to innovation?

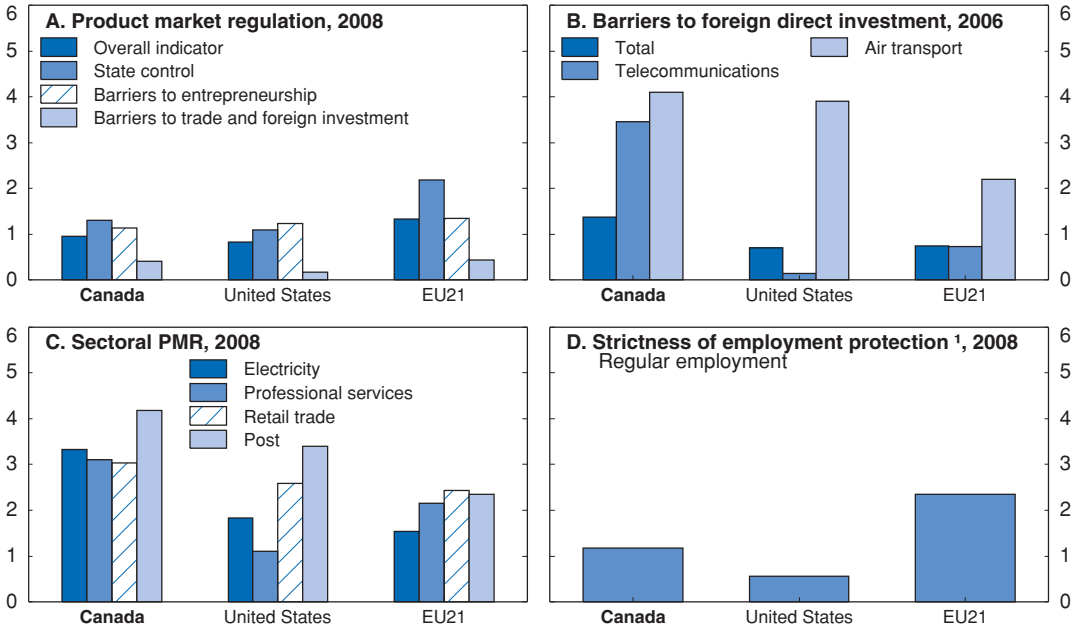
Vigorous competition is a key motivator of innovation, as firms are driven to innovate to stay in business (CCA, 2009; Sharpe, 2010). Competitive behaviour is nurtured by openness to trade and foreign direct investment internationally and by low barriers to entry and exit in product and labour markets at home. Conversely, firms that are sheltered from competitive pressures may earn sufficient rents to survive without innovating, even if that condemns them to remain small. Canada's product-market policy settings are largely in line with OECD best practice. Barriers to entry, as captured by the OECD's Product Market Regulation (PMR) indicators, are among the lowest in the OECD (Figure 14, Panel A). Employment protection is also moderate, which facilitates firm entry and organisational innovation (Panel D).

Yet, there are residual impediments to competition. In 2011, the OECD's *Going for Growth* (OECD, 2011a) identified Canada's network sectors and professional services as offering ample scope for regulatory improvement (Figure 14, Panels B and C). There are signs that some of these barriers are being recognised and tackled:

- OECD work shows that infrastructure sectors are critical to translating the benefits of innovation, notably in ICT, into generalised productivity gains, and so rigidities there may reduce efficiency in all sectors (Conway and Nicoletti, 2007). The government is, encouragingly, committed to sustaining competition in telecoms, and foreign-investment restrictions have begun to be eased. New competitors have emerged in the wireless telephony market. The government has also implemented the competition policy recommendations of *Compete to Win* (CPRP, 2008). Competition authority powers of monitoring and enforcement against cartel-like behaviour and abuses of dominant

Figure 14. **Product and labour market regulation indicators**

Index scale of 0-6 from least to most restrictive



1. The OECD indicators of employment protection are synthetic indicators of the strictness of regulation on dismissals and the use of temporary contracts.

Source: Panels A and C: OECD, OECD.stat – *Market regulation Database*; Panel B: Koyama and Golub (2006), "OECD's FDI regulatory restrictiveness index: revision and extension to more economies", *OECD Economics Department Working Paper*, No. 525; Panel D: OECD.stat – *Employment protection Database*.

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market positions have been strengthened, and merger and acquisitions notifications and review procedures have been streamlined.

- Differences in provincial certification requirements for regulated professions that prevent their mutual recognition create barriers to the interprovincial mobility of workers in these occupations. Professional services such as architecture, engineering, and various other businesses and skilled trades include skills necessary for many intangible investments. The 2009 amendments to the Agreement on Internal Trade (AIT, Chapter 7) have resulted in principle in the recognition of certified workers across provinces and territories and encouraged the adoption of common inter-provincial standards that facilitate mobility. Implementation of the chapter is still ongoing.
- In health care, one of the fastest growing sectors, representing 10% of the economy, rigid prohibitions on private entry hamper innovation (OECD, 2010a). In the wake of relaxations on the restrictions on provinces in this area, they have formed an interprovincial body on health-care innovation and should seize the opportunity to foster it.

As a relatively small market, Canada's ability to reap the benefits to innovation of both scale and competition requires fully exploiting international trade opportunities. Canada has dismantled most merchandise trade barriers (except in dairy and poultry products; see the chapter on agriculture in the 2008 *Economic Survey of Canada* (OECD, 2008)). NAFTA resulted in sharp increases in US-Canada trade and investment. The impact of increased continental competition on Canada's productivity growth is less clear, although the weak Canadian dollar until recent years may have induced Canadian firms to delay or avoid

restructuring (Rubin and Lester, 1999). Bilateral FTAs are now being pursued with EU and Pacific partners, a welcome development. Success in expanding and diversifying trade linkages will also depend on investing heavily in transport infrastructure (McMillan, 2011). The recent federal budget, in fact, proposes significant streamlining of regulatory approvals for major infrastructure projects such as oil pipelines.

Barriers to FDI are mainly in the form of ownership restrictions or regulatory discretion over mergers and acquisitions in specific sectors. The more general "net benefit test" has long been thought to have insignificant disincentive effects. However, its recent first-time use by the government to deny proposed investments in certain sectors (aerospace and potash) and subject others to questionable scrutiny (Target), relatively low thresholds for review in sheltered sectors (culture), and a lack of transparency in the review process, could have a dissuasive effect on future FDI and on openness to Canadian companies abroad (Bergevin and Schwanen, 2011). The federal government recently announced that targeted improvements to the administration of the *Investment Canada Act* will be introduced to enhance transparency while preserving investor confidentiality.

Canada has undergone much structural reform over the years, and pressing forward with remaining issues may be correspondingly difficult. A competitiveness council, as recommended by the Competition Policy Review Panel (2008), or else a national innovation council, as recommended by the Jenkins Panel (IPFSRD, 2011), could catalyse reform efforts, as the Productivity Commission did in Australia and most recently in New Zealand.

Is there a commercialisation gap?

The OECD Innovation Strategy accords a key role to new, young and entrepreneurial firms as exploiting opportunities neglected by more established companies (OECD, 2010b). Risk-taking is a defining characteristic of entrepreneurs. According to the 2009 Survey of Innovation and Business Strategy (SIBS) the risks and uncertainty of innovation outputs are the main impediments to undertaking it. Case studies have pointed to commercial failure as the most frequent cause of exit of innovative start-ups, which tend to be led by technically, rather than managerially, skilled people (Barber and Crelinsten, 2009). More generally, an apparently high degree of risk aversion in doing business, rooted in a fear of failure is one characterisation of Canadian social attitudes toward commerce. These attitudes are partly confirmed by surveys, which also point to a greater dependence on government help than on market opportunities for commercial success (Deloitte Research, 2011). The best way to stimulate willingness to take risk may be to boost competitive pressures and openness, as discussed above, and to complement this by enhanced attention to management training and diversity at all educational levels. More tertiary education in general is also needed (Chapter 2): Canada still lags in attainment of university degrees, whereas highly educated persons are much more likely to be owners of high-growth innovative firms (ICP, 2012).

Subsidies received by small Canadian-owned firms may be one way of targeting funding on the commercialisation gap. However, they are generally inefficient (IPFSRD, 2011). Business grant programmes have rarely been evaluated or culled, which has led to a proliferation of small and fragmented schemes at both federal and provincial levels. This points to the need to consolidate programmes and improve business access to them. It will be important to guard against the risks of "picking winners", especially as innovation support is being rebalanced toward more grants and strategic use of procurement, for example by ensuring competitive and open awards with safeguards against capture, *e.g.* by support of general-purpose rather than specific technologies.

Innovation can also help reduce the costs of avoiding environmental degradation

Green innovation displays positive externalities common to all forms of innovation but also reduces the negative externalities of environmental degradation (air and water pollution, climate change, biodiversity loss, etc.) and will in any case be needed if Canada is to transition to a low-carbon economy. The OECD Innovation Strategy (2010b) concludes that such policies can succeed only if a price is put on such environmental externalities, ideally in this case through a carbon tax or an emissions trading scheme. Such pricing corrects for externalities and can also be a source of government revenue. British Columbia, Québec and Alberta have moved a small way towards carbon pricing, and Alberta is also subsidising innovative technologies like carbon capture and storage, but this appears to require higher prices on carbon to be profitable.

The federal government has accorded substantial funding to clean energy projects and sustainable agriculture via genomics but is not prepared to impose generalised carbon pricing so long as the US government is uncommitted, given the very close economic linkages. It also provides direct support for green innovation to the private sector, for example by innovative procurement and by leadership in standards setting, which may also help create a critical mass of market demand. Other OECD governments have used schemes such as feed-in tariffs to motivate green commercial innovations, though with mixed success and sometimes heavy costs. The 2012 federal budget provided funding for several environmental initiatives and also proposed to speed up environmental assessment procedures for natural resource exploitation. This reinforces the need to balance environmental and economic growth objectives through price incentives.

Box 3. **Recommendations for enhancing innovation outcomes**

Priority recommendations:

- Fulfil commitments to fully open telecoms, and fully implement Chapter 7 (Labour Mobility) of the Agreement on Internal Trade (AIT) to ensure interprovincial mobility of regulated professions and skilled trades. Ease ownership restrictions in other network sectors, such as banking, broadcasting, culture, post and air transport.
- Further improve targeting of government support for business R&D by shifting funding at the margin away from the scientific research and experimental development (SR&ED) tax subsidies by lowering the refundable small firm rate toward the large firm rate. Use savings to reinstate capital costs in the eligible base and scale up direct grants.
- Subject the Industrial Research Assistance Programme (IRAP) and other R&D support programmes to rigorous cost-benefit evaluations. Consider user fees to recover the high costs of expert advice, especially as it nears the commercialisation stage associated with private benefits.

Other recommendations:

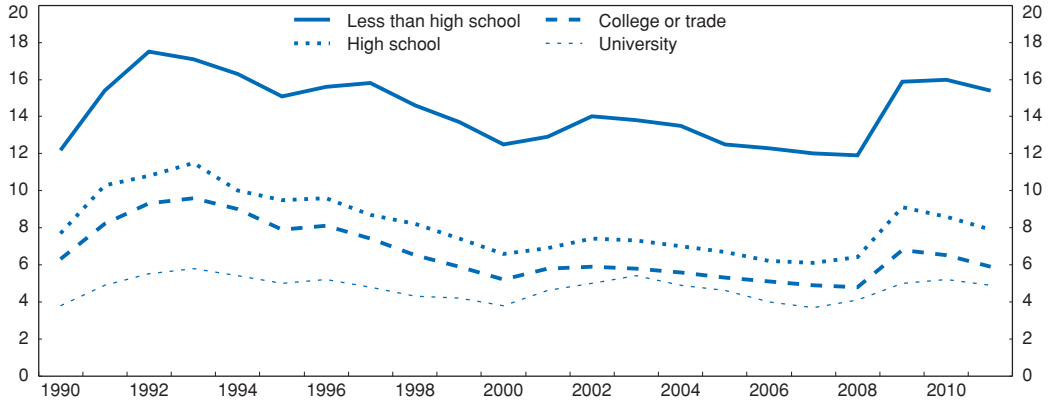
- Wind down public support to VC markets while attracting private funding and management through risk sharing. Phase out tax credits to labour sponsored venture capital corporations (LSVCCs).
- Encourage tertiary education institutions to include training in entrepreneurship and business skills in their science-based programmes.
- Encourage green innovation through demand-pull instruments, such as pricing of environmental externalities, notably in the areas of carbon emissions and water quality.

Strengthening higher education

Investing in education can bring substantial economic and social benefits, including higher wages and job satisfaction, fewer periods of unemployment, and improved health and quality of life. Wider benefits of a skilled workforce include higher productivity, innovation and economic growth, and stronger communities with greater civic engagement and social cohesion. In general, the less educated have faced more job loss, especially during downturns, than those with more credentials (Figure 15). Over time, educational disadvantages can thus translate into greater economic hardship and higher risks of poverty.

Figure 15. **Unemployment rate by education level**

Per cent



Source: Statistics Canada, *Labour Force Survey*.

StatLink http://dx.doi.org/10.1787/888932617873

Educational attainment is a key driver of economic performance. From the perspective that human capital is an input into the production function, it interacts with physical capital to affect the *level* of output (Lucas, 1988; Mankiw *et al.*, 1992). High-quality basic education is needed as a foundation for strong human capital acquisition. However, for growth and, especially, innovative growth, the high level of skills obtained in tertiary education is key (Nelson and Phelps, 1966; Aghion and Howitt, 2009). Hence, investments in advanced education would therefore generate the highest returns in the form of faster aggregate labour and multi-factor productivity gains (Coulombe and Tremblay, 2009a).

Empirical evidence supports a significant impact of educational attainment on growth in Canada. Coulombe and Tremblay (2001) find that about half of the difference in relative per capita income growth across provinces can be explained by differences in educational attainment. The skills acquired by one extra year of schooling are found to raise per capita income by about 5% (Coulombe and Tremblay, 2007). These results are similar to the 6% impact found in studies of OECD countries as a whole (Santiago *et al.*, 2008). However, while education levels may provide a good indicator of human capital (so long as attainment is not primarily a screening mechanism), it is the actual skills and knowledge acquired that matter for productivity. Therefore improving the quality of education may be at least as important as increasing attainment rates (Coulombe and Tremblay, 2009a).

Tertiary education attainment needs to continue to expand to meet long-term requirements

Canada boasts a highly educated population by international standards, thanks to a diverse range of tertiary education institutions consisting of universities, community colleges, polytechnics, university-colleges, and private career colleges. Compared to other countries, the country has a large college (non-university tertiary) sector. Colleges differ from universities in that their programmes tend to be shorter in length and emphasise practical, technical and occupational training for the labour market. While colleges typically grant diplomas and certificates rather than degrees, a small but growing subset of "polytechnic" institutes has emerged that grants baccalaureate degrees and differentiates itself by its focus on applied research for industry. Meanwhile, university-colleges exist mainly in western provinces and provide primarily teaching-focussed undergraduate programmes.

Long-term demographic trends suggest that tertiary education participation rates will need to continue rising to maintain the supply of skilled labour. The rapidly changing needs of a knowledge-based economy and imminent retirement of the baby-boom cohort are likely to create a widening demand for workers with tertiary attainment as well as management skills. Meanwhile, a shrinking youth population implies that growth in the supply of skilled labour will require encouraging participation in tertiary education for currently under-represented groups such as those from low-income families with no history of higher education, mature students and Aboriginal students.

Given the continually evolving skills demanded by a knowledge-based economy, the tertiary sector will need to provide more flexible entry points and pathways for students seeking to upgrade their skills throughout their careers (OECD, 2011b). Education is a responsibility of the provinces and territories (although the federal government plays an important funding role). The provinces have a well functioning co-ordinating body, the Council of Ministers of Education, Canada (CMEC). The provincial educational systems have undergone rapid but differentiated growth, giving rise to a plethora of different types of institutions to meet the labour market's increasingly diverse needs.

While this differentiation is a strength, it can hinder mobility for students wishing to transfer credits across institutions and thus limit pathways to human capital accumulation. Although studies suggest that the system already accommodates a considerable amount of student movement (Finnie *et al.*, 2012), provincial systems vary widely in the ease with which credits can be transferred across institutions. Providing more flexible access will thus require further co-ordination to facilitate credit transfer both inter-provincially and across different types of institutions within provinces. Inter-provincial transfer agreements have been established among western provinces and among Atlantic provinces, which can serve as models for others. Ontario has also announced significant funding to set up a framework to guide the credit transfer system toward a web-based portal. And the CMEC Working Group on Credit Transfer aims to develop a pan-Canadian system over time.

University participation rates in Canada vary to a large extent with socio-economic status, and factors such as parental education levels play an important role. The combination of fairly modest tuition fees and the student loan system is generally successful at eliminating much of the influence of parental income on tertiary participation, as evidenced by Canada's high level of intergenerational mobility relative to other OECD countries (Causa and Johansson, 2009). However, it is not sufficient to

completely level the playing field as far as financing is concerned. Individuals from disadvantaged backgrounds may be more debt-averse and sensitive to changes in the cost of education (Carmichael and Finnie, 2008; Palameta and Voyer, 2010), suggesting that an effective grant system, in addition to loans, is important for lowering access barriers for these students. Ontario has also responded by offering lower tuition to students from less affluent backgrounds. Equality of access could be improved by increasing the transparency of the grant application process, while stepping up efforts to deliver information to low-income families at an early stage to help them understand the benefits of higher education and their options to finance it, as Ontario and British Columbia are doing with the Life After High School project. Expanded grants to disadvantaged students could be funded by reducing education tax credits, which are not means tested.

Immigration may be an under-utilised source of skilled labour

Immigration can provide an important source of knowledge diffusion while improving labour-supply flexibility; it is likely to become increasingly important as the workforce ages. Over the past three decades the labour market outcomes of immigrants to Canada have declined (Picot and Sweetman, 2012). Many recent arrivals have had difficulty finding employment, and their average earnings have gone down over time, particularly among men. Research has shown that there is no single explanation for this earnings decline, pointing instead to a number of factors such as a shift in source countries, weak language skills and the high-tech bust of the early 2000s. Moreover, immigrants may also encounter difficulties with employers not recognising their foreign credentials, even if they have been admitted through Canada's points-based immigration system. In recognition of these challenges, the Canadian government has made changes to the country's immigration policies and put greater emphasis on criteria such as language skills proven to lead to better immigrant outcomes. Canadian governments have also launched several initiatives in recent years to provide employers with guidelines for assessing foreign credentials and hiring internationally trained workers.

As immigrants who study in Canada have better labour-market outcomes that those who study abroad (Rollin, 2011), this Survey recommends that a greater share of immigration should come from foreigners studying at Canadian tertiary institutions (TEIs). Canadian governments have made welcome progress in this direction over the past few years. In 2008, Citizenship and Immigration Canada introduced the Canadian Experience Class, which facilitates the attainment of permanent resident status for foreign students who have studied at a Canadian TEI and following graduation have acquired at least one year of full-time (or full-time equivalent) skilled work experience within the last two years. Moreover, international students enrolled in a PhD programme in Canada, and who have completed at least two years of study towards a PhD, have been since November 2011 eligible to apply for permanent residence. Several provinces also have the Provincial Nomination Program to fast-track permanent residency for international graduates, often conditional on having a full-time job offer in their field of study. Preliminary results suggest these programmes are helping to improve labour-market outcomes for recently arrived immigrants (Sweetman and Warman, 2009).

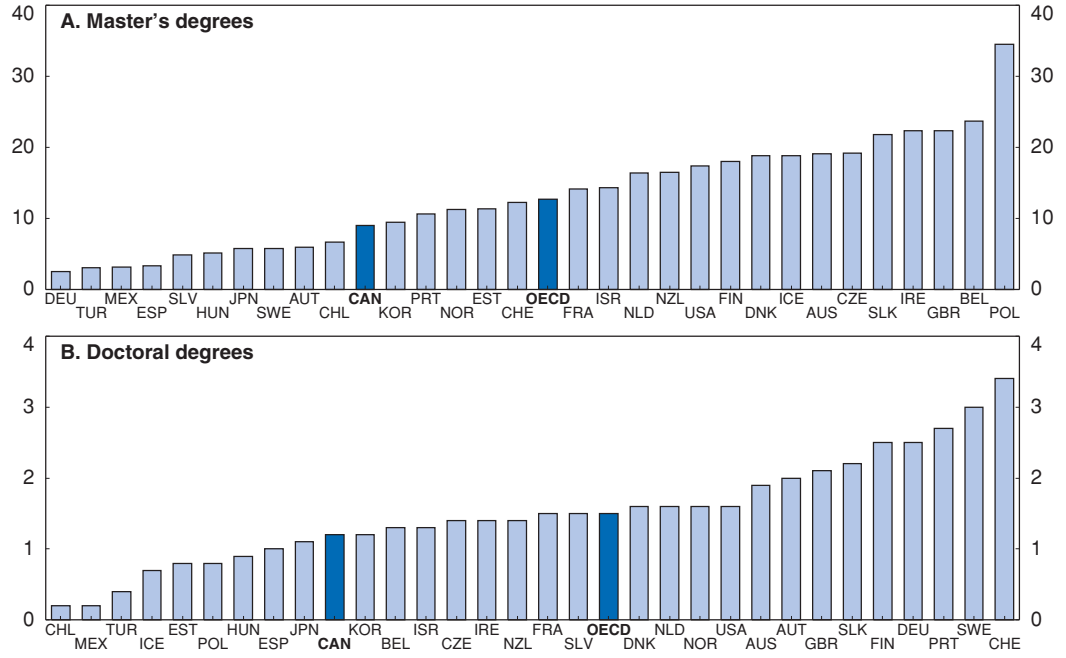
Strengthening skills for innovation

Innovation draws upon a wide range of competences, including subject-specific skills, thinking and creativity skills, and social and communications skills (OECD, 2011d). Improving innovation performance in Canada will require a workforce with more of both

advanced and multi-disciplinary skills. However, Canada lags its peers in the attainment of master's and doctoral degrees (Figure 16), as well as in the development of business and entrepreneurial skills. While the country performs well relative to the OECD average in producing advanced science and technology degrees, significant and in some cases rising earnings premiums for graduates in computer science and business fields suggest that demand for these graduates may be increasing faster than their supply (Walters and Frank, 2010). In addition, a deficiency appears to exist in the availability of tertiary graduates who possess the right combination of skills demanded by employers, including technical skills, industry experience, business acumen and communications skills (Information and Communications Technology Council, 2008).

Figure 16. **Graduation (attainment) rates for Master's and PhD programmes, 2009**[1]

Graduation (attainment) rates for single year of age, by programme



1. The term graduation rate is used in its OECD sense of attainment rate for a specific cohort.

Source: OECD (2011), *Education at a Glance 2011*. StatLink http://dx.doi.org/10.1787/888932617892

Strategies to foster a high-quality system

While funding for TEIs comes primarily from provincial governments, over time there has been a shift towards greater contributions from tuition fees. On the whole, public and private cost shares of tertiary education appear to be reasonably distributed based on similar monetary rates of return on private and public investment. Even if average university tuition fees across Canada are in the middle of the range for OECD countries, some provinces could benefit from evaluating whether their low-tuition policies have undermined institutional quality and competitiveness, particularly in the context of strained government finances.

TEIs contribute to innovation through two main channels: research (knowledge creation) and skills development (knowledge diffusion). In Canada, increasing policy emphasis on innovation has generally shifted government funding for TEIs away from core operating activities towards research: sponsored research as a share of total government

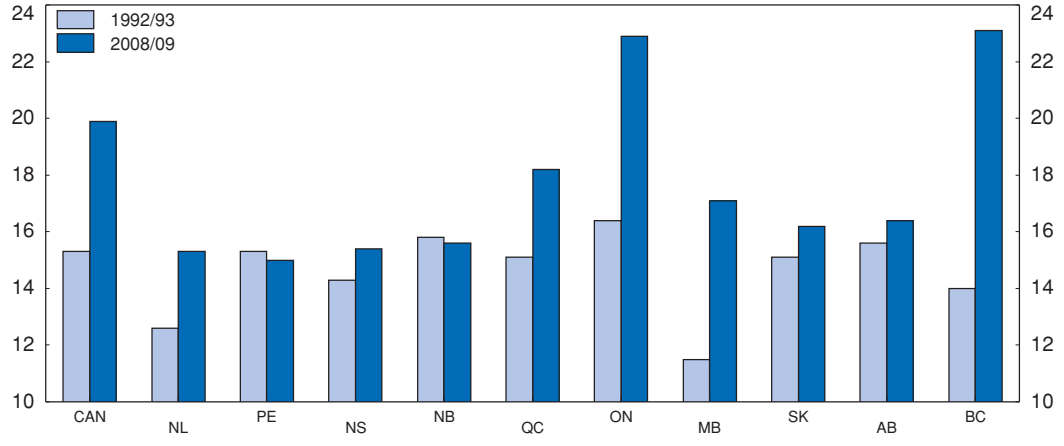
funding to universities rose from 13% in the early 1990s to over 25% by the mid-2000s (though this proportion subsequently declined somewhat). Research output in the higher education sector has improved notably over the past decade.

As a result Canada has a strong research capacity centred on its universities: per capita academic publications, quality-adjusted for journal ranking, is 10th highest in the world, and near the top in some cutting-edge areas of research, notably in life sciences (OECD, 2012c). Yet, however successful on its own terms, this does not seem to have translated into a stream of innovative commercial products, even though there are some outstanding exceptions. There are two main levels of technology transfer (TT): i) from universities or public research institutions to business, typically via TT offices trying to market university-generated patents, or by various forms of collaboration including internships, co-op programmes, research contracting, incubators, science parks, etc.; and ii) from business to business, most often via leasing or sale of intellectual property (IP) to allow an efficient specialisation across research and commercialisation functions. Such flows may occur domestically or, increasingly, internationally, including via inter-governmental collaboration.

Canada faces challenges in improving its TT systems. Academics should be provided with stronger incentives to produce research relevant to business needs, starting with the peer-review granting process, then sharing their IP with business through collaborative efforts and finally having some form of ownership rights over their patented inventions. Business should be encouraged to discover what academia has to offer in terms of research skills ready for business use, perhaps by means of integrated one-stop shops, as proposed by IPFSRD (2011). By putting firms in the position of demanders of research products, a system of business vouchers (in lieu of tax credits) to purchase or contract for R&D with both academics and other business could help to focus more research on business needs.

However, funding constraints have driven up ratios of full-time students to full-time university faculty, especially in Ontario and British Columbia (Figure 17) as full-time faculty have shifted some of their focus from teaching to research. Universities have been moving to larger class sizes, more sessional lecturers and increased reliance on less time-consuming evaluation instruments (such as multiple-choice examinations). There is some risk that these trends may hinder students from fully developing the skills needed for innovation, although evidence on this point is scarce. Policymakers and TEIs need, therefore, to evaluate

Figure 17. **Ratio of university full-time students to full-time faculty**



Source: Statistics Canada.

StatLink http://dx.doi.org/10.1787/888932617911

the effects of such increasingly widespread changes in teaching approaches and try to balance the demands of research with those of teaching. In the presence of tight budget constraints, resolving this issue is likely to require ways to increase the efficiency of both teaching and research. Creating greater differentiation between TEIs that engage in research and those that focus on teaching may help strengthen overall quality by allowing institutions to specialise by targeting resources on their areas of comparative advantage.

Such initiatives should be complemented with funding and efforts to improve the quality and availability of educational data (including on the relative costs on teaching and research) at a system-wide level. Provinces vary considerably in the availability of comparable data on student outcomes and institutional performance because their data systems are designed to respond to the internal demands of their respective jurisdictions. CMEC and Statistics Canada have an ongoing partnership through the Canadian Education Statistics Council (CESC) to improve Canadian data on education. These deficiencies create challenges both for students to evaluate the quality of TEIs and make informed choices about their educational pathways, and for policymakers to ensure accountability for public funds. Certain provinces are taking welcome steps to develop universal student identifiers to track student outcomes and movements across institutions. However, data collection needs to be co-ordinated at the national level, preferably by Statistics Canada working with CMEC through the CESC, to ensure harmonisation and comparability and improve inter-provincial student mobility.

Box 4. **Policy recommendations for improving tertiary education**

Priority recommendations

- Improve access for disadvantaged groups by increasing targeted need-based financial assistance, which may be funded with reduced education tax credits where public finances are constrained. Reduce barriers for debt-averse financially disadvantaged students by increasing the transparency of the aid application process. Further, lower barriers for risk- and debt-averse students by providing relevant and reliable information to support their learning and career choices.
- Allow a greater share of immigrants to enter through the tertiary education system as foreign students, along with efforts to expand opportunities for them to work and obtain permanent residency after graduation.
- Consider implementing, according to the particular needs and priorities of each province and territory, greater differentiation between institutions that engage in research and those that focus primarily on teaching for its potential quality and efficiency benefits.

Other recommendations

- Promote a more flexible delivery model of higher education to encourage skills upgrading through continued efforts to strengthen credit-transfer arrangements for TEIs within and between provinces.
- In provinces with constrained public finances, evaluate whether tuition policies undermine institutional quality and competitiveness.
- Allocate more funding to Statistics Canada to co-ordinate data collection on TEIs and student outcomes at a nation-wide level.
- Motivate technology transfer from academia by adopting demonstrated best-practice models for university patenting, a research-granting process more open to the needs of business and a system of vouchers for research contracting.

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ANNEX A1

Progress in structural reform

This annex reviews action taken on recommendations from previous *Surveys*. Recommendations that are new in this *Survey* are listed in the relevant chapter.

Recommendations	Action taken since the previous *Survey* (September 2010)
BUSINESS TAXATION	
Switch from provincial sales taxes to value-added taxes (VAT). Change tax mix to rely more on VAT and less on less efficient income and profit taxes.	Ontario and British Columbia eliminated their retail sales taxes and adopted the federal Harmonised Sales Tax as of 1 July 2010. However, British Columbia has decided to return to its previous sales tax regime on 1 April 2013 following a referendum on the issue. In its 18 April 2012 budget, the government of Prince Edward Island indicated that it is entering into formal negotiations with the federal government to implement the Harmonized Sales Tax (HST) in the province, effective 1 April 2013.The federal corporate income tax rate was cut from 18% to 16.5% for 2011 and 15% for 2012, bringing the combined federal-provincial statutory corporate income tax rate from an average of 29.4% in 2010 to 26.1% in 2012.
Continue to rationalise the federal and provincial business tax preferences (special low rates, accelerated Capital Cost Allowance (CCA), deductibility of provincial royalty payments, etc.) to sectors like manufacturing and natural resources, and to small scale, Canadian owned firms.	Legislation has been amended to phase out the accelerated CCA for tangible assets in oil sands projects over the 2011-15 period. Legislation has also been amended to reduce the deduction rates for intangible capital expenses in oil sands projects to align them with the rates applicable in the conventional oil and gas sector (this change will be fully implemented by 2016). A temporary accelerated CCA treatment applying to manufacturing and processing machinery and equipment has been extended for two years for acquisitions made before 2014. Cuts in the general corporate income tax rate between 2000 and 2012 result in a 75% fall in the differential between the general corporate income tax rate and the small business rate at the federal level.
Continue to move toward the elimination of the preferential federal tax treatment for mining. Re-examine the tax treatment of exploration and development costs as well as flow-through shares. Review royalty regimes.	The temporary Mineral Exploration Tax credit for flow-through share investors was extended through 31 March 2013. The 2012 budget also proposed to phase out by 2016 both the Atlantic Investment Tax Credit for mining and oil and gas and the Corporate Mineral Exploration and Development Tax Credit.
PERSONAL TAXATION	
Eliminate GST zero rating for basic groceries	No action taken.
PRODUCT MARKET COMPETITION	
Lift restrictions on foreign direct investment in airlines, telecommunications and broadcasting.	In the 2012 budget, the government announced that it would lift foreign investment restrictions for telecommunications companies that hold less than a 10% share of the telecommunications market.
Minimise use of industrial subsidies, and scale back business assistance programmes to those that address a real market failure at minimum economic cost.	No action taken.

Recommendations	Action taken since the previous *Survey* (September 2010)
FISCAL POLICY AND FISCAL FEDERALISM	
Make more use of property taxes and user fees by municipalities, while easing the property tax burden on business. As their tax base becomes more sustainable, reduce local authorities' reliance on provincial transfers by granting them more revenue-raising powers.	No significant action taken.
Consider establishing provincial budget agencies or an agency reporting to the Council of the Federation that provide(s) independent analysis of fiscal forecast and cost estimates for policy proposals.	No action taken.
Continue working toward a more stable, rules-based system for determining transfers to provincial governments.	In December 2011 the federal government announced that it would continue to raise the Canada Health Transfer (CHT) by 6% per year until 2016-17. Thereafter it will grow in line with a three-year moving average of nominal GDP growth with a minimum guaranteed rate of 3%. The federal government will extend the current 3% annual escalator for the Canada Social Transfer (CST) to 2014-15 and subsequent years. Equalization transfers will continue to grow in line with the rate of growth of nominal GDP. Territorial Formula Financing (TFF) will remain on its sustainable growth path, growing according to its legislated formula.
SOCIAL AND LABOUR-MARKET POLICIES	
Ban contractual mandatory retirement.	The *Canadian Human Rights Act* and the *Canada Labour Code* were amended in 2011 to prohibit federally regulated employers from setting mandatory retirement ages.
Remove the differential treatment for public funding of for-profit and non-profit childcare in provinces where such differentials still exist.	No action taken.
Introduce employer experience rating into Employment Insurance (EI), or scale back access to it for seasonal and temporary workers.	The federal government has announced plans to significantly tighten EI rules based on a worker's history of use of EI benefits. The longer and more frequently someone has previously claimed employment insurance, the broader their job search will have to be and the lower the wages they must be willing to accept.
ENERGY AND ENVIRONMENTAL POLICIES	
Continue to make more use of market instruments. Consider introduction of a (federal) GHG emissions tax. Lower levels of government could also implement more green taxes and congestion charges.	The federal government currently has no plans to introduce a carbon tax or a cap-and-trade system. It is aligning its climate and energy policies with those of the United States and is implementing a sectoral regulatory approach as in the United States. To date, GHG regulations have been finalised for light vehicles, drafted for coal-fired power generation, and are being developed for new heavy vehicles, and the oil and gas sector. British Columbia and Québec have introduced levies on fossil fuels. Québec has also adopted regulations to establish a cap and trade system, and Alberta has implemented a greenhouse gas emission trading scheme. In December 2011, Canada formally announced its intention to withdraw from the Kyoto Protocol effective in December 2012.
Regularly review water pricing and rights to ensure efficient use. Check that Alberta's water allocation and licence transfer processes reach conservation objectives while minimising effects on oil sands developments.	Results from surveys and reports show that Canadian municipalities are providing more appropriate market signals, resulting in an efficient amount of water conservation. Water use in the oil sands areas is regulated through a system of licensing and monitoring. The interim Water Management Framework prescribes when, and how much, water can be withdrawn from the Lower Athabasca River for oil sands mining. Oil sands projects in northern Alberta recycle up to 90% of the water used in their operations.
Monitor emissions in the transport sector. Introduce a (carbon) fuel tax in addition to standards.	Both federal and provincial levels of government levy excise or product taxes on motor fuels. Québec and British Columbia have also introduced separate carbon-related levies linked to their specific environmental objectives.
Liberalise electricity markets in provinces where they are still regulated. Liberalise trade in energy goods and services among provinces by finalising the energy chapter of the Agreement on Internal Trade.	No action taken.
Review the efficiency of the policy of promoting corn and cellulosic ethanol and other biofuels. Rather than mandate use, offer increased research subsidies or prizes for technological breakthroughs if a carbon tax or permit trading infeasible in agriculture.	No action taken.
Review the oil sands tenure process regularly and remove the exploration/production requirement to make the system consistent with Alberta's sustainability objectives.	No action taken.

Recommendations	Action taken since the previous *Survey* (September 2010)
AGRICULTURAL POLICIES	
Phase out the supply management regimes by progressive introduction of market forces, in particular, by shrinking single commodity transfers for milk and eggs.	No action taken.
Consider the use of business risk-management tools to replace government safety-net programmes that serve to build up moral hazard and place a heavy burden on the budget.	No action taken.
FINANCIAL-SECTOR POLICIES	
Balance strengthened bank regulation with market-based incentives to address "too big to fail" moral hazard.	The Office of the Superintendant of Financial Institutions published an Advisory for Non-Viability Contingent Capital (NVCC) setting out the principles governing inclusion of NVCC instruments in regulatory capital and an overview of criteria for triggering its conversion. Draft recovery and resolution plans are being developed for the six largest banks.
Establish a national securities regulator, with strengthened efforts to get the consensus of all provinces.	Legislation was proposed but rejected by the Supreme Court in December 2011 on constitutional grounds. The federal government is consulting with the provinces and territories as to how a common securities regulator can be established consistent with the Court's decision.
HEALTH-CARE POLICIES	
Eliminate zero patient cost sharing for core services by imposing co-payments and deductibles.	No action taken.
Clarify the Canada Health Act to facilitate private entry in hospital services and mixed public/private physician contracts.	Provinces are increasing their purchases of hospital services from private providers. Ontario plans to shift routine procedures currently done in hospitals to cheaper non-profit clinics.
Replace historical-based cost budgeting of Regional Health Authorities (RHAs) with a formula-based approach.	Several provinces are refining their models of funding RHAs.
Devolve integrated budgets for hospital, physician and pharmaceutical services to RHAs.	Local Health Integrated Networks (LHINs) in Ontario have been given more planning responsibilities for primary care. In British Columbia, Divisions of Family Practice have been set up to integrate the work of health authorities and family practitioners.
Introduce an element of capitation or salary for doctor payment together with fees regulated by RHAs.	While most medicine is on a fee-for-service model, alternative clinical payments (including capitation) accounted for 26.9% of total payments in 2008-09. 63% of Ontario physicians receive some of their income from capitation.
Move to activity-based budgets for hospital funding, contracting with private and public hospitals on an equal footing. Adjust overall budget caps up to reward efficiency.	The three largest provinces (Ontario, Québec and British Columbia) have either implemented or announced their intention to implement activity-based funding for hospitals.
Control prices for generic drugs at international benchmarks.	Generic pricing varies widely across Canadian public drug plans because reimbursement policies vary. However, this heterogeneity has been decreasing significantly since 2010. In the four largest provinces, price reductions have been applied to public and private plans as well as cash-paying customers. In sum, Canadian generic price controls are moving closer to international benchmarks.
Revise public core package to include essential pharmaceuticals and eventually home care, selected therapy and nursing services.	The Mental Health Commission has published a long-awaited national mental health strategy, calling for CAD 4 billion annually in new funding for mental health care.
Regulate private health insurance (PHI) to prevent adverse selection, and remove tax exemptions for employer PHI benefits.	No action taken.
Accelerate the applications of information and communications technologies in health care.	Over the past decade the federal government has spent over CAD 2 billion on Canada Health Infoway to support the development of electronic health ICTs. At end-2011 over half of all Canadians had electronic health records.
Establish a pan-Canadian independent agency to monitor and analyse health-care quality.	No action taken.

Chapter 1

Unleashing business innovation

This chapter discusses how to improve Canada's business innovation in order to boost labour productivity and output growth. Many general framework conditions are highly favourable to business risk-taking and innovation, including macro stability, openness, strong human capital, low corporate tax rates, low barriers to firm entry and flexible labour markets. However, they can be improved further by reduced external and interprovincial barriers in network and professional service sectors, more efficient capital markets, fewer capital tax distortions and improved patent protection. A second focus should be on ensuring that incentives arising from government subsidies are targeted on actual market failures. The very high level of support to business R&D via the federal Scientific Research and Experimental Development (SR&ED) tax credit and provincial top-ups may weaken the incentives of small firms to grow and should be redesigned. A plethora of small, fragmented granting programmes, mainly geared to SMEs, should be streamlined for better academic-business collaboration. The large public share in venture capital should be wound down, as it may crowd out more productive private finance. A final focus should be on boosting manager and worker skills that are intrinsic to all forms of innovation, by filling gaps in training, mentoring and education.

Innovation is the key long-run driver of productivity and income growth. It is likewise the main means of confronting looming structural challenges in Canada and other OECD countries. Innovation to boost product quality and variety will enable Canada to stay competitive against formidable new global suppliers; breakthroughs in agriculture and energy seem to be more necessary than ever to reach the elusive goal of green growth; and radical cost-reducing innovations in health-care organisation and delivery are needed for the affordable care of ageing populations.

At the same time, global economic forces may be acting to constrain innovation in Canada (Rao, 2011). Alongside sluggish recovery in the OECD, which accounts for the bulk of Canada's export markets, strong non-OECD growth has induced large terms-of-trade shifts for Canada, causing resources to move from areas of increasing returns to scale (tradeable manufactures) to those of diminishing returns (exhaustible resources). This reduces aggregate R&D capacity and contributes to environmental degradation. Competition for highly skilled people worldwide, including by the large emerging markets, is increasing while their supply within the OECD is shrinking due to accelerating baby boomer retirements. This may hamper businesses' ability to innovate and adopt technology. Hence, policies should be oriented to providing a domestic environment that is conducive to innovation and human capital accumulation.

Innovation is most likely to flourish under sound structural conditions. There may be various reasons for more specific public intervention that provides a framework for innovation by private business and accords an appropriate level of protection to its fruits while encouraging their diffusion (OECD, 2007). Public subsidies can help to overcome the failure of financial markets to invest sufficiently in intangible assets, which are hard to value and plagued by information asymmetry problems, yet in the case of business R&D have strong spill-overs. Public policy can further assist the transition to a knowledge economy through provision of vital public goods like education and basic research (Chapter 2), while compensating the lower skilled and others who are made worse off as a result of technological change. All OECD countries currently implement a mix of policies aimed at supporting innovation, and many are reinforcing them in light of the global crisis.

The Canadian productivity paradox

A striking paradox that has baffled Canadian policy makers and researchers alike is this: despite rich natural and human-capital endowments, generally strong institutions, social capital and policy fundamentals, deep economic integration with the technology leader (the United States), and ample public spending in support of innovation, Canada's business innovation activity is by any aggregate measure lacklustre, and productivity growth has persistently lagged behind that of its OECD peers.

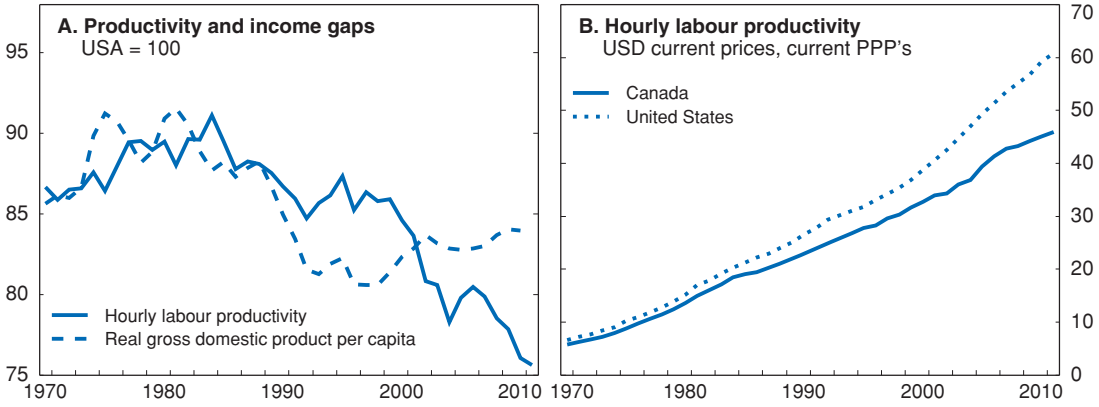
Canada is one of the few OECD countries to trail the United States in productivity growth over a long period of time. Comparisons with the United States are compelling for two reasons. First, similar geography, endowments, free-market institutions, cultural and

social affinities, high cross-border labour mobility and close trade and investment linkages might on the whole point to expected convergence rather than divergence. Second, efforts have been made by the Canadian statistical authorities to correct for numerous inconsistencies *vis-à-vis* the United States in the measurement of real output, labour and capital inputs, and although measurement issues remain, notably regarding PPP price deflators, quality adjustments for ICT and capital depreciation rates (Baldwin and Gu, 2009; Tang *et al.*, 2010), they mainly affect comparisons of productivity levels rather than growth rates.

Persistently weaker Canadian productivity growth since around the mid-1980s has opened up a significant and widening gap in productivity levels with the United States (Figure 1.1). As the latter is Canada's major competitor, this has contributed to rising relative unit labour costs in Canada. The Canada-US productivity growth gap can be entirely attributed to a longstanding multi-factor productivity (MFP) growth shortfall (Table 1.1). Capital deepening, except in the recession of 2008-10, and improvements in labour quality (as measured by changes in educational attainment rates) have been somewhat stronger in Canada. By 2010, the capital intensity of the Canadian economy was some 110% of the US level, whereas MFP was only about two-thirds as large.

Figure 1.1. **Economic performance of Canada relative to the United States**

Total economy



Source: Centre for the Study of Living Standards (2011), *Aggregate Income and Productivity Trends, Canada vs United States – www.csls.ca/data/ipt1.asp*; *OECD Annual National Accounts Database* and OECD calculations.

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Table 1.1. **Decomposition of Canada-US gap in average annual labour productivity growth**

Differences in percentage growth rates: Canada minus the US, business sector

	1961-2010	1961-1980	1980-2000	2000-07	2008-10
Gap in labour productivity growth	–0.2	0.4	–0.4	–1.7	–2.8
a) Capital deepening	0.3	0.8	0.2	0.1	–1.0
b) Workforce composition	0.2	0.4	0.1	0.1	0.0
c) Multifactor productivity	–1.0	–1.0	–0.6	–1.8	–1.8

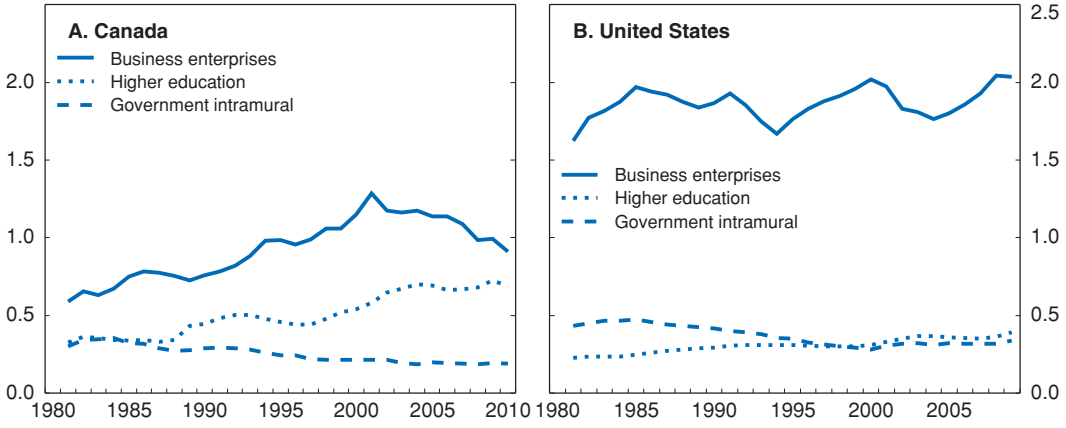
Source: US Bureau of Labor Statistics and Statistics Canada.

MFP can be broken down into three components: average returns to scale, allocative efficiency effects and a technological residual (Basu, 2010). The last can be viewed as the benefit of innovation proper and is in turn a function of factors like public infrastructure, the "free" receipt of knowledge externalities from academe and other firms, management and organisation, human capital of workers and managers, "own" R&D and other investments. Policies to boost productivity should be targeted at all three components: firm growth, resource mobility and innovation. This chapter will focus on innovation, though all three channels are mutually reinforcing and tightly bound. For example, adjustments to economic shocks occur via innovations to adapt to the new conditions but also depend on the ability to reallocate resources to successful innovators, allowing them to grow and prosper, while less adaptive firms exit (Andrews and de Serres, 2012). Thus, many factors influencing innovation will also affect resource allocation and growth capacities.

Empirical studies suggest that the Canada-US MFP gap is related to three underlying and interdependent gaps in: R&D; machinery and equipment (M&E) investment, in particular ICT; and human capital, specifically university education attainment of the working population which is 31% higher in the United States (Rao, 2011). Business expenditure on research and development (BERD) is often considered to be the best single predictor of MFP growth (Jaumotte and Pain, 2005). Canada's BERD intensity is less than half of its US counterpart, and since 2001 it has steadily declined, whereas that of the United States initially dipped but then bounced back (Figure 1.2). Both countries' R&D capacities were strongly shocked by the bursting of the ICT bubble in 2001, but Canada was harder hit by the subsequent commodity price boom and exchange-rate appreciation, which induced resources to move from manufacturing (which is R&D intensive) to mining and oil and gas extraction (which are not). Higher education expenditure on R&D (HERD) in Canada has grown steadily since the early 1980s, while government expenditure on R&D (GERD) has drifted downwards; the opposite pattern can be seen in the United States. These various gaps may reflect differences in economic structure, but only partly (see below).

Figure 1.2. **Research and development expenditure**

As a percentage of GDP



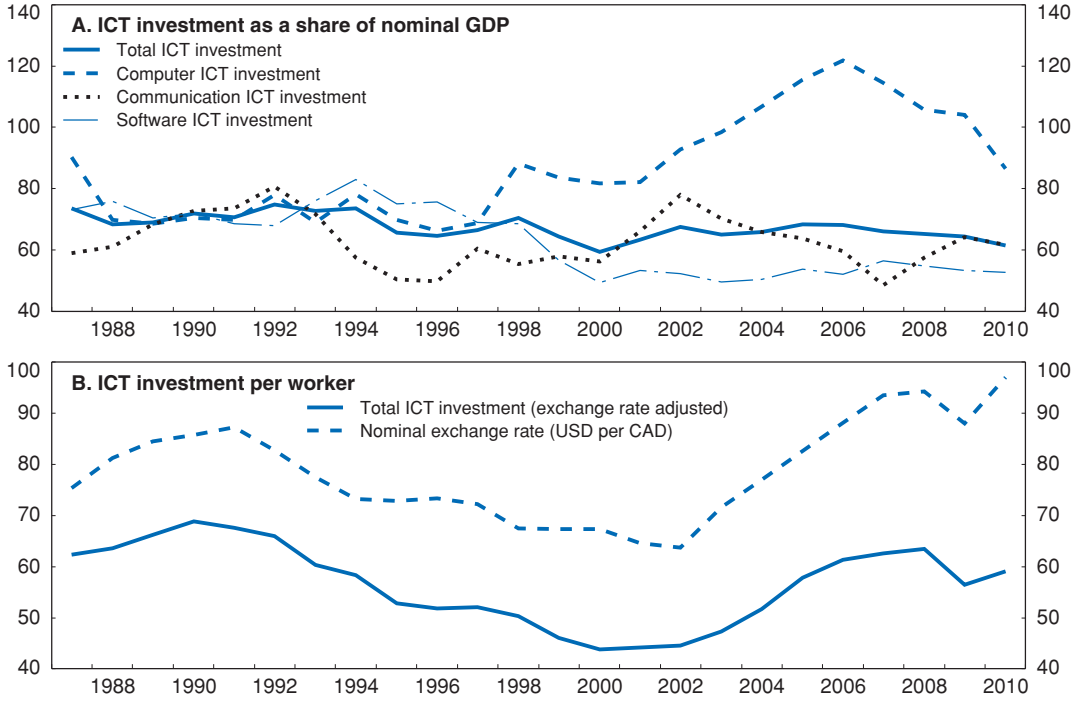
Source: OECD.stat, *Main Science and Technology Indicators Database*.

StatLink http://dx.doi.org/10.1787/888932617949

Research has found a significant positive correlation across Canadian industries between the MFP and ICT capital-intensity gaps (Rao *et al.*, 2008). The wide gap in ICT investment per worker displays a marked correlation with the exchange rate, likely reflecting that during the long period of currency weakness, the cost of ICT capital (most of which is imported) was inflated relative to the cost of labour, and conversely since the dollar has appreciated (Figure 1.3, Panel B). Within non-M&E, the Canadian advantage reflects engineering capital (pipelines, utilities, oil and gas sector, etc.), the intensity of which is four times the US level (Baldwin and Gu, 2009).

Figure 1.3. **ICT investment in Canada relative to USA**

USA = 100



Source: Centre for the Study of Living Standards, database for *information and communication technology*; OECD (2011), *Economic Outlook 91 Database*.

StatLink http://dx.doi.org/10.1787/888932617968

The Canada-US productivity gap might reflect structural composition, as opposed to a systemic problem. While such structural differences may explain a part of the gap, research indicates that it is not large, while the *levels gap in MFP* is widely spread across the economy. Negative gaps are particularly large (30-50% below the US level) in sheltered sectors like utilities, information and culture, arts and entertainment, and professional, scientific and technical services and high-tech manufacturing, which also tend to be highly knowledge intensive and dynamic, exhibiting increasing returns to scale (Table 1.2). While a number of sub-sectors show productivity near or above US MFP levels, notably oil extraction, manufacture of raw materials, food processing, and services open to competition (*e.g.* construction, wholesale trade, waste management), many of these are at the lower value-added end of production.

Table 1.2. **Labour productivity, multifactor productivity and capital intensity comparisons**

USA = 100

Sector or Industry	Labour productivity		Multifactor productivity		Machinery and equipment	ICT
	2002	2007	2002	2007	2000-07 average	2000-07 average
Goods sector						
Agriculture, forestry, fishing and hunting	85.5	86.4	82.8	86.2	70.5	79.1
Mining	88.9	88.0	79.3	72.5	80.0	31.2
Mining, except oil and gas industry	58.1	47.3	52.2	39.4	57.0	35.1
Oil and gas extraction industry	87.9	81.6	94.9	100.3	100.5	25.6
Utilities	76.5	62.7	53.9	49.0	51.0	73.6
Construction	149.5	192.5	151.8	196.9	79.2	14.7
Manufacturing	84.4	73.2	91.1	77.2	91.1	36.6
Service sector						
Wholesale trade industries	73.7	90.0	97.8	120.3	29.9	45.6
Retail trade industries	81.3	75.6	95.3	85.5	70.4	72.1
Transportation and warehousing industries	123.8	108.1	112.5	96.7	86.8	19.7
Information and cultural industries	64.5	46.6	69.9	52.3	82.8	98.5
FIRE[1] and management of companies industries	70.0	72.1	75.7	74.9	105.4	72.2
Professional, scientific and technical services industries	45.4	38.6	54.0	47.6	45.7	42.3
Administrative and waste management industries	113.5	107.6	144.1	126.2	39.9	49.9
Education, health care and social assistance industries	99.4	95.9	102.0	98.0	34.2	17.8
Arts, entertainment and recreation industries	39.6	39.0	49.4	47.9	39.3	128.7
Accommodation and food services industries	74.1	72.2	85.2	78.8	28.3	47.1
Other services (except public administration) industries	145.3	143.8	181.6	178.3	61.1	102.1
Average for all sectors and industries (business sector)	77.3	72.1	75.4	68.5	74.5	47.9

1. FIRE stands for finance, insurance, real estate and leasing.

Source: Tang *et al.* (2010).

Given the sheer magnitude of the 2002-12 terms of trade uptrend, it could be hypothesised that the decade's fall in MFP is just a composition effect in response to the workings of comparative advantage. However, over time, the within-sector effect appears to dominate the effect of changes in composition for the business sector as a whole (Table 1.3). Much of the weakness is accounted for by the mining sector, where MFP fell by over 6% at an annual rate as high oil prices made profitable the exploitation of marginal reserves of a depleting resource.

Firm turnover and growth are an important source of MFP growth. For the United States and other countries, entry and exit rates facilitate aggregate productivity growth by the process of creative destruction. This process may not be as effective in Canada as in the United States. Specifically, Leung and Cao, (2009) find that, contrary to the United States, job creation and destruction are negatively correlated in Canada, implying that job destruction following economic shocks is associated with slower redeployment, and possible product- or labour-market rigidities. A major source of firm dynamics is also in the middle of the size distribution. There is little direct evidence as yet on the impact of firm dynamics on the Canada-US productivity gap (Rao, 2011). However, the unincorporated sector (sole proprietorships and partnerships) is responsible for a sizeable portion of the Canada-US productivity gap: self-employment, which is less productive, is relatively high in Canada, and partnerships are much less productive than in the United States. As unincorporated firms are often at the first stage in their life cycles, the gap in productivity

Table 1.3. **MFP growth decomposition**

	Value-added share		MFP (index 2002 = 100)		Within-sector effect	Shift-share effect[1]
	2000	2008	2000	Per cent annual growth 2002-08		
Agriculture, forestry, fishing and hunting	2.9	2.4	109.7	1.68	0.05	–0.51
Mining and oil and gas extraction	7.9	13.4	110.3	–6.25	–0.49	5.68
Utilities	3.4	3.0	91.7	0.34	0.01	–0.40
Construction	6.5	9.3	94.8	–0.72	–0.05	2.68
Manufacturing	24.4	15.0	102.3	–0.71	–0.17	–9.49
Wholesale trade	6.6	6.8	96.6	1.84	0.12	0.14
Retail trade	6.7	7.2	93.5	1.56	0.10	0.52
Transportation and warehousing	5.7	5.4	102.4	–0.51	–0.03	–0.31
Information and cultural industries	4.2	4.3	93.1	2.25	0.09	0.10
Finance, insurance, real estate and renting and leasing	14.1	14.2	99.5	0.04	0.01	0.13
Professional, scientific and technical services	5.7	6.3	99.0	–0.33	–0.02	0.63
Other services (except public administration)	12.1	12.8	98.6	–0.62	–0.08	0.65
Business sector	100.0	100.0	100.0	–0.60	–0.45	–0.18

1. Includes interaction term.
Source: Statistics Canada.

could reflect not so much a lack of entrepreneurs at the early-development stage as a failure to grow this dynamic group, *e.g.* due to smaller market size. It is also possible that tax incentives encourage the more productive small firms to incorporate more frequently in Canada or paid workers to become self-employed (Baldwin *et al.*, 2011).

The state of innovation

Innovation is a multifaceted activity and difficult to measure because of the intangible nature of its output, which is new knowledge proximately and productivity (MFP) ultimately. Available indicators show a mixed picture of Canadian performance, with strong basic research but weak commercial pay-off.

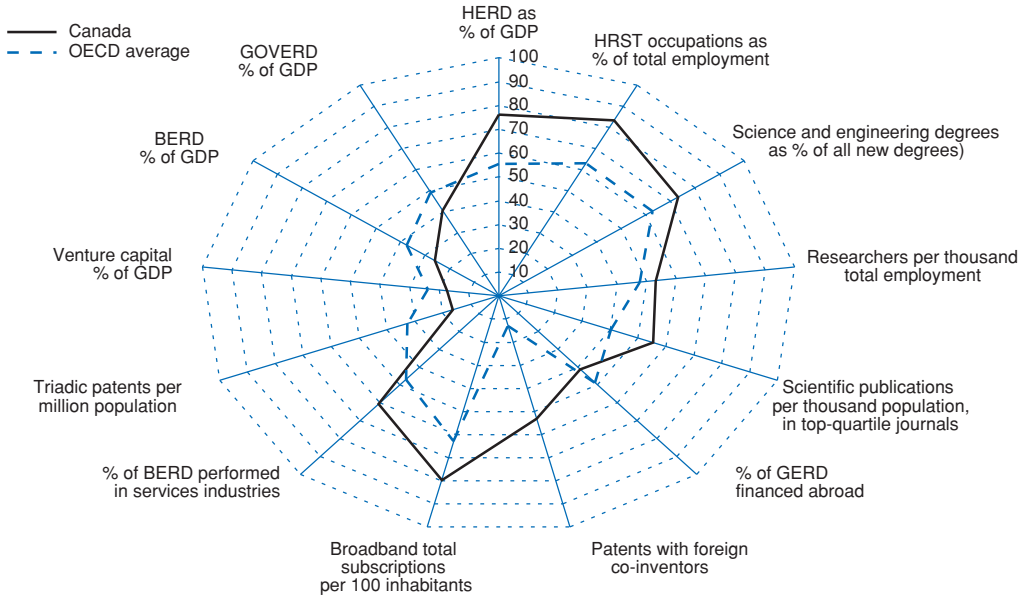
The innovation ecosystem

The public supply of knowledge

Making Canada a global science and technology (S&T) leader has long been a policy objective, one that has to a large extent been achieved in the realm of academic output. The public supply of knowledge is rich in Canada, as measured by two key indicators: scientific articles per capita (quality adjusted for journal ranking) and spending on higher education R&D in proportion to GDP (HERD), which is fourth highest in the OECD (Figure 1.4). The public education system has likewise apparently kept up with the needs of the knowledge economy. The workforce displays a high share of human resources in science and technology (HRST). Science and engineering degrees, as well as the number of researchers, are slightly above their OECD averages. Innovation policy as a whole is still mainly viewed through a traditional S&T lens, centred on the universities, though this is slowly changing in line with growing recognition of a commercialisation gap between academic and applied research. BERD and patenting, which are positively correlated, are two areas where Canada does not perform well compared to other OECD countries. This might seem surprising, given both the quality of its human capital and the level of fiscal

Figure 1.4. **Science and innovation profile of Canada**[1]

2010 or latest available year



1. For each indicator in the radar graph, the OECD country with the maximum value is set at 100 (with a position on the outer ring of the radar). The average is calculated by taking into account all OECD countries with available data.

Source: OECD.dat; *OECD Science, Technology and Industry Outlook 2010*; *OECD Science, Technology and Industry Scoreboard 2011*.

StatLink http://dx.doi.org/10.1787/888932617987

support given to business innovation, the third highest in the OECD. It should nevertheless be noted that Canada performs well compared to other OECD countries for the incidence of innovation, as measured by innovation surveys (OECD, 2009; see also Figure 1.5 below).

The imbalance between world class academic research and lacklustre business R&D has led policy makers to re-examine the linkages between academe and business. The recent Jenkins report for the federal government (IPFSRD, 2011) recommended that the National Research Council (NRC) – which governs the main public research institutes – be reconfigured to be more focused on demand-driven applied research better able to serve the needs of business. This refocusing has already gotten underway, and in its new budget the federal government has committed to carrying it further. The relatively high level of broadband penetration, thanks to strong public support, has also provided critical infrastructure for enhancing the spill-over benefits of public and private innovation (Figure 1.4).

Business demand for innovation

Innovation encompasses more than science-based activities. However, significant measurement issues are involved in capturing of innovation inputs more broadly. According to experimental Statistics Canada data, R&D represents only about one-quarter, and purchases of intellectual property (IP) another quarter, of all estimated intangibles investment (Box 1.1; Table 1.4). A key missing link, as also suggested by preliminary OECD cross-country data (Table 1.5), may be managerial ability to commercialise knowledge developed within Canada.[1] Furthermore, adapting technology from abroad may be less productive than performing "own" R&D, given that spill-overs from the latter are likely to be much larger (Andrews and de Serres, 2012). The large numbers of S&T personnel not performing R&D may be engaged in less productive adaptive and implementation activities (Figure 1.4).

Box 1.1. **Capturing innovation through intangible investments**

Innovation covers a broader range of science-based investigative activities than just R&D, extending to non-scientific forms of knowledge creation with commercial and social value potential. R&D pertains to basic and applied research and experimental development geared toward the acquisition of new knowledge and the resolution of uncertainty concerning its practical applications. Most business R&D occurs in the pre-commercial experimental development phase, whereas most basic and applied research is undertaken by university and public sectors (IPFSRD, 2011; MacIntosh, 2012). The knowledge produced by R&D is mostly patentable, and its key characteristic is novelty. Later stages of the innovative process concern mainly the implementation of the new concept, *i.e.* its integration into production. Non-R&D scientific activity usually encompasses such later pre-commercialisation stages. Engineering and production departments often contribute to innovation in its earliest stages, suggesting ideas that are later developed by R&D departments (Baldwin *et al.*, 2009). IP is also purchased for later commercialisation via licensing of patents, contracting out of R&D and other professional (*e.g.* business, engineering, architectural) services to other firms or academe. Software and related database development occurs within firms or it may be outsourced. With the increasing importance of services sectors to economic output and innovation activity, organisational and managerial innovations, as well as training and marketing, are gaining in importance relative to product and process innovation that are chiefly associated with manufacturing. Design is increasingly a key component of innovation in all its aspects, and many countries are giving it greater policy prominence (Diamond and Lewis, 2011). This is not to say that the traditional interest in R&D is becoming any less important. If anything this focus will grow, as revolutionary innovations will almost always be science and technology based, even in services.

Statistics Canada (Baldwin *et al.*, 2009) has made estimates of business-sector intangible investment including the full scope of science-based innovation along with advertising (branding) and resource extraction. Over the past three decades, business investment in intangibles has grown markedly faster than in tangibles, and by 2001 outweighed business fixed investment in importance (Table 1.4). Over the entire period, R&D represented only about one-quarter of total innovative investments, purchases of external IP another quarter and non-R&D scientific activity plus a small amount of software the other half. Manufacturing and services (notably professional, scientific and technical services) accounted for the bulk of R&D investments and of non-R&D scientific in-house investigations, in roughly even amounts. Services as a whole were much more heavily engaged in advertising and software investments. Purchases of external IP were mainly carried out by manufacturing where it is notably larger than in-house R&D; this

Table 1.4. **Intangible investments**

Business sector, as per cent of GDP

	Advertising	Mineral exploration	Innovation science				Total science	Total intangible investment
			Purchased science and engineering	Own-account				
				Research and development	Software	Own-account other science		
1981	1.5	0.5	1.9	1.5	0.2	2.7	6.4	8.3
1985	1.6	0.5	1.8	1.6	0.3	2.9	6.7	8.7
1990	1.9	0.3	2.2	1.6	0.5	3.1	7.4	9.6
1995	1.7	0.4	2.1	1.9	0.7	3.0	7.8	9.9
2001	2.1	0.8	2.6	3.6	0.9	3.2	10.3	13.1
Average 1981-2001	**1.8**	**0.5**	**2.1**	**2.0**	**0.5**	**3.0**	**7.7**	**9.9**
of which (%):								
Goods	36.2	100.0	80.3	45.6	20.0	47.1	54.0	53.1
Services	63.8	0.0	19.7	54.4	80.0	52.9	46.0	46.9

Source: Baldwin *et al.* (2009).

Box 1.1. **Capturing innovation through intangible investments** *(cont.)*

may in part reflect the large auto sector, which tends to import its R&D from its US and Japanese parents. It is also very significant in the construction sector, which outsources virtually all of its architectural and engineering IP. Mining and exploration activities, which, though not classified as R&D or even as scientific innovation, are constantly being adapted to new challenges and contain a high degree of sophisticated science and engineering content. Emerging high technologies that are attempting to limit the environmental damage wrought by resource extraction involve a significant amount of measured R&D, moreover (STIC, 2011).

The OECD has published experimental figures on intangibles for a set of OECD countries, including Canada, for around the year 2006 (Table 1.5). Following a slightly different classification than above (narrower for R&D and broader for branding activities and including economic competencies like worker training and organisation capital), it shows less but still sizeable intangible investment in Canada. The OECD figures also suggest that Canada's main lag *vis-à-vis* the United States is to be found in managerial, marketing and organisational rather than scientific human capital. They also point to a strong lead by Canada in total intangibles investments *vis-à-vis* the OECD average. The fact that it is not reflected in relative productivity performance reinforces concerns about the quality of science-based innovation and/or the ability to commercialise it.

Table 1.5. **Intangible investments, selected OECD countries**

Business sector, as a per cent of GDP

	Computer-ised information	Innovative property				Economic competencies				Total
	Software	Scientific R&D	Mineral exploration	Copyright and licence costs	Other product development design and research	Brand equity: Advertising	Brand equity: Market research	Firm specific human capital	Organisation capital	
Australia (2005-06)	0.77	0.82	0.26	0.07	1.10	0.76	0.11	0.45	1.57	5.90
Canada (2005)	1.03	1.83	1.14	0.11	1.92	0.40	0.09	2.15	1.11	9.78
Japan (2005)	2.14	2.88	0.00	1.01	1.94	1.14	n.a.	0.38	1.18	10.67
United States (2007)	1.38	1.82	1.01	n.a.	1.82	1.43	n.a.	4.01	n.a.	11.43
EU27 + Norway (2005)	1.04	1.04	n.a.	0.83	0.48	0.61	0.32	0.53	1.63	6.49

Source: INNODRIVE Intangibles Database, May 2011, *www.innodrive.org/*; Fukao, K., T. Miyagawa, K. Mukai, Y. Shinod and K. Tonogi (2008), "Intangible Investment in Japan: New Estimates and Contribution to Economic Growth", *www.euijtc.org/news/events_2007/20080719/Fukao.pdf*; Barnes, P. and A. McClure (2009), "Investments in Intangible Assets and Australia's Productivity Growth", Australian Government Productivity Commission Staff Working Paper, Canberra, Australia; Corrado, C.A., C.R. Hulten and D.E. Sichel (2006), "Intangible Capital and Economic Growth", National Bureau of Economic Research, Working Paper 11948; Belhocine, N. (2009), "Treating Intangible Inputs as Investment Goods: The Impact on Canadian GDP", *IMF Working Paper*, WP/09/240, November.

Intangible investment should cumulate to a stock of knowledge assets entering the economy's production function. Currently, intangibles expenditures are subtracted from revenues as an expense rather than added to demand as an investment (except for software and mineral exploration). But, insofar as they provide a flow of services lasting more than one accounting period, they should properly be considered as investment rather than intermediate expenditures, albeit with depreciation rates presumably much higher than for physical capital. If all intangibles were to be reclassified as investment, this would significantly boost GDP and productivity measures. If all countries were to do this, Canada's relative productivity performance might improve, given its strong intangibles investment flows, though early estimates of the GDP impact of capitalisation of intangibles suggest otherwise (Andrews and de Serres, 2012). R&D expenditures have indeed been capitalised in the 1993 System of National Accounts (SNA93), though only in the satellite accounts. This area remains a significant challenge for statisticians.

System performance

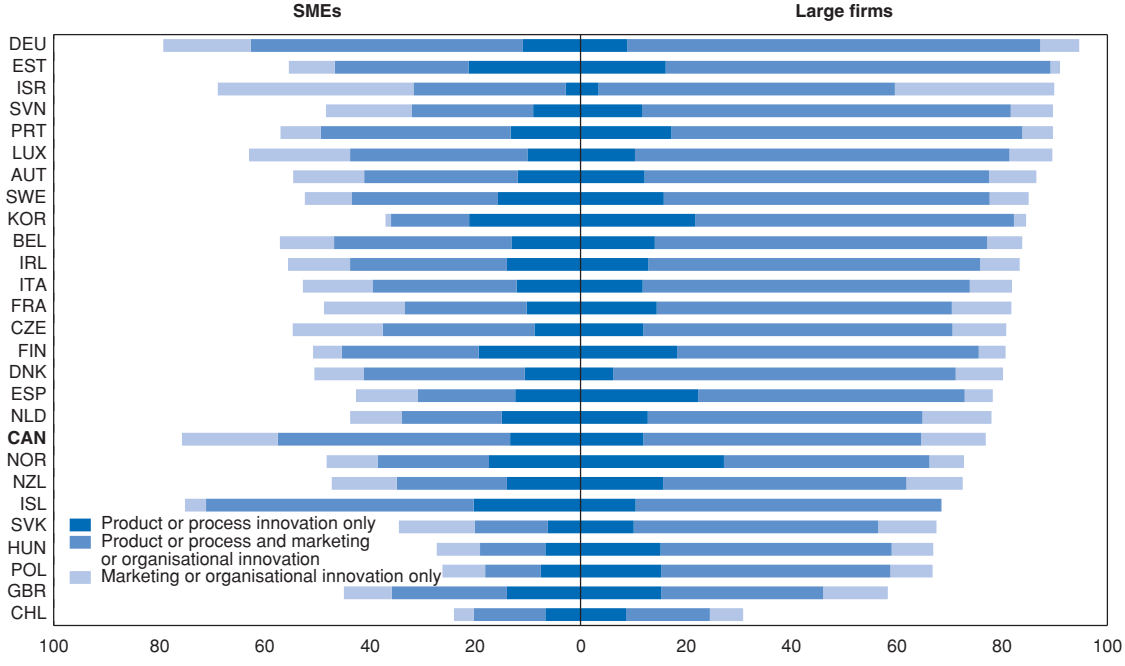
Weak (and indeed, negative) MFP growth may imply a relatively unproductive pattern of innovation. For example, there may be too many S&T human resources devoted to engineering processes in industries of declining MFP (Figure 1.4), and – despite many outstanding exceptions – too few efforts devoted to original R&D or organisational (workplace, global supply chain, etc,) innovations may be holding back MFP growth. Furthermore, the fact that BERD intensity is comparatively low and declining, whereas fiscal support to BERD is substantial and rising, suggests either inefficiency of such policies and/or countervailing barriers to innovation.

Firm-level evidence

The 2009 Canadian *Survey of Innovation and Business Strategy* (SIBS) (Government of Canada, 2011), based on updated notions of the OECD's Oslo manual (OECD and Eurostat, 2005), indicates that a large share of firms in all sectors introduced one of the four types of innovation between 2007 and 2009. Comparing across firm sizes and with other OECD countries, this share was particularly high among SMEs (Figure 1.5), possibly reflecting the large proportion of public support devoted to SMEs (see below). The SIBS also substantiates complementarities in the different types of innovation and between innovation and other business activities – product innovations being frequently coupled with organisational and marketing activities, a result also found in the EU Community Innovation Survey (CIS) – and the greater likelihood that manufacturing rather than non-manufacturing firms will adopt advanced technology. The survey also gives some perspective on what businesses themselves see as the main challenges to their ability to innovate effectively. Respondents have identified uncertainty and risk as the biggest

Figure 1.5. **Innovation strategies by firm size, 2006-08**[1]

As a percentage of all SMEs and large firms



1. Canada, 2007-09; Chile, 2007-08; Korea, manufacturing, 2005-07; New Zealand, 2008-09.

Source: OECD (2011), *OECD Science, Technology and Industry Scoreboard 2011*.

StatLink http://dx.doi.org/10.1787/888932618006

obstacles to innovation, followed by lack of skills and then lack of internal financing. Regulatory issues and IP protection were not seen as major problems, though the former is relatively more important for medium-sized firms and the latter for larger firms.

Research has tried to assess the relative output benefits from product *versus* process innovation, with possible policy implications. Jaumotte and Pain (2005) find (at the macro level) that product innovations have higher productivity impact. OECD (2009), using firm-level microeconomic data, also finds that product innovations are highly productive in terms of sales per employee, while process innovations reduce productivity, at least in the short run, perhaps reflecting transition costs. Van Leeuwen and Klomp (2006) using CIS data for the Netherlands, obtain a similar result and suggest that it may reflect a missing endogenous employment response (*i.e.* process innovation causes unit labour use to fall but total employment expands due to increased competitiveness in output markets). The latter study also finds: *i*) a strong impact of innovation output (measured as sales of innovative products) on demand and thereby on MFP growth, suggesting that science is relevant mainly for the explanation of inputs into innovation, but that the use of market sources for technological inspiration (customers, suppliers or competitors) contributes more directly to innovation output and MFP; but also *ii*) a sizeable impact of permanently performing R&D on the level of innovation output (absorptive capacity hypothesis). Such studies seem to confirm the importance of all types of innovation and their joint use.

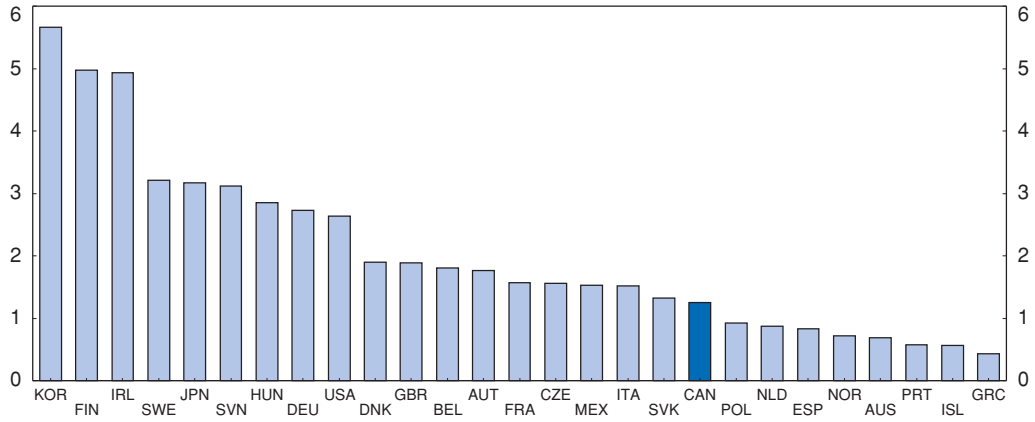
What seems needed is more research on the economic and social benefits of the main types of intangible investment (R&D, organisational, purchased S&T, non R&D scientific activity, software, mineral exploration, branding); the OECD is in the early stages of just such a project (Andrews and de Serres, 2012 and OECD, 2012b). Early research supports the hypothesis that investment in ICT is a important driver of MFP, because it is the vehicle through which innovations are put to use, implying important complementarities (spill-overs) between R&D, human capital accumulation and ICT investments (Rao, 2011). Corrado *et al.* (2012) find strong positive interaction effects between ICT and intangible investments in the determination of MFP growth in a panel of European countries plus the United States. These authors suggest that countries may benefit from tax breaks to software in addition to those often given to R&D and training, whereas the major tax advantages to tangible capital are less warranted given the lack of spill-over from such investments.

International comparative advantage

A large technology deficit on the balance of payments and many patents with foreign co-inventors (Figure 1.4) are likely to reflect structural features of Canada's "branch plant" economy, *i.e.* the strong role of US subsidiaries that frequently draw on technology flowing from the United States. Innovation could thus be viewed as a comparative advantage of the United States, with Canada importing R&D from the technology leader (as an early adopter), while supplying resources and resource-based semi-finished goods for export. However, absorptive capacity requires that a critical mass of innovation be performed within the technology-importing country itself. Empirical work by the OECD has identified two significant effects of R&D on productivity and growth: the first is a direct effect of R&D on innovation creation and the second an indirect influence through the absorption of new technology. The importance of the indirect effect depends positively on the distance from the world frontier of each industry (Nicoletti and Scarpetta, 2003). While Canada is at the forefront of a number of industries, notably those that are natural resource based, it appears to be rather far from the R&D-intensive high-tech manufacturing frontier (Figure 1.6); it follows that Canada should raise industrial R&D in order to better exploit the

Figure 1.6. **Share of high technology manufacturing in GDP**

2009 or latest available year



Source: OECD.stat, *STAN Database* and *OECD Economic Outlook 91 Database*.

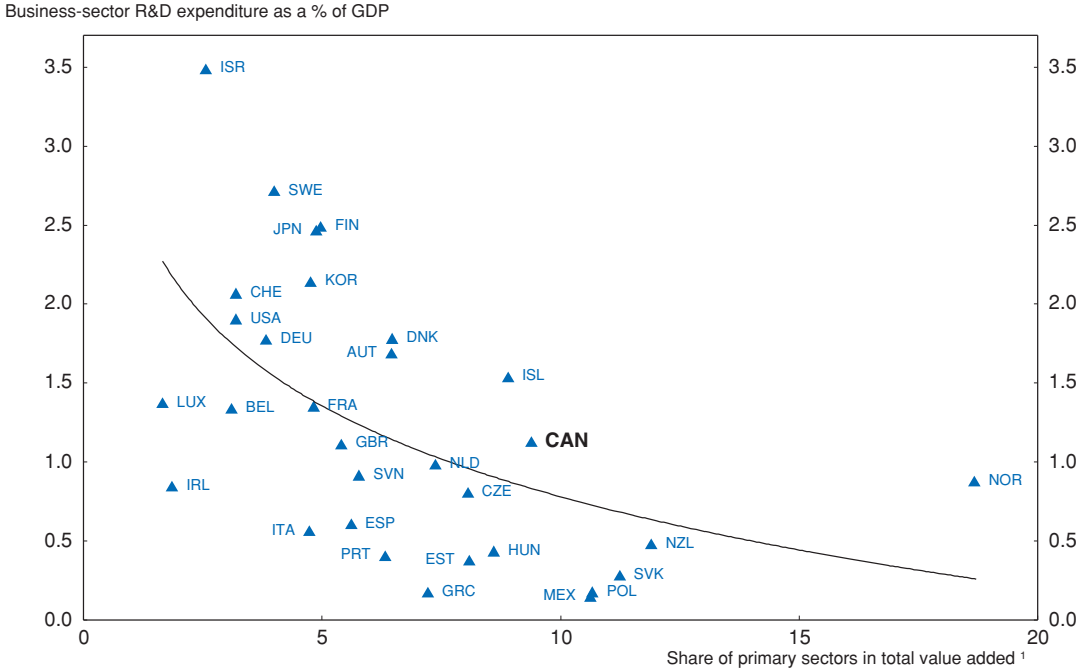
StatLink http://dx.doi.org/10.1787/888932618025

indirect benefits of absorption, whilst moving steadily toward the technology frontier by means of both direct and indirect channels of effect.

Natural resources may matter for innovation propensity. It is indicative that resource-rich countries like Canada, New Zealand and Norway all appear to underperform when it comes to innovation (controlling for GDP), whereas their resource-poor counterparts like Israel, Korea and Japan, are highly innovative (Figure 1.7). This may

Figure 1.7. **Business R&D intensity and natural resource intensity**

Average of 2000 to latest available year



1. Primary sectors include agriculture, forestry, logging and related activities, fishing and related activities and electricity, gas and water supply.

Source: OECD.stat, *Main Science and Technology Indicators Database*.

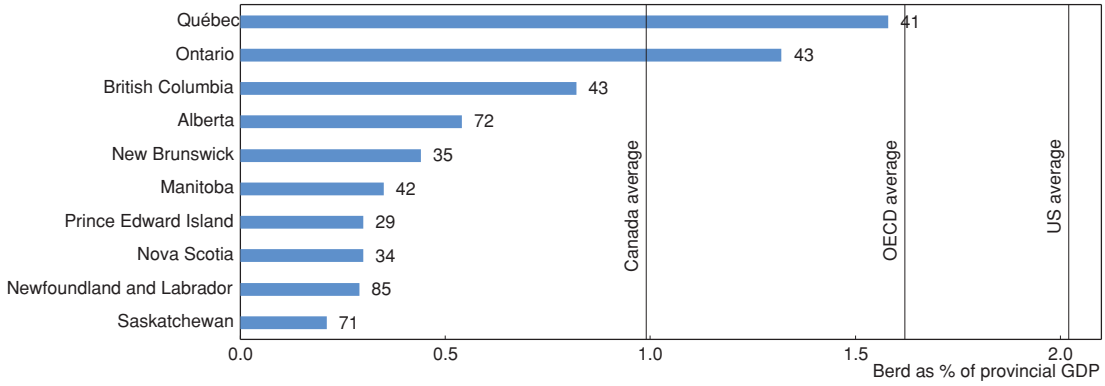
StatLink http://dx.doi.org/10.1787/888932618044

reflect a level of per capita income that is "too high" owing to resource rents, boosting the denominator of the BERD-intensity ratio. But the presence of resource rents might itself dull the drive to innovate, by attracting labour and capital to less BERD-intensive sectors like mineral exploitation, refining and transportation.

Regional differences within Canada likewise suggest a link between innovation and resources. Per capita incomes are higher in the resource-rich provinces of Alberta, Saskatchewan, and Newfoundland and Labrador, owing to resource rents, but BERD is higher in the central manufacturing and business services-based provinces of Ontario and Québec (Figure 1.8). The latter two provinces are still more heavily exposed to resource-based industries than the typical OECD country; otherwise their BERD intensities might be even closer to the OECD average. A feature of the low-BERD jurisdictions is that their resource industries are able to generate large amounts of GDP without the need for correspondingly large investments in R&D (Freedman, 2011). Cross-provincial income disparities, as measured for instance by the Gini coefficent of income inequality (*OECD Regional Outlook 2011*), have been growing due to strong relative price shifts coupled with unequal resource endowments. Addressing this problem may require extra efforts in building human capital and innovation capacity in the resource-poor regions.

Figure 1.8. **BERD intensity in Canada**

By province, 2008



Note: The figure at the end of each bar is the province's productivity level (CAD per hour worked) in the business sector (goods and services) in 2008.

Source: Statistics Canada.

StatLink http://dx.doi.org/10.1787/888932618063

International scoreboards

Global rankings provide a barometer of the strengths and weaknesses of national innovation systems, based on consistent methodologies for calculating various performance indices. The latest *Global Innovation Index* (INSEAD, 2011) ranks Canada's innovation capacity favourably and as consistent with its high per capita GDP. Major strong points are the regulatory and business environments, quality of research institutions, non-ICT infrastructure, the investment climate, new businesses, innovation linkages, creative outputs, notably service exports, and business/organisation ICT models. On the other hand, Canada ranks in 54th place in innovation efficiency, indicating an overall poor return in terms of innovation output for the corresponding inputs. Related to this result are very low rankings (roughly 40th or worse) for: energy efficiency of production, gross capital

formation (M&E), strength of legal rights for credit (collateral and bankruptcy laws), openness to trade and competition, computer and communications service imports, net inflows of FDI, and resident trademark applications.

The European Commission's 2008 *Global Innovation Scoreboard* (EC, 2009) compares innovation performance in the EU27 to that of 16 other major R&D spenders in the world, including Canada. Three "pillars" of innovation are proposed, supported by the relevant indicators: firm activities and outputs (triadic patents per population, BERD); human resources (S&T tertiary enrolment ratio, labour force with tertiary education, R&D personnel per capita, scientific articles per capita); and infrastructure and absorptive capacity (ICT expenditures per capita, broadband penetration per capita, GERD). Canada ranks second in human resources (though the methodology does not account for the mix of different types of tertiary education, which is unusual in Canada; see Chapter 2), eighth in infrastructure and 18th in firm innovative output.

No other country in the global peer group displays such a wide divergence between human resources/research infrastructure and firm R&D/patenting activity. Germany and the Netherlands manifest an opposite conundrum: relatively weak human resources but strong firm innovation output, although in these countries in-work training is likely to be a very important dimension of human resources not well captured by the indicator.

Policy drivers and barriers to innovation

This section explores major determinants of business innovation so as to identify key innovation barriers that may explain the Canadian paradox and which may be amenable to policy influence.

Economic openness

Openness to trade, capital and labour flows (both inward and outward) reinforces competition – in turn the driver of innovation as a central competitiveness strategy (CCA, 2009). Reducing anti-competitive regulations in sheltered sectors is found to be the second most powerful incentive for increased business R&D spending (Jaumotte and Pain, 2005). Geography can be viewed as both a handicap and an advantage in this respect. Economic integration with the United States offers major opportunities for market expansion, scale economies, knowledge spill-overs and competitive intensity. Mobility of goods and services, capital and labour is high, particularly following the 1980s US-Canada free trade agreement and the 1990s North American Free Trade Agreement (NAFTA). In 2010, three-quarters of Canada's exports went to the United States, and more than half of Canadian manufacturing sales were by affiliates of US multinationals. North-south trade and capital flows across contiguous US states and Canadian provinces are more extensive than east-west integration across the Canadian provinces themselves. The recent economic crisis highlighted the risks of overdependence on one large market, however. The Canadian government is negotiating trade and investment agreements with the European Union and Asian partners, or planning to.

It is frequently asserted that R&D and other high-value-added activities have been displaced to head offices of US multinationals, with a consequent "brain drain" out of Canada and a diminution of Canadian innovative and business prowess ("hollowing out"). Similar concern has been voiced over the fact that of 137 VC-backed Canadian firms whose ownership changed hands in 2006-10, nearly 60% were sold to foreign buyers mainly for their valuable IP, taking Canadian-educated talent with them (CIC, 2011).

However, integrated production chains (notably in automobiles) allow ready access by Canadian affiliates of US multinationals to the latest US technological and managerial know-how. In the auto industry, Canadian affiliates of US auto firms have traditionally been more productive than their US counterparts, mainly through a tradition of innovation in work processes and organisation, despite doing less R&D (CCA, 2009), although this advantage has waned in light of the 2000s terms-of-trade shock (Rao, 2011). Foreign-controlled manufacturing firms in general display higher MFP than their Canadian-controlled counterparts, even after accounting for differences in other firm characteristics (Rao *et al.*, 2008). The resulting benefits in terms of competitive intensity and access to knowledge flows are likely to be diffused more widely, as domestic competitors and suppliers learn by example and strive to catch up (Bergevin and Schwanen, 2011).

To take full advantage of FDI, Bergevin and Schwanen (2011) and CPRP (2008) have recommended that the Investment Canada Act's (ICA) net benefit test for foreign investments, which risks being used as a protective device, should be either removed or the onus shifted to government to prove that a proposed investment is *not* in Canada's interests, with the reasons publicly stated. As announced in the 2012 budget, the federal government is in the process of making targeted improvements to the *Investment Canada Act* to enhance transparency while preserving investor confidentiality. The Ministries of Industry and Canadian Heritage should create procedures to provide foreign investors with timely and binding opinions concerning ICA compliance of prospective transactions (CPRP, 2008). At the same time, ownership restrictions in sheltered sectors, notably telecommunications and broadcasting, need to be lifted in order to get much needed capital, contestability and management talent. This process has already begun: in 2010, foreign ownership restrictions were removed for Canadian satellites and changed to permit greater foreign investment in the air transport sector. Most recently, as announced in the 2012 budget, the federal government is in the process of lifting foreign investment restrictions for telecommunications companies that hold less than a 10% share of the total Canadian telecommunications market.

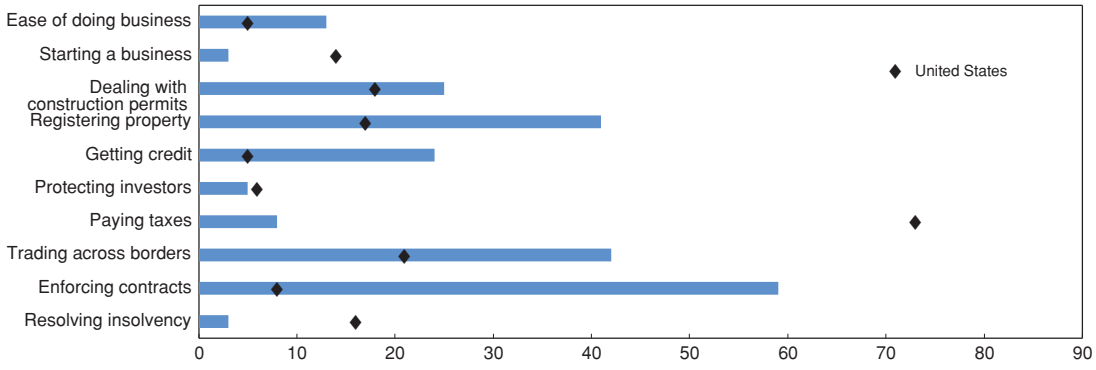
Inter-provincial barriers to goods, services and resource flows reflect a lack of openness internally, limiting market size, competitive pressures and the gains from trade. Amendments to the Agreement on Internal Trade (AIT), agreed in 2009, made it a more effective framework to ensure labour mobility for regulated professions and trades. But implementation is still ongoing.

Entrepreneurship

Entrepreneurial firms are the subset of firms that are growing and innovative. These firms take advantage of technological and market opportunities, and a few grow into global leaders. They also include "gazelles", young firms that experience high growth (OECD, 2010b; ICP, 2012). The World Bank's ease of doing business index indicates many favourable factors for entrepreneurship in Canada (Figure 1.9). The number of days needed to start a business is low, bankruptcy procedures are particularly simple, and paying taxes is easy. On the other hand, the number of days needed to get an electrical connection is higher than in most countries, and enforcing contracts is also difficult. Compared with the United States, it is also significantly harder to obtain credit in Canada owing in part to lenders' collateral requirements, and trade across provincial borders is relatively hampered. Such indicators echo some of the Global Innovation Index rankings.[2] Ease of entry is needed to stimulate competition and innovation, even if only a small number of innovative start-ups (perhaps 2-4%) eventually grow into large firms (IPFSRD, 2011 and MacIntosh, 2012).

Figure 1.9. **Ease of doing business**[1]

June 2011



1. Ranking on the ease of doing business among 183 economies. A high ranking on the ease of doing business index means the regulatory environment is more conducive to the starting and operation of a local firm. This index averages the country's percentile rankings on 10 topics (getting electricity is not shown), made up of a variety of indicators, giving equal weight to each dimension.

Source: World Bank, *Doing Business Database.*

StatLink http://dx.doi.org/10.1787/888932618082

Successful entrepreneurs seem to have a higher than average propensity for risk-taking (ICP, 2012). Some empirical evidence suggests more cautious attitudes to risk by Canadian as compared with US businesses, however (Box 1.2). In the United States, the prevailing wisdom is that business or professional failure is a valuable learning experience and that entrepreneurs are deserving of second chances. New US business theories are

Box 1.2. **Attitudes to risk and managerial quality**

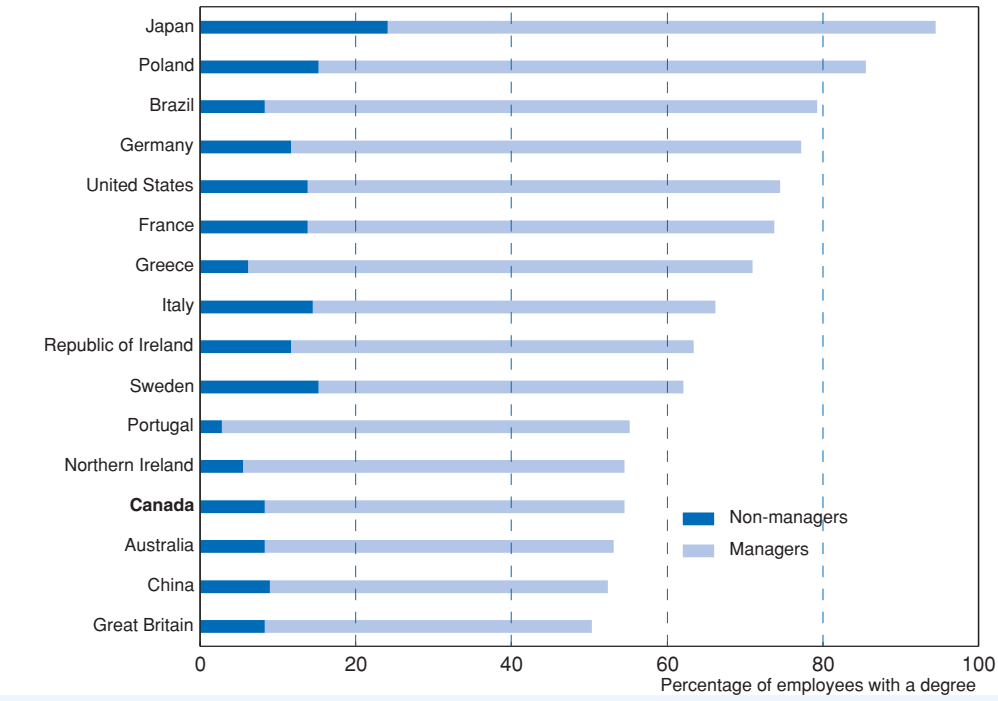
Available business innovation surveys such as SIBS and CIS suggest relatively highly risk-averse behaviour by Canadian managers when undertaking innovation. For example, whereas in Canada, 44% of medium-sized firms reported uncertainty and risk as a major obstacle to innovation, in the United Kingdom the corresponding figure was 36% (McCann, 2010), although this difference is not significant. A recent survey by a major polling firm of a wide spectrum of Canadian and US firms focused on the attitudes of senior executives to assuming business risks associated with growth and innovation (Deloitte Research, 2011). Whereas Canadian executives see themselves as neither more nor less willing to take on reasonable risks than their colleagues south of the border, the level of risk tolerance displayed by the actual decisions that they reported making, filtered by researchers through the heuristics used in arriving at these decisions, suggest that American respondents are 13% more tolerant of risk than the Canadians. The gap widens to 18% when adjusting for the more negative current economic state and future outlook of US respondents in 2011. This result is driven by a much lower R&D rate of participation among risk avoiders in the two countries (70% *versus* 83%), rather than higher R&D intensity among risk takers or a difference in the proportional sizes of these two groups. The survey data also suggest a greater reliance by Canadian firms on government support in order to motivate investments in R&D. US firms indicate a greater responsiveness to an expansion in the availability of risk capital or an improvement in the protections afforded to IP rights. While excessive optimism among US managers has also been documented, and could lead to reckless behaviour, research shows convincingly that a high degree of managerial optimism can lead to more socially optimal levels of innovation, especially when combined with product market competition (Galasso and Simcoe, 2011).

Box 1.2. **Attitudes to risk and managerial quality** *(cont.)*

An international survey and empirical analysis of management quality in manufacturing by Bloom (2011) sheds further light. It finds that firms in Canada, in fact, follow good practices similar to those found in firms in Germany, Japan and Sweden, and better than in most other European and developing countries. However, 22% of Canadian firms are worse managed than the average from Brazil, China and India, suggesting a long tail of Canadian manufacturing vulnerability. US firms outperform Canadian ones by a significant margin. One reason for superior US performance is competition and market discipline: well run firms are rewarded more quickly with greater market share, while poorly managed firms are forced to shrink and exit. According to this author, Canada is not far from the United States in terms of openness of product markets and lightness of labour market regulation, though its higher rate of trade unionisation (36% *versus* 16%) may restrict some management practices. The two countries are also not too dissimilar in ownership patterns, with mostly well managed publicly quoted and private equity-owned firms as opposed to family (inherited) and government managed firms as in some other countries. The one area where Canada appears to lag markedly is in worker and manager education (Figure 1.10 and Chapter 2). The author's estimations show that worker education is as important to management quality as manager education, reflecting that workers often drive innovation and productivity improvements.

Figure 1.10. **Educational attainment of managers and workers**

Bachelor degree or higher



Source: Data have been drawn from Bloom, N. (2011), "Management and Productivity in Canada: What Does the Evidence Say?", *Industry Canada Working Paper Series*, No. 2011-05.

also putting emphasis on "delighting the customer" as the key to corporate survival (as exemplified by Apple) and, in principle, the main driving force of innovation (Denning, 2011). However, according to Roger Martin, Dean of the University of Toronto's Rotman School of Management, Canadian businesses are significantly lagging in adopting such a mindset. In order to improve the innovative capacity of Canadian companies, senior managers need to enhance customer understanding and the pursuit of customer satisfaction.

Entrepreneurship skills are acquired by a process of lifelong learning, but education is an important first step and can be provided at all levels. Innovation/science awards by age group are increasingly popular as a motivational device. At the tertiary level, entrepreneurship education is a rapidly developing field. US business schools are the acknowledged leaders in this area, providing courses in entrepreneurship, small business management and new venture creation with an approach using case studies, business plans, discussions and lectures by business owners and guest speakers. Though similar courses are taught in Canadian business schools, they are not as well developed, and participation is only one-third that in US business schools (OECD, 2010a).[3] The University of British Columbia, nonetheless, offers a course on commercialising technology, which allocates half the seats to MBA students and half to graduate students from science and engineering departments, and also provides access to a network of industry people who serve as guest lecturers; this has contributed to technology transfer (spin-offs) by encouraging a culture of commercialisation on campus (Agrawal, 2008). Beyond formal education, training at work is essential. Ultimately, however, the cognitive and social skills that characterise entrepreneurs do not necessarily bear a causal connection with education or management training, and human capital of different sorts is associated with survival probabilities in start-ups. Attitudes toward risk, moreover, may be largely a function of institutional context rather than culture or training.

Another important route to imbuing society with entrepreneurial dynamism is through continuing immigration and ethnic diversity. It might be argued that economic immigrants are by definition system outsiders and often originate from highly entrepreneurial cultures themselves. They must take risks, be entrepreneurial and work hard in order to advance materially and socially. Research has found that many successful R&D-intensive start-ups have been led by foreign-born entrepreneurs, who are often more pragmatic, frugal and prepared to do what it takes to succeed in commerce (Barber and Crelinsten, 2009). Highly skilled immigrants display similar characteristics to those of entrepreneurs and are for this reason a focus for Canada's immigration programme. First- and second-generation Canadians are prominent in the pool of university-educated labour force entrants, crucial for productivity in the knowledge-based economy. Second-generation Canadians are also much more likely to have a university degree and be employed and less likely to rely on social assistance, and their average earnings are higher than those of young adults of Canadian-born parents.

The federal government recognises both the near- and long-term benefits to Canada's economic growth resulting from skilled immigration. In fact, some immigration programs such as the Federal Business Immigration Program are specifically designed to select experienced investors, entrepreneurs and self-employed immigrants, targeting more active investment in Canadian growth companies and more innovative entrepreneurs. Moreover, under its 2012 budget, the federal government outlined that it will begin to target more active investment in Canadian growth companies and more innovative entrepreneurs under the Business Immigration Program. Nonetheless, given the variable

quality of foreigners' current performance – notably reflecting official language proficiency, access to business and professional networks, and cultural adaptability – it is suggested that additional focus could be put in the short term on attracting graduate students to Canada and giving them easy access to work visas following receipt of their advanced Canadian degrees. This, though, may become more difficult as economic opportunities multiply in China, India and elsewhere.

A greater inclusion of women in the ranks of managers and owners could also tap into latent talent. Statistics indicate a mediocre performance in this regard, however, with the share of individually owned enterprises with a female owner varying between 20% and 40% across OECD countries. Furthermore, empirical evidence suggests that enterprises founded by women tend to have lower levels of innovation activity relative to enterprises founded by men. Recent OECD research has found that, while part of the gap in the propensity to innovate across gender groups may be explained by the disparity in the characteristics of the enterprises owned by women relative to men, there is increasing evidence that the difference may be largely attributable to the owners' characteristics. A number of barriers to innovation activity for women entrepreneurs have been identified: *i)* an education and careers experience gap in certain innovative or high-tech fields; *ii)* an equity financing gap; and *iii)* a networking gap, generated by the low numbers of women entrepreneurs in innovation-intensive industries and by the low visibility of successful innovative women. Policies should be used to address such barriers.

Women could also help fill the looming shortages in STEM and other advanced technical skills, but they are vastly underrepresented in the STEM disciplines. Women's scientific inclinations should be nurtured at an early age via enlightened teaching, science clubs, contests and the like that encourage girls to participate.

Fiscal incentives

Canadian government support to business innovation is among the most generous among OECD countries, but its composition is atypical. Indirect funding *via* generally available R&D tax credits is the second highest among a sample of OECD countries, after France, whereas direct funding of business innovation is one of the lowest (see Figure 12, Panel A in Assessment and recommendations). This reveals a choice by the Canadian authorities to stress forms of funding that apply neutrally, so as to establish a "level playing field" and a presumably more efficient "let markets decide" approach to R&D resource allocation. The government thus attempts to avoid "government failures", notably those that require "picking winners" by means of grants. However, the downside of such a policy is a lack of targeting and possible tax deadweight costs. Moreover, the playing field is not truly level: small, Canadian-owned firms are substantially favoured in the design of the tax credits over foreign-owned and large firms. It is also possible to lower the risk associated with picking winners by means of competitive grant procedures.

R&D tax credits

The Scientific Research and Experimental Development (SR&ED) tax credit is one of the most expensive tax expenditures in Canada (costing CAD 3.6 billion for the federal government in 2011 and an estimated CAD 1.5 billion for the provinces and territories). Its high cost reflects the high rate of subsidisation rather than intensity of business R&D activity. The general federal SR&ED tax credit rate is currently 20% of eligible R&D performed in Canada. Unused credits may be carried back up to three years and forward up

to 20 years. For small Canadian controlled private corporations (CCPCs), the credit increases to 35% (up to a maximum of CAD 3 million in qualified expenditures), in which case it is also refundable.[4] Almost all provinces top up the federal tax credit with their own variants (Table 1.6). The common base includes both capital and current expenditures plus "overhead" costs (of up to 65% of wage costs, which is generous) and most R&D contracts with tertiary institutions (except for Québec which counts only wage costs plus 50% of such contracts). On top of these investment tax credits, qualifying SR&ED expenditures are fully deductible from taxable income, and unused deductions may be carried forward indefinitely. Since R&D current and capital spending may be considered to be an investment, allowing its immediate expensing (rather than capitalisation) provides a significant benefit to firms.

Table 1.6. **Federal and provincial tax credit rates**

Per cent

Provinces	Provincial tax credit	Federal plus provincial[1]	
		Small CCPCs	Other firms
Alberta and British Columbia	10	42	28
Manitoba	20	48	36
New Brunswick, Newfoundland and Labrador, Nova Scotia, Saskatchewan and Yukon	15	45	32
Northwest Territories and Prince Edward Island	0	35	20
Ontario (small/large firms)	10/4.5	42	24
Québec (small/large firms)[2]	37.5/17.5	48	27

1. The federal credit is 35% for small CCPCs (Canadian-controlled private corporations) and 20% for other firms. The base for the federal credit is reduced by the amount of provincial credits.
2. The Québec credit is paid on wages and salaries plus 50% of contracts. The federal-provincial rate is expressed as a percentage of R&D costs eligible for the SR&ED credit.

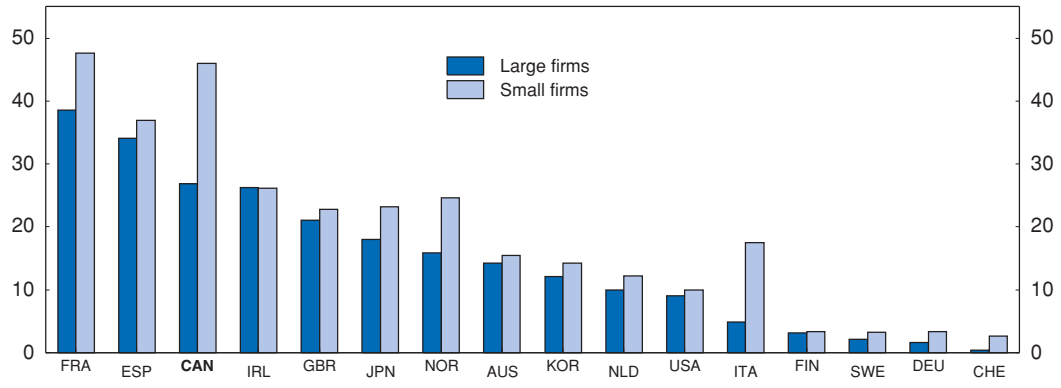
Source: Independant Panel on Federal Support to Research and Development (2011), *Innovation Canada: A Call to Action*, Ottawa.

The SR&ED credit adds to complexity in the tax code, raising administrative and compliance costs. Activities eligible for the SR&ED tax incentives involve systematic investigation or search carried out in a field of science or technology by means of experiment or analysis. In general, three broad categories of activity are eligible: basic research, applied research, and experimental development. The definition of SR&ED for income tax purposes is largely consistent with the OECD definition of R&D, as presented in the Frascati Manual (OECD, 2002), and is generally consistent with the definitions in other industrialised countries for their R&D tax incentives. Firms must demonstrate that their R&D activities meet this definition. The SR&ED tax incentive program is administered by the Canada Revenue Agency (CRA), which sets out three qualifying conditions: *i*) the activity must generate information that results in scientific or technological advancement; *ii*) the outcome must be unknown in advance of undertaking the activity; and *iii*) the activity must be carried out by qualified personnel and involve systematic investigation through experiment and design (Parsons, 2011). For small firms, complexity in the SR&ED program may lead them to use the services of SR&ED related consulting services, whose high contingency fees reflect the generosity of the tax credit. The 2012 budget announced a study of contingency fees charged by tax preparers. It is estimated that small firms spend on average 14% of their tax credit in compliance costs, while large firms pay around 5% (IPRFSRD, 2011).

The difference between the small and large firm effective subsidy rates is the largest in the OECD (Figure 1.11), exacerbating the incentive to stay inefficiently small. Moreover, the refundable tax credit offered to small CCPCs is renewable without limit, encouraging entry though giving rise to a soft budget constraint that could keep some companies going beyond a point where they should have exited, as they do not need to earn a market return in order to get revenue. Furthermore, firms undertaking R&D have access to a wide range of federal and provincial support programmes and frequently obtain funding for the same project from more than one, creating a "stacking" of R&D support. In 2007, 70% of all small firms received financial assistance amounting to 40-50% of their spending on R&D and 10% received more than 50% (RFSRD, 2011). This implies a high effective tax rate on earnings above the income qualifying threshold of CAD 500 000. There is also the question of how well the enhanced subsidy targets firms most in need of support. The age of a company (start up or mature) may say more about its problem with access to capital than its size (OECD, 2006; Parsons, 2011). The best response to market failures that may adversely affect SMEs is unlikely to be through size related tax measures (Parsons, 2011).

Figure 1.11. **Tax subsidy rate on investment in R&D**[1]

2009, percentage



1. The data include income tax deductions and R&D tax incentives provided by sub-national governments. The element of income tax deductions corresponding to an economic depreciation allowance is not a subsidy and thus not included.

Source: Department of Finance (2009), Tax Expenditures and Evaluations 2009, Part 2, "An International Comparison of Tax Assistance for Investment in Research and Development", Ottawa.

StatLink http://dx.doi.org/10.1787/888932618101

A further problem is the suspected deadweight cost of the tax credit for large firms, which may have performed the R&D in any event (Baghana and Mohnen, 2009, suggest such an outcome in Québec). Nonetheless, the broad literature on stimulative effects of R&D credits shows that they do effectively increase the total amount of R&D spending, though small firms may be more responsive to the price signal, possibly reflecting that they are more concentrated in R&D intensive sectors (Corchuelo and Martinez Ros, 2009). It has been suggested that use of an incremental based R&D credit increases large firm responsiveness and from that perspective may be preferable to a volume-based credit (Baghana and Mohnen, 2009). While incremental tax credits are more efficient for government (minimising the amount of "subsidised" R&D that would have been undertaken even in the absence of support), they are also more complex to implement. The general OECD trend has been to make R&D tax incentives more generous and simpler to use (OECD, 2010e).[5]

The key issue regarding the SR&ED is not the extent of financial-market failure but the level of subsidisation that is justified by externalities (*i.e.* the efficient effective tax credit rate). The "net benefit" of the SR&ED tax incentive has been calculated to be positive (Parsons and Phillips, 2007), but wide ranges of uncertainty around parameters used make this calculation highly uncertain (Parsons, 2011). Furthermore, the analysis was based on an "average" federal tax credit, so that the expected net return for the much richer tax credits for CCPCs might well be negative. The Jenkins report concluded that the calculation of the net benefit is not sufficiently precise at this time to permit a benefit-cost ranking of the government's various business R&D support programmes, though that remains a worthy goal (IPFSRD, 2011). A preliminary analysis by Lester (2012) provides just such a ranking and finds that whereas the general SR&ED credit rate is around the optimal level, the refundable credit and Industrial Research Assistance Program (IRAP) (the major grant programme targeting SMEs) may not be, as their beneficial spill-overs (*i.e.* the social return less the private return of the additional R&D induced by the subsidy) are strongly outweighed by the economic cost of financing the assistance with taxes that harm economic performance plus the costs of administering and complying with the programmes.[6] His calculations show that the negative net benefit of the refundable SR&ED can be eliminated if the subsidy rate falls to 18% and administrative and compliance costs fall by 25% and 50%, respectively.

The ongoing dramatic reduction in the statutory federal corporate income tax (CIT) rate has not changed the unit value of the SR&ED credit, but made it less likely for large firms to fully benefit from the credit in the year in which the costs are incurred. Hence, they face larger "tax risk" that they must have sufficient tax payable in order to fully benefit from the credit (since carrying unused credits forward is not costless). Such tax risk may have the advantage of "targeting success" (IPFSRD, 2011), though only in a limited sense, as large businesses unable to use the credit are those that make consecutive losses until they finally fail. Nevertheless, the 2012 federal budget proposes, as of 2014, a reduction in the general SR&ED investment tax credit rate from 20% to 15%, in line with the recent federal CIT reductions (from 22% in 2007 to 15% in 2012) (Government of Canada, 2012). The small-firm tax credit remains at 35%; being refundable, it is unaffected by the CIT reductions. This enlarges the gap with large firms, however. Also, the general rate would appear to be now too low from the viewpoint of social welfare. The lower CIT rate, if anything, might justify a larger subsidy insofar as it reduces the deadweight costs of taxation.

The Jenkins report (IPFSRD, 2011) recommended that the enhanced refundable credit apply to wage costs only (as is already the case in Québec). Such streamlining of the base would help to reduce small-firm compliance costs, though at the peril of creating a new distortion in favour of labour-intensive small firms, which may be less innovative. The panel, nevertheless, recommended maintaining capital expenses in the base for large firms, where they are likely to be a more significant part of R&D activity. It also called for the credit for small firms to be made partially refundable, with this change to be phased in. Refundability for small firms may be justified insofar as they have difficulty getting outside funding for their R&D efforts, whereas non-refundablility would help to reinforce small firms' motivation to succeed. Making the small firm credit partly refundable could help to balance this trade-off. However, partial refundability would result in firms not being able to claim the SR&ED tax credits in the year that they are earned and in ongoing growth of unused tax credits until such time that the firm earns a return.

The 2012 federal budget proposed to exclude capital costs as of 2014 from the expenditure base of the SR&ED, but for *all* firms, large and small, on the argument that the rules regarding the eligibility of capital expenditure are the most complex for businesses to comply with (Government of Canada, 2012). However, this multiplies concerns about distorting technology choices due to non-neutrality of the base. It also reduces the effective subsidisation of large firms beyond that already implied by the cut in the general tax credit rate. As just 75 larger firms perform about half the R&D in the economy, and 25 perform one-third (IPFSRD, 2011), the large drop in their effective subsidy rate below the presumed optimal level poses significant risks to BERD. Even so, several other OECD countries have credit schemes that focus only on R&D wages, presumably as a way to control public cost or boost high skilled employment. The budget also lowers the cap for eligible overhead costs and removes the profit element from covered contract costs.

In conclusion, it would be preferable to lower the small-firm rate toward the general rate, while also reducing small-firm administrative and compliance costs. The general rate should be kept at 20% and capital should stay in the qualifying expenditure base (though overhead and contract costs should be streamlined as planned). As the small-firm credit accounts for around 45% of the total federal SR&ED tax expenditure of CAD 3.6 billion, reducing it from 35% to 20% would yield fiscal savings of nearly CAD 700 million per year. Even going only part way to this goal would address both fiscal and economic efficiency considerations. Liquidity constraints could be best addressed by retaining (partial) refundability.

Grants

Fiscal savings from these reforms could be used to shore up targeted business grants and to provide vouchers for use in academic contracting. The voucher approach has been successfully piloted in Alberta and used extensively outside Canada, notably in the Netherlands, and it is effective because the fiscal spending is controllable and directly stimulates technology transfer, while leaving full autonomy to firms in defining projects.

Direct subsidy programmes in the form of grants, subsidised loans, provision of services and public procurement of research or innovative products are numerous at both federal and provincial levels. They are geared predominantly to small businesses, on the grounds that they lack internal resources and face difficulties in obtaining external funding. These programmes are individually small and fragmented and even cumulatively are of a very small scale. They remain for the most part unevaluated by government or other researchers. Consolidation and co-ordination could at once reduce administration costs and help businesses to understand what help is available and access it.

One scheme that stands out as an exception to this general picture is the IRAP, which is the largest programme at 15% of all granting, yet still small by international standards. The 2012 federal budget doubled the programme's contributions to small and medium-sized businesses, using part of the savings from the streamlining of the SR&ED. It provides for funding for R&D and various other innovative activities, including marketing and organisation, which are not provided for in the restricted base of the R&D tax credit, along with commercialisation advice to small businesses. However, such advice is very expensive and could reduce the net benefit of the IRAP (Lester, 2012). Moreover, while outsourcing the advice function bolsters the skill set of decision makers, it does not provide firms with the mentoring associated with venture capitalists (below), and these advisors do not have strong financial incentives, since they are fixed rather than residual claimants (MacIntosh, 2012). Direct funding also lends itself much more easily to political

interference, and one safeguard could be to target such funding on sectors of maximum beneficial social spill-overs. IRAP is broadly patterned on the US small-business innovation research (SBIR) programme, which in turn is widely credited as being an important part of the US small-firm innovation success story and development of the venture capital (VC) market (OECD, 2011b). SBIR-like programmes have been gaining popularity in other OECD countries as well. However, the dominant OECD pattern has been one of decreasing reliance on grants and increasing use of tax credits (OECD, 2010e).

The Jenkins report (IPFSRD, 2011) provided an original contribution in attempting to evaluate the main grant programmes' effectiveness. It recommended using the savings from streamlining the small-firm SR&ED to expand IRAP and commercialisation vouchers, while consolidating the myriad of smaller programmes along several distinct "product lines".[7] The report also proposed an arms-length federal agency – the Industrial Research and Innovation Council (IRIC) – to advocate for a whole-of-government approach to innovation, and to fund, oversee and deliver the various business-support programmes in close collaboration with provinces and business. As the report states, governments further need to evaluate the performance of tax-credit and direct-support programmes to assess their comparative cost-effectiveness in stimulating R&D as a guide to future resource allocation. It will thus be important to build federal capacity to undertake such evaluations.

Demand-side policies

Many countries have noted that a significant challenge for innovation is often not the lack of knowledge or technology, but rather the lack of a receptive market for these innovations. Some Canadian experts argue for a broadening of demand-side, sector-specific support policies as the priority for public policy to promote innovation (Côté and Miller, 2011). This is particularly the case for markets with important public-good characteristics, *e.g.* in environmental, health and other public services. The OECD has recognised that supply-push policies may be ineffective in isolation, and action on the demand side is needed to complement them (OECD, 2011c). Demand-side policies have the added attraction of relatively low costs, depending on their design, in a context of heavy pressure on public resources. Policies to foster demand for innovation – such as innovation-oriented public procurement, standardisation of platform technologies to stimulate firm entry and network effects, taxes or subsidies notably in the environmental area to correct for externalities – are comparatively underdeveloped in Canada.

The Jenkins panel report supported using public procurement to bolster innovation, particularly for SMEs. Whenever feasible, procurement tenders should be framed in terms of needs to be met or problems to be solved, rather than of detailed technical specifications that leave little scope for innovative proposals (IPFSRD, 2011; OECD, 2011c). In health sciences and green innovation, social spill-overs might be greatly enhanced by supporting promising new platform technologies such as hydrogen cell technology, genome- and nano-technologies that can spawn as yet unimagined applications, rather than specific ones such as wind power, biofuels, etc. The federal government should work collaboratively with provincial and municipal governments – municipalities are major procurers for infrastructure projects, and provinces are responsible for health-care spending, where there is likely to be substantial potential for innovative procurement – toward the same end. It would also be well to open tendering to foreign firms (even if not required by international trade agreements), in order to stimulate competition and knowledge transfers. It is also important to make transparent the amount of implicit subsidy involved.

Financing

Financial markets in Canada are highly developed, yet several indicators suggest room for improvement. The median cost of equity (risk-free rate + equity risk premium) has been higher for Canadian than for US firms by 50 basis points after adjusting for firm size and industry structure, despite nearly equal risk-free interest rates (Witmer and Zorn, 2007). Canadian firms may likewise be forced to maintain higher profitability than US firms to attract footloose foreign capital (Freedman, 2011).

Banking

The Canadian banking system is well regulated and supervised, and profitability is high. At the same time, there may be a trade-off between banking-system stability and economic dynamism (OECD, 2010c). Canadian banks' prudence in lending served them well in the global economic crisis, but financial innovation could also have significant benefits for consumers (Lerner and Tufano, 2011). Canada's banking culture also implies a preference for collateral-based lending; hence, domestic mortgages account for a share of bank assets that is high by international standards (OECD, 2010c).

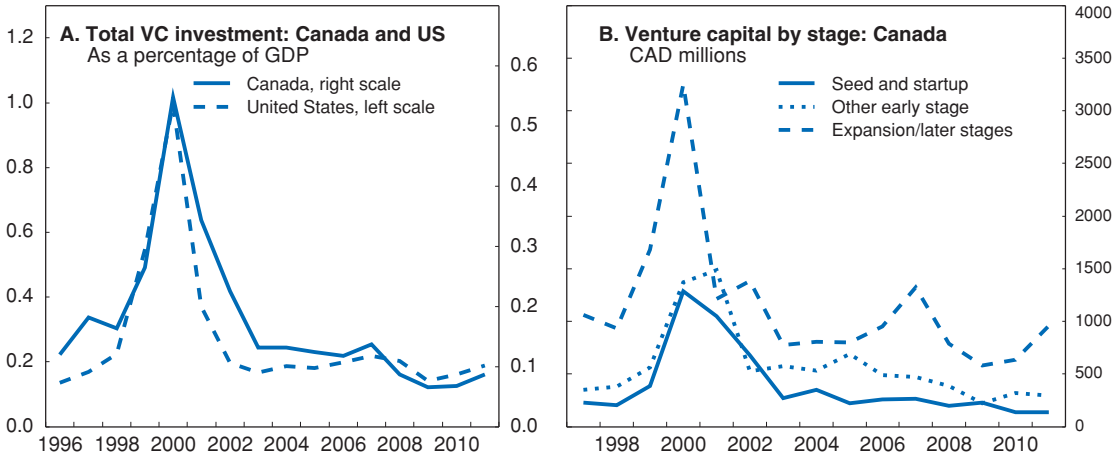
Banks are not involved in early-stage seed-capital funding for innovative start-ups because intangible investments by definition lack a physical form that can be collateralised. Furthermore, the entrepreneur may have no track record and few product lines so that cash flow deficits and surpluses across multiple products cannot be used to offset each other. Business surveys reveal that SME financing is more problematic in Canada than in the United States, and there is evidence of a greater reliance on loans from family and friends, suggesting a lower availability of formal debt financing (Leung *et al.*, 2008). Whereas 29% of all business loans in the United States go to SMEs, only 17.5% do so in Canada (OECD, 2012c). This may reflect the fact that US lenders effectively price risk whereas Canadian lenders follow a more uniform pricing policy. Thus, riskier SMEs benefit by being able to obtain credit more cheaply, but less risky ones end up paying higher interest rates than they would in the United States (Leung *et al.*, 2008). While its aggregate impact on the cost of SME finance is uncertain, this would still imply a less efficient allocation of capital in Canada.

Securities markets

A liquid and dynamic capital market can provide ample and affordable funding to innovation by spreading risk across many investors. However, severe information asymmetries, exacerbated by the non-rival nature of intangible assets (making innovators reluctant to reveal much of their plans to competitors), lead to a high cost of capital for small and start-up firms, in part to cover the risks of market "lemons" (Hall and Lerner, 2009). Venture capitalists can be enticed to take the high risks of funding unknown start-ups by relying on their own entrepreneurial and industry experience for monitoring, and even then only under the prospect of lucrative exits in the form of initial public offerings (IPOs) or mergers and acquisitions (M&As). Large established firms tend to prefer cheaper internally generated funds for their R&D rather than external finance.

In both the United States and Canada, stellar growth of VC in the two decades prior to the global financial crisis was associated with attractive exit opportunities for venture capitalists, which in turn was a function of buoyant stock markets (Figure 1.12, Panel A). Nevertheless, Canadian VC remained less than half as large (in proportion to its GDP) as its US counterpart, and nearly one-third of all investors in that market are in fact US-based (Figure 1.13). This partly reflects the fact that the United States is the VC originator and

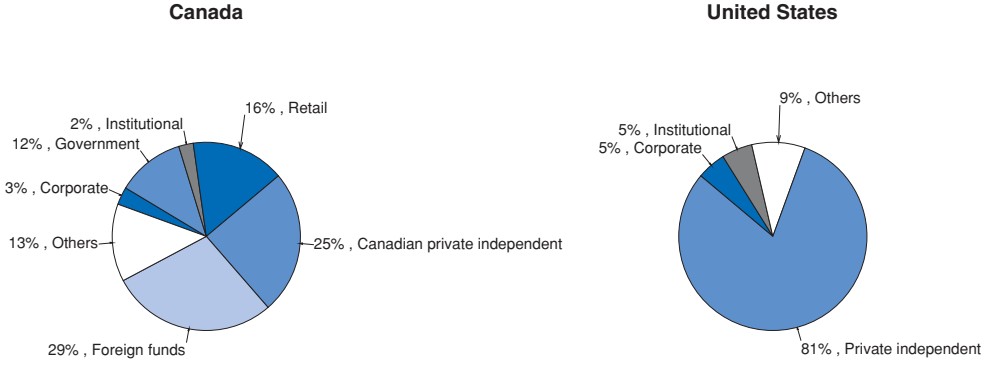
Figure 1.12. **Trend in VC investment, USA and Canada**



Source: Canada: Thomson Reuters VC Reporter; United States: PricewaterhouseCoopers/National Venture Capital Association MoneyTree; OECD (2012), *Financing SMEs and Entrepreneurs 2012: An OECD Scoreboard*, OECD Publishing. *http://dx.doi.org/10.1787/9789264166769-en.* StatLink *http://dx.doi.org/10.1787/888932618120*

Figure 1.13. **VC funding sources in Canada and the United States**

2011



Source: Thomson Reuters for the Canadian Venture Capital and Private Equity Association.
StatLink *http://dx.doi.org/10.1787/888932618139*

leader, but it could also be related to a lack of experienced venture capitalists, entrepreneurs and a well-functioning ecosystem in Canada. However, the US-Canada gap seems to be driven by two outliers, Massachusetts and California, suggesting a high degree of path dependence in this market. Expressing VC investments as a percentage of BERD virtually eliminates the gap between the two countries. This suggests that the Canadian VC market is itself limited by fundamentally weak business innovation and/or that the lack of VC financing could be contributing to Canada's low BERD ratio.

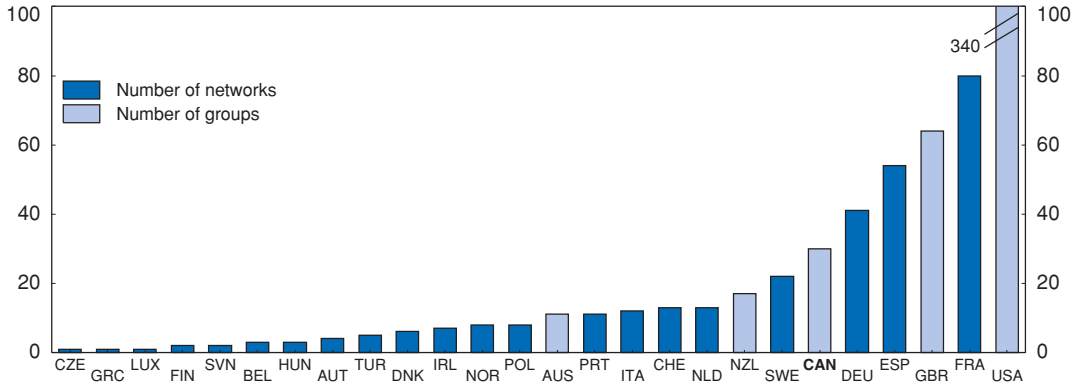
International experience shows that venture and other start-up forms of capital are important enabling factors for business innovation, as well as *vice versa* (Lerner, 2009). VC markets everywhere collapsed in the aftermath of the "dot.com" bubble and have languished since the 2007-09 financial crisis. VC funds have at the same time refocused their attention on late-stage start-up funding, which is less risky (Figure 1.12, Panel B). The durability of the VC model can be questioned, given that it is apparently dependent on

equity-market bubbles to score occasional big wins and that only a tiny share of companies (1 or 2%) get VC funding. Indeed, the VC solution to the problem of financing innovation has its limits: it tends to focus only on a few ("hot") sectors at a time, with minimum size too big for some start-ups, and it is very hard to establish as it requires at least three interacting institutions: investors, experienced venture fund managers and a deep market for IPOs (Hall and Lerner, 2009). Nevertheless, the contribution of VC funding to employment and value added has been very much out of proportion to its small size (CVCA, 2011).

The decline of the VC sector has shifted policy attention to angel investors, who typically operate at even earlier stages than venture capitalists and also provide the hands-on support that nascent entrepreneurs need. Angel investors tend to be experienced "serial entrepreneurs" who have been successful themselves and provide valuable mentoring and patronage as well as financial support to start-ups in an alignment of philanthropy and self-interest. Although data are sparse, reflecting the largely informal nature of angel investing, estimates are that angel and venture capital investments are roughly equal to each other in size in both the United States and Canada, though, looking at only seed within and early stages, angel capital is much bigger (OECD, 2011f). So far, the angel market in Canada is developing, and angels are increasingly investing through groups and becoming more visible (Figure 1.14). A good source of angels might be Canadian entrepreneurs returning from the United States, bringing back valuable experience gained there.

Figure 1.14. **Business angel networks/groups**[1]

2009



1. Business angel groups are formed by individual angels joining together with other angels in order to evaluate and invest in entrepreneurial ventures. The angels can pool their capital to make larger investments. A business angel network is an organisation whose aim is to facilitate the matching of entrepreneurs with business angels.

Source: OECD (2011), *OECD Science, Technology and Industry Scoreboard 2011*.

StatLink http://dx.doi.org/10.1787/888932618158

Subsidies to innovation finance

Significant failures in the market for innovation finance have been used to justify public intervention, though such measures must be carefully designed and subsequently evaluated, given a strong risk of unintended consequences (Lerner, 2009). Canadian governments provide two main types of support. The first is federal and provincial tax credits to retail investors in venture capital (VC) or angel funds. The main ones are Labour-Sponsored VC Corporations (LSVCCs). Retail investors can claim a credit on their federal income tax equal to 15% of their investment in such funds (up to a limit). Funds eligible for this tax credit can be invested in a Registered Retirement Savings Plan (RRSP),

and so are also eligible for that tax deduction as well. Provinces often top up the federal credit generously. Ontario has recently discontinued its LSVCC credit on the basis of a cost-benefit analysis. British Columbia has introduced large tax credits for angel investors, allowing individual investors to claim personal tax credits of up to CAD 60 000 per year. The British Columbia government claims that each tax dollar of subsidies calls forth many more in the form of private investment and eventual new tax revenues (Hellman and Schure, 2010). This may be an overestimate, because the analysis does not consider all other government support received by these businesses or attempt to measure the incremental value added by the B.C. tax credit, and also because innovative firms typically employ people with good labour market opportunities.

The second form of support is through direct federal government involvement on the supply side of the risk-capital market via incubators, seed funding, loan guarantees and the like. The main vehicle for such support is the Business Development Bank of Canada (BDC). The BDC plays a leadership role in delivering financial and consulting services to Canadian small business, with a particular focus on technology and exporting. To take advantage of financial markets, the BDC increasingly co-finances specific projects alongside private VC firms and also invests in VC "funds of funds".

Altogether public funding (*i.e.* non-private independent, non-foreign) represents nearly half of the entire VC market in Canada. One-fifth is direct government investment (Figure 1.13). This is a very large share that does not seem to bode well for a sustainable market and exposes the government to financial risks, notwithstanding the supposed alignment of public and private incentives by way of design. There is evidence that it introduces distortions into the VC market. In the case of the LSVCCs, these distortions include: retail investing in VC funds for tax-planning purposes rather than for the long term; goals extending beyond making the best possible return for investors; poor governance structures (organised as perpetual corporations rather than as limited partnerships with 10-year lifespans as are most private VC funds); absence of strong incentives for managers, with inefficient constraints on investments; and a lack of transparency and effective performance review by retail investors, as institutional investors like pension funds potentially able to exercise effective oversight are excluded (MacIntosh, 2012; Cumming, 2007).

Such features give rise to negative returns net of management fees and may crowd out private credit supply unable to compete with heavily subsidised credit, adding indirect costs of crowding out to the direct costs of tax subsidies (Cumming, 2007). That is, tax subsidies enable LSVCCs to outbid other VCs for investee companies, driving deal prices up and market returns down, discouraging private entry. Insofar as the largest LSVCCs tend to serve non-commercial goals like regional development and fund only very little actual innovation (MacIntosh, 2012), this attenuates the actual extent of crowding out they cause, though they still distort capital allocation in the market as a whole. An empirical study of Canada's public venture capitalists has shown that they underperform private venture capitalists, and while this would not necessarily be worrying if the publicly funded investments are truly marginal, it may at least in part reflect the crowding out of more productive private capital (Brander *et al.*, 2008). The BDC, for its part, as a crown corporation, is technically immune from political interference; however, it is ultimately accountable to Parliament and the Minister of Industry, and its activities reveal a strong regional bias, with very poor returns for its subsidiary BDC Venture Capital (MacIntosh, 2012).

While recognising the weak state of the VC market, the Jenkins report recommended boosting the resources of the BDC further to support the development of larger-scale, later-stage funds in support of the private VC and equity industry, thereby hoping to catalyse a "critical mass" that is necessary for the market's efficiency. The report also recommended BDC co-funding with angel investors on a "side-car" basis (*i.e.* where private partners make all the decisions). The 2012 federal budget made available an extra CAD 500 million in funding to VC support, including CAD 100 million through the BDC and an additional CAD 400 million in new funding (with details as to programme design and implementation to come).

Government can indeed help develop the market through co-investment funds in which private investors make the investment decisions, but its involvement should be on a strictly temporary basis, as in the case of the former Israeli Yozma fund. Such funds need to partner, rather than compete, with private VC funds, while bridging the gap when the market fails due to structural impediments (Cumming, 2007). Following the examples of the successful US SBIR programme and the Israeli Yozma fund, the government's investment could be guaranteed a modest rate of return on the upside in exchange for sharing in the downside risks, thereby leveraging private returns. More critically, federal and remaining provincial tax credits to retail investors in the LSVCCs should be withdrawn and the entry of pension funds into the VC market encouraged. More could be done to attract US VC funds as well, which should find Canada attractive not least because proximity is important for monitoring by investors. In this respect, it should be noted that the federal government has removed major tax barriers to private equity (OECD, 2010c), including narrowing of the definition of taxable Canadian property which eliminated the need for tax reporting of dispositions by non-residents of many equity investments. Finally, national angel associations could benefit from some government support, but preferably non-financial insofar as these tend to be wealthy individuals (OECD, 2011f).

Accounting rules that enhance investment transparency, notably by further improving the reporting of intangible investment valuations, would greatly facilitate institutional investment in VC (Cumming, 2007). Continuing improvements in financial reporting are likewise useful to enterprises engaged in innovative activity (OECD, 2010b). Government can assist this process by identifying and disseminating standards of best practice for the reporting of information on intellectual assets that can help investors assess future earnings and risks associated with investments in innovating firms. This would not only ease information asymmetries but also strengthen the exercise of ownership rights, subject management and boards to greater discipline and make intangibles valuation more efficient (OECD, 2012b).

Skills

A critical question for policy makers is to what extent public support for research and innovation (public or private, grants or tax incentives) bids up researcher wages and entails wasteful duplication and/or non-productive research. How can wage premia that are necessary for signalling desired supply responses (in education and training systems) be distinguished from such wasteful forms of wage push? Jaumotte and Pain (2005) found that goals like raising R&D intensity were bound to fail unless bolstered by measures to increase the supply responsiveness of R&D skills. With large numbers of baby boomers nearing retirement and educational attainment not rising as rapidly as elsewhere (Chapter 2), this becomes more of a risk, especially as governments are boosting R&D funding to remain competitive against innovating OECD and low cost non-OECD competitors alike.

What skill mix is required? On one count, there are four main functional skill levels: management, R&D, sales/marketing and production (Hanel, 2008). The relative importance of each type of skill depends on the nature of innovation (product, process, organisational or some mix; revolutionary or incremental, etc.), sector (manufacturing or services), firm size (small or large) and ownership (domestic or foreign). Surveys show that SMEs prefer a broader skill set than that offered by PhD graduates when hiring R&D employees. Wage premia are another indicator. Knowledge workers are needed both in production and in R&D, though to a much greater extent in the latter. It is presumed that knowledge-worker skills will be mainly associated with the first three functions. Their wages comprise the bulk of innovation expenditures, together with investments in ICT and other capital with high technology content.

R&D skills are perhaps the most portable of all four and the most important for new-to-market innovations. Firms can obtain them by hiring recent university or college graduates with the latest technical knowledge, or by providing in-house training. Technology transfer is another way in which firms can access such skills, albeit indirectly, typically by purchasing other researchers' output via contracting, leasing rights to others' intellectual property (or else purchasing their patents outright), collaborating in research, or making efforts to benefit from knowledge externalities more broadly. The SIBS showed that Canadian firms are significantly more likely to train workers in-house than to hire recent graduates of tertiary institutions or to collaborate with public research institutions.

High-tech manufacturing and knowledge-intensive services are a relatively small part of Canada's total production. This is likely to curb the demand for R&D skills, implying smaller wage premia for R&D-related skills than in some other OECD countries (Chapter 2). Indeed, notwithstanding the high quality of basic research and the magnitude of business-directed supports, employer demand for knowledge workers or purchases of their output appears disappointing. For instance, PhDs, of which there are proportionately fewer than in the United States, suffer unemployment rates three times as high as south of the border (OECD, 2010d). The science and technology share of total employment is relatively large, without producing correspondingly high innovation output, raising the possibility of underemployment of their skills. There is likewise still too little business collaboration with academics, despite multiplication in recent years of public grant programmes to encourage academic-business linkages. This suggests weak business demand also for the outputs of academic research, even while "supply-push" is being ramped up by various public outreach programmes (centres of excellence, incubators, student internships, etc.). Other disincentives or barriers appear to be at play.

Management is a key skill required for entrepreneurship, which plays a central role in stimulating firm entry and innovation (OECD, 2010a). Case studies of R&D-intensive firms that fail despite sound ideas and public support have pinpointed a lack of management and commercialisation skills as being most often the critical factor in their failure (Barber and Crelinsten, 2009). Thus, these can be suspected of being the key missing skills required for boosting innovation in Canada, as already noted. In part, this is because most innovators have a science and technology background. Indeed, in many smaller firms, notably innovative start-ups, one person (the inventor/innovator) will embody all four functions, all too often imperfectly. By the same token, they lack the knowledge of how even their excellent ideas can be commercialised. Finding the right contacts to line up financing and market interest is another critical feature of effective management.

Innovative workplace organisation (a function of management and worker skills alike) is very likely to be required to boost the creativity of the firm's workforce (OECD, 2011a). Research shows that Canadian manufacturing firms that were better able to adjust to the 2000s exchange-rate shock and maintained their production in the home market excelled chiefly in terms of flexible workplace management practices (Baldwin and Yan, 2010). The most important features appear to be staff training and granting them a high degree of autonomy, which encourages creative thinking, self-direction and responsibility. Motivated and engaged workers are the most productive.

Knowledge flows

Patent and copyrights

The non-rivalrous and intangible nature of knowledge (at least codified) makes it easy to copy and steal, and hard to value. This can be partly overcome by assigning legal property rights to it, for example via patents, trademarks and copyright. The main alternative to legally protecting IP is often secrecy, which may be socially less beneficial. The market for patents, in particular, has important efficiency aspects. One is that innovation is encouraged by enhancing creators' ability to appropriate commercial or other benefits flowing from IP. A second is that it allows a cleaner separation of R&D and commercialisation functions via trading, helping in this way to fill the management skills gap. In so-called vertical specialisation, an individual innovator or small start-up firm specialising in the generation of IP sells or leases the associated patents to a larger firm that is more adept at commercialisation.

There are well known tradeoffs involved with providing IP protection. One is the possibility that it will be abused so as to create monopolies, diminishing competitive intensity to the detriment of subsequent innovation. Empirical work by the OECD suggests that IP protection is on balance favourable to innovation, nonetheless (Jaumotte and Pain, 2005). Another nonetheless is the use of litigation to generate revenues from supposed infringements of IP by so-called patent trolls. In the high-profile case of Research in Motion, Canadian maker of the popular BlackBerry, patent trolls acquired patents relevant to its device, but never used them, and later sued RIM for a majority of its profits (Cummings, 2007). Such risks can be mitigated by carefully delineating the scope of the patent and the legal remedies available.

Canada appears to be falling behind in the international patent race. Canadian patent applications have languished since 2000, even as they have boomed in the United States, many countries in Europe and China (CIC, 2011). In terms of patent quality (adjusting by the number of citations by subsequent patent applications), Canada does much better (OECD, 2011d), though, as in many other countries, patent quality seems to have declined over the past decade, even if measurement is difficult. This widespread decline in patent quality reflects in part the exhaustion of earlier technological possibilities (notably in pharmaceutical research), and partly the rise of patent proliferation as a new form of competition.

Small firms are especially vulnerable to litigation risk once they attempt to market their IP, as larger incumbents with the means to do so may subject entrants to the immense cost of defending themselves against (sometimes frivolous) claims. Canadian start-ups have had some bad experiences in this regard when attempting to enter the US market (where the onus of proof is on defendants, and juries in some US states overwhelmingly favour US claimants). The OECD recommends making intellectual property rights (IPR) systems in member countries more "SME-friendly" by diffusing knowledge and know-how about IPR, streamlining procedures and reducing application

time, adequately structuring fees and costs, and improving litigation and enforcement mechanisms (OECD, 2011g). The OECD is also increasingly emphasising cross-licensing arrangements, open innovation and other forms of co-operation and collaboration as alternatives to litigation as a method of enforcing patent rights and diffusing knowledge (OECD, 2011d). These alternative methods rely much more on recognition of mutual benefits of knowledge sharing. They may be accelerated by the sheer technological difficulty of unravelling bundles of IP in areas like biotechnology. Canada's high level of social trust would seem to make it well suited for leadership in promoting such tendencies.

Copyright protection faces new challenges in the Internet age, where copying of music files, films, etc. is extremely cheap. Also, because network effects are integral to the business (and social) value of Internet services, exclusive rights to software and artistic output could inhibit this development if not carefully designed. The 2011 *Copyright Modernization Act* introduced new tools and exceptions to invest in IP and roll out cutting-edge business models in the digital era. Overzealous privacy protections could still have harmful effects, however, *e.g.* by blocking lucrative new sources of marketing to Internet advertisers, or by inhibiting the development of electronic medical records able to save lives through highly beneficial network effects. Policymakers must therefore weigh these real economic and social costs against the social benefit of privacy protection (Goldfarb and Tucker, 2011).

Technology transfer

The inability to capitalise on Canada's strong record in academic research leaves much potentially useful knowledge unexploited. The transfer of direct knowledge from academe to industry has always been the purview of the federal research granting councils (NSERC, SSHRC, CIHR for natural, social and health sciences, respectively). They fund placement programmes and research scholarships for university undergraduate, graduate and doctoral students who can then take their breakthrough research to industry and hope for commercial success, or at the very least gain a better understanding of how Canadian businesses operate. Internships, co-ops, and placement programmes have always been geared toward graduate-level students and newly minted university graduates; therefore, industry has had only that finite talent pool from which to choose when accessing placement programmes, leaving substantial resources in colleges untapped.

Investments in university research and technology transfer personnel have increased sharply since the early 2000s, while innovation output (as measured by patents and licenses for academic research) has risen far less dramatically. This suggests a low and declining productivity of technology transfer, especially in comparison with the United States where technology transfer surged over the same decade. Agrawal (2008) examines this "Canadian commercialisation discount" and attributes it chiefly to a weak commercialisation culture at universities, along with an overly bureaucratic mindset among technology transfer offices (TTOs) when it comes to deal making. The dearth of large high-tech firms acting as local demanders of innovation also plays a role, as may the lack of faculty superstars comparable to those found in the big US universities.

Policies have attempted to improve technology transfer in various ways. Public research is becoming more focused on issues of social relevance rather than purely curiosity-driven subjects. The marginal research dollar is increasingly tied to the needs of business. For example, academic grants may require signalling of their commercial relevance via co-funding by business. Community colleges are becoming proactive in

directly meeting the needs of small business in areas of problem solving, process innovation and technical skills, even though they benefit from little taxpayer support via the granting councils. Students involved in such collaborations, *e.g.* via internships, view them as highly motivational learning experiences. Governments are also attempting to stimulate academic-business collaborations and knowledge transfers through networks of excellence, incubators and the like. While these methods may reduce informational asymmetries and transactions costs that stymie collaboration, and they have seen some marked successes in Canada, international experience shows that it is very difficult to create vibrant clusters of innovative activity, unless many conditions and incentives are present (Box 1.3).

Basic and applied research are essential parts of the innovation ecosystem and, as the private sector does not typically do much of either, the government has a special and irreplaceable role in funding them (MacIntosh, 2012). For example, three-quarters of the most important therapeutic drugs introduced world-wide between 1965 and 1992 had

Box 1.3. **Geographical clusters**

It is a well known fact that intensive innovative activity is more likely to take place within geographical clusters that are able to reap agglomeration economies – supply chain linkages, large labour pools and tacit knowledge diffusion – as epitomised by California's Silicon Valley, Singapore and Tel Aviv. Some research suggests that agglomeration effects are very limited in scope, not extending outwards by more than perhaps 10 km beyond a central zone (Baldwin *et al.*, 2008), so physical proximity is important for effective collaboration, despite all the advantages of modern communications. Investors in high-risk start-ups also like to be near their investments in order to monitor them. Innovation "hot spots" are few and far between (OECD, 2011e). They tend to arise somewhat spontaneously, often relying on a confluence of favourable factors such as a strong research university, or a public or corporate laboratory at its core, as well as urbanised social and artistic amenities and cultural diversity.

Government spending often plays a role as well, especially in promoting university hubs. For example, US military contracts with Stanford University helped to spur the development of Silicon Valley, as commercial ventures were spun off from the new silicon chip technology being developed for military purposes (Lerner, 2009). Famous firms like Intel got their start under the highly regarded US federal Small Business Innovation Research (SBIR) programme. Venture capitalists clustered in the region, setting up a virtuous cycle of funding and creativity. However, government support is not a sufficient condition. The darker side of the story is that governments everywhere have wasted large amounts of public money in attempting to artificially build the next great innovation cluster (Lerner, 2009). They should probably stay away from trying to do so and focus rather on creating the right framework conditions for innovation.

Canada has some notable hot spots in Montreal (aeronautics, operations research, video games), Waterloo (smart phones, ICT), and Toronto (life sciences), each based on very different approaches and models. Montreal has been significantly led by provincial government and universities, whereas Waterloo was more grass roots and business-oriented, reflecting perhaps the cultural heritage of the large German immigrant population that settled there (CCA, 2009).Toronto's MaRS Discovery District has benefited from strong public and private foundation support for hospital-based research and a number of excellent universities in close proximity within a diverse urban culture. There is a risk that some of these hotspots remain too close to academia and fail to develop their commercial dimensions.

their origins in public research; almost all drugs coming out of biotechnology companies had their origin at universities (Stephan, 2012). Pushing universities to become more business relevant in all areas risks a focus on short-term research with immediate applications and reducing projects that may have important long-term impacts on productivity and social welfare. Nevertheless, a marginal rebalancing away from basic research, as is currently being sought, is appropriate. To bolster this process, academics should face stronger incentives to produce commercially relevant and creative research. Review panels for competitive awarding of federal research grants should include experienced business people. They should make selections on the basis of researchers' track records, rather than just research proposals, as the latter may be very time consuming and could even stifle creativity (see Wheeldon and Gordon, 2011 for a critical view).

University TTOs have not been very efficient in their role – *i.e.* all too often holding out for top dollar in licensing fees or "hoarding" IP. Private markets of this sort may require a level of sophistication about IP and doing business that TTOs often lack. Universities need to overhaul TTOs to focus less on licensing fees and more on industry collaboration, infrastructure sharing and training (CIC, 2011). Provincial governments, which govern education, should send a clear signal to the universities to this effect.

The Competition Policy Review Panel suggested that Canada's tertiary education institutions could expedite the transfer of IP rights by moving to an "innovator ownership" model, learning the lessons of the University of Waterloo's extraordinary success in commercialising its faculty research (CPRP, 2008). The Expert Panel on the Commercialization of University Research proposed a federal IP framework modelled on the 1980 US Bayh-Dole Act, which facilitated the interest of business in commercialising university inventions by strengthening private property rights to federally funded research, while imposing uniform patenting and licensing procedures across universities (Advisory Council on Science and Technology, 1999). Agrawal (2008), though, finds that the current mixed-model system in Canada mimics the property rights effects of the US legislation well enough, and that the causes of inefficient technology transfer lie elsewhere, much of it outside the purview of federal policy, as argued above.

Conclusions

Canada clearly has the potential to be a nation of innovators and seems to possess all the right fundamentals to be a major international player in IP. What seems to be holding it back is a certain dichotomy in policies: at the general level, they internalise virtually all of the OECD market-based best practices, yet selective government supports to sectors, firm sizes and ownership structures may have serious impacts on incentives to innovate, succeed and grow. Estimating the economic/social costs and benefits of these selective policies will be needed to overcome the political hurdles to eliminating the least efficient of them. By levelling the playing field and letting market forces run their full course, business innovation in Canada can be unleashed and high productivity growth achieved. Governments should also resist going too far toward discretionary R&D policies, just as other OECD countries are moving toward the Canadian model of heavier reliance on tax credits in their search for efficiency. The education system should supply more skills and knowledge serving business innovation needs. A list of recommendations to strengthen the policy framework for innovation, drawing on the above discussion, is provided in Box 1.4.

Box 1.4. **Recommendations for boosting business innovation**

Provide a stronger culture of competition, risk taking and customer orientation

- Increase competitive intensity in network sectors and professional services, in line with *Going for Growth* (OECD, 2012a) and *Compete to Win* (CPRP, 2008) recommendations. Fully implement the Agreement on Internal Trade to dismantle provincial barriers. Clarify the net benefit test for FDI and apply it narrowly.
- Promote efficient and deep financial markets by: improved accounting for intellectual assets, more vigorous competition in financial services, and consistent and high standards in provincial securities market regulation.
- Examine how institutions can better develop cognitive and social skills for entrepreneurship and risk-taking. Support and encourage risk-takers across the board, from high-tech *avant-garde* to skilled trades.

Better target fiscal supports to R&D

- Scale down SR&ED tax subsidies, reducing the small firm subsidy rate toward that of large firms while keeping the base broad (inclusive of capital) to avoid distortions in technology choice. Restore the 20% general SR&ED rate.
- Streamline fragmented federal granting programmes to boost business interest in collaborations with academics. As IRAP is expanded, consider partial cost recovery of pre-commercial business advice.
- Carefully design support to venture capital by means of strictly temporary co-financing arrangements, giving private partners full management control and possibly capping government returns in order to leverage private returns. Eliminate tax credits to retail investors in LSVCC funds. Provide institutional support to angel funds.
- Co-operate with provinces to align their grants and tax credits to R&D and VC with federal government.
- Design low-budget-cost policies to foster market demand for innovations, including "green" technologies, *e.g.* consumer policies and getting prices right via carbon taxes. Public procurement is relevant here, though it needs to be carefully designed to focus on technology neutrality and performance to stimulate innovation.
- As the policy mix shifts toward more granting and procurement, design safeguards against the risks of: lack of capacity in the public sector to wisely choose projects; inefficient policies and market distortions (including at the international level) due to Canada-only provisions; and capture by vested interests.

Update institutional foundations of the "knowledge economy"

- Motivate technology transfer from academia by means of improved incentives for academics, *e.g.* by adopting a more open and inclusive research-granting process, and business vouchers for academic collaborations. Consider rationalisation of currently widespread distribution of research resources in order to promote Canadian "star" universities better able to command market interest for their research.
- Strengthen the IP system: *i)* modernise the relevant legislation/public agencies to enhance transparency and guidance to inventors; *ii)* establish national protocols for sharing/transfer of IP in academic-business collaborations; *iii)* provide IP management services to SMEs, *e.g.* within regional centres of excellence; *iv)* establish a specialised Patent Court or section of a court; and *v)* promote international IP collaboration.
- Build capacity to undertake comparative evaluations of fiscal supports to better guide funding allocations and programme design. This could be done by an arms-length Innovation Council as recommended by the Jenkins panel.
- Tailor privacy protections to minimise tradeoffs with knowledge diffusion and network benefits from the Internet and integrated electronic medical records.

Notes

1. There have been numerous cases, *e.g.* canola oil, in which Canada developed the technology but failed to commercialise it, ending up having to pay large royalties on foreign patents (CIC, 2011).
2. Nevertheless, there is a strand of research that concludes that policies that make business entry harder, such as strict bankruptcy laws or higher taxes on success, may lead to increased lending and higher-quality entrepreneurship. In US states with generous bankruptcy laws, for example, it is more difficult for low-income households to obtain loans (Gropp *et al.*, 1997).
3. A recent OECD study of eastern Germany showed that teaching can have a greater effect if linked to support for enterprise start-ups by students and staff, including mentoring, grants and incubation facilities (OECD, 2010a). This is starting to happen in Canada, where colleges are at the forefront of developing such support systems.
4. Small CCPCs are defined as having up to CAD 500 000 in prior-year taxable income and up to CAD 10 million in prior year taxable capital. As these thresholds are exceeded, the qualifying R&D expenditure limit for the 35% rate is phased out. At CAD 800 000 in income or CAD 50 million in capital, the firm is considered large and fully subject to the 20% general subsidy rate. Tax credits earned at the 35% rate are fully refundable for current expenditures and for 40% of capital expenditures. Those earned at the 20% rate are non-refundable, with the exception of qualifying expenditures of small CCPCs in excess of the CAD 3 million limit, which are eligible for 40% refundability (see Parsons, 2011).
5. Australia, for example, introduced in 2001 a premium R&D tax concession (over and above the baseline tax concession) for incremental R&D above a firm's most recent three-year average R&D expenditures, which is thought to have resulted in an acceleration of business R&D in that country (Cumming, 2007). However, in 2010 it replaced the hybrid volume and incremental-based schemes with a simpler and more generous volume-based scheme (OECD, 2010e). The R&D tax concession was replaced in 2011 by an R&D tax incentive scheme based on a tax credit (Australian Government, 2011).
6. The parameters used for the calculations are based on surveys of the empirical literature for Canada. The spill-over rates for SR&ED are assumed equal for large and small firms (56% on average, 110% for basic/applied research and 42% for experimental development), despite some evidence that they may be larger for large firms. Elasticities of response to R&D credits are also assumed equal across firm sizes. The spill-over benefit is assumed to be higher for IRAP-financed projects due to its use of targeting. See Lester (2012).
7. The report also makes reference to the German Fraunhofer institutes as particularly effective institutions for business finance and support. The Fraunhofer Gesellschaft operates a network of 60 institutes as an integral part of the technological virtuosity of German industry and competitive strength of its economy. It is funded one-third by government subsidies, one third by industry, and one-third by competitive public research grants. The institutes are customer-oriented, applied research organisations striving to transform scientific findings into useful innovations. They provide: *i)* highly specialised, professional R&D services to industry; *ii)* demand-driven research combined with scientific excellence; *iii)* strong integration with academia; and *iv)* autonomy combined with simple corporate rules and a strong brand (IPFSRD, 2011).

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Chapter 2

Tertiary education: Developing skills for innovation and long-term growth

The tertiary education system in Canada performs well in fostering a skilled workforce with generally good labour-market outcomes and is internationally recognised for its research contributions. Tertiary educational attainment is high, but participation rates will need to continue expanding to maintain the supply of highly skilled labour as the population ages and the needs of the knowledge-based economy rapidly evolve. This should be achieved by encouraging access to higher education for disadvantaged socio-economic groups, while enhancing the flexibility of the system to allow students with diverse needs to move between institutions more easily to meet their learning objectives. Immigration is another important source of skills that could be better utilised. The development of skills for innovation can be improved by increasing the integration of technical, business and communications skills training with practical industry experience within tertiary education programmes. In an environment of government spending restraint, the quality of tertiary education could be strengthened by increasing the distinction between institutions that target research and those that emphasise teaching and re-evaluating tuition policies in provinces where public finances are stretched.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

As economic activity in Canada becomes increasingly knowledge-based, human capital provides the foundation for innovation and gains in productivity and plays a critical role in raising living standards over the longer term (Box 2.1). Education can lift the quality of labour and raise economic performance through its effects on the pace of technological change, the adoption of more innovative and productive work practices, labour-market participation and managerial quality. Education can also contribute to equality of opportunity and promote broader benefits through lower crime, improved health outcomes and greater social cohesion. However, higher skill levels can translate into greater economic prosperity only if individuals are able to employ those skills productively. Canadian policymakers thus face the key challenge of producing the right mix of skills to meet both present and future labour-force needs and to support innovation-driven growth.

Canada already enjoys a comparatively high level of educational attainment. High-school completion is nearly universal, and international student assessment results indicate that the elementary and lower secondary education system graduates students with strong performance by global standards. In reading, maths and science, Canadian students perform at or above the OECD average PISA scores in almost all provinces. Although these outcomes vary across socio-economic groups, the disparities are small compared to other OECD countries, suggesting a relatively equitable compulsory education system (OECD, 2010a). The country also benefits from high attainment rates at the tertiary level.

Box 2.1. **Human capital and productivity in Canada**

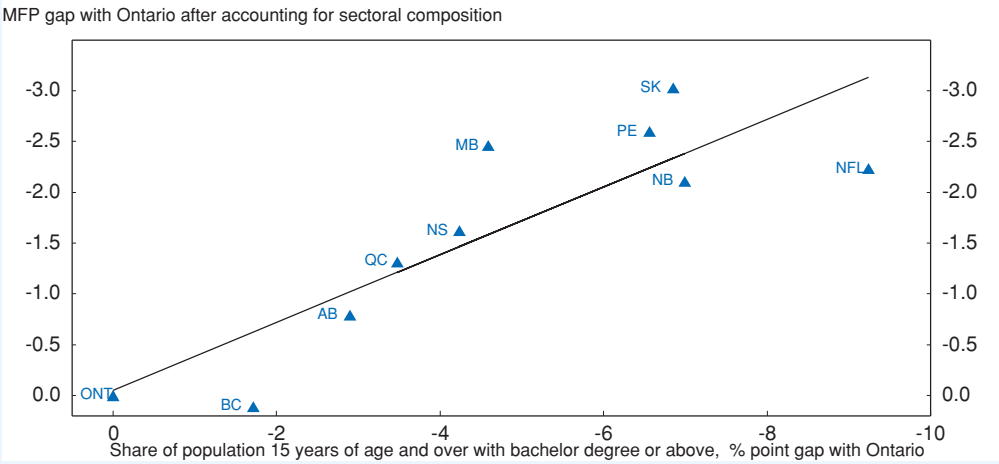
Economic theory predicts that in a small open economy with perfect capital mobility, human capital is complementary to physical capital in the production process (Barro *et al.*, 1995). Because of the impossibility of using human capital as collateral, financing constraints on investments in education prevent the instantaneous flow of financial capital to where rates of return are highest. It is thus human capital accumulation that ultimately determines the rate of return on physical capital and divergences in per capita income levels. The relationship between human capital and income per capita can be tested on data for Canadian provinces where social infrastructure is fairly similar, to better understand regional disparities in standards of living. Indeed, Coulombe and Tremblay (2007) find strong evidence that differences in literacy levels and university attainment play a significant role in explaining relative per capita income levels across Canadian provinces.

Industry composition differs widely across the country and may explain a considerable portion of the regional variation observed in productivity. Everything else equal, provinces with a large share of output coming from high-productivity industries will tend to have higher overall productivity levels. It is therefore important to account for such differences in sectoral makeup when assessing the relationship between human capital and output across different regions. This can be done by using disaggregated data on real output for 18 industries and 10 provinces over the 1997-2010 period. Multifactor productivity levels

Box 2.1. **Human capital and productivity in Canada** *(cont.)*

can be derived by industry and province from the residuals of conventional Cobb-Douglas production functions (see Cheung and Guillemette (2012) for details on methodology and data). After controlling for industry composition and cyclical economic effects, differences in productivity levels across provinces appear to be strongly correlated with educational attainment, as measured by the population share with a university degree (Figure 2.1).

Figure 2.1. **Productivity and university attainment across provinces**



Source: OECD calculations based on Statistics Canada, CANSIM Tables 031-0002, 379-0025 and 383-0009. See Cheung and Guillemette (2012).. StatLink http://dx.doi.org/10.1787/888932618177

All of these outcomes indicate a highly skilled talent base to support strong productivity growth. Nonetheless, Canada has not enjoyed rapid productivity gains for many years. Also, it lags somewhat in the development of computer science, and business and advanced skills. These deficiencies are a concern as the challenges posed by globalisation and demographic ageing highlight the need to raise educational attainment and quality, and to continuously upgrade these skills through lifelong learning to remain internationally competitive and avoid future skills shortages. This chapter assesses the record of the tertiary education system in delivering the appropriate mix of skills to sustain growth in a knowledge-based economy driven by continuous innovation. The tertiary sector here refers to education offered at both universities and colleges (tertiary education institutions or TEIs), and for the purposes of this chapter the term "college" will refer to both community colleges and polytechnics (see Box 2.2).

Box 2.2. **The tertiary education system in Canada**

Tertiary education is normally defined using the International Standard Classification of Education (ISCED) to include programme levels 5A, 5B and 6. Tertiary-type 5A refers largely to theory-based programmes lasting at least three years full-time, and typically covers university undergraduate and master's degrees providing qualification for entry into advanced research programmes such as PhDs (tertiary-type 6) as well as high-skill professions (*e.g.* medicine, dentistry, law). Tertiary-type 5B programmes are shorter in duration and focus on practical,

Box 2.2. **The tertiary education system in Canada** *(cont.)*

technical or occupational skills for direct entry into the labour market. Level ISCED 4 programmes include occupational preparation and adult education programmes and are labelled non-tertiary post-secondary education and may be provided by either upper-secondary or post-secondary education institutions, depending on the country.

Tertiary education institutions (TEIs) in Canada generally include universities, community colleges, polytechnics and university-colleges. Universities normally offer tertiary-type 5A and 6 programmes, whereas colleges traditionally provide tertiary type-5B programmes. Colleges typically grant diplomas and certificates rather than degrees, although a small subset of "polytechnic" institutes emerged in the early 2000s that grant baccalaureate degrees with a focus on applied research for industry. A university-college system also exists in the western provinces, which provides four-year undergraduate degree programmes, distinguished from universities mainly by its emphasis on teaching over research. In Canada, many community colleges and polytechnics offer both tertiary-type 5B and non-tertiary post-secondary type 4 programmes, and so international comparisons of tertiary education systems should be viewed with some caution.

Canada has 163 recognised public and private universities and 183 recognised public colleges and institutes, including those granting applied and bachelor's degrees. Private institutions are mainly limited to theological or online universities and career colleges, although a few private non-denominational universities exist in British Columbia and New Brunswick. Publicly funded universities are largely autonomous, set their own admissions standards and degree requirements, and generally manage their financial affairs and programme offerings. Provincial and territorial governments intervene in the areas of funding, fee structures, quality assurance and the introduction of new programmes. In publicly funded colleges, government involvement can extend to admissions policies, programme approval, curricula, institutional planning and working conditions. Vocational education straddles both secondary and tertiary sectors; training may be offered during the last two years of secondary school or in separate specialised schools, or in public and private colleges. Admission requirements for universities and colleges are based largely on secondary school academic performance.

In Canada, education is regulated by the ten provinces and three territories, and there is no national integrated education system. In the 13 jurisdictions, departments or ministries of education oversee the organisation, delivery and assessment of education at all levels. Provincial governments provide on average over 80% of direct public funding to tertiary education institutions. Although there is no federal department of education, the federal government provides funding for tertiary education in a number of ways, including through transfer payments to provinces and territories (most notably, through the Canada Social Transfer), through direct financial support to colleges and universities (mainly to individual scholars for research), and through direct financial support to students. The federal government also has responsibility for the education of Canada's First Nations population living on reserves. The education policies and the delivery of educational services vary across provinces and territories according to the particular needs and priorities of their respective jurisdiction. Provincial and territorial ministers of education regularly meet and coordinate on initiatives of mutual interest through the Council of Ministers of Education, Canada (CMEC).

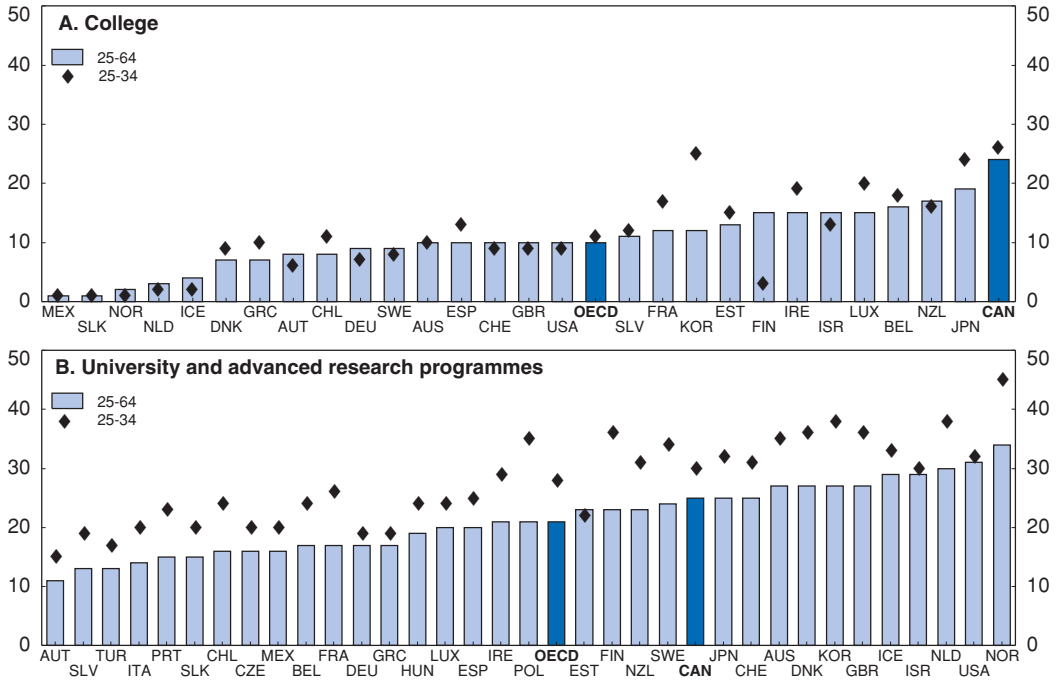
Educational attainment

Educational attainment levels have been rising over time in Canada and across OECD countries. This trend may reflect in part the effects of technological change and globalisation, which have raised demand for highly educated workers and changed the nature of skills needed in the workplace (Riddell, 2001). Canada currently leads the OECD with the highest proportion of adults aged 25-64 that have completed tertiary education at 49%, compared to 30% for the OECD average (OECD, 2011a). This share rises to 56% for the cohort of 25-34 year-olds, exceeded only by Korea. However, this ranking reflects a remarkably high community college attainment rate; at 24%, Canada boasts the highest share of adults with a college (tertiary-type 5B) education, *versus* the OECD average of 10% (Figure 2.2, Panel A). Meanwhile, Canada's share of adults with university (tertiary-type 5A) education ranks tenth among OECD countries at 25% (*versus* the OECD average of 21%), but only fifteenth among adults aged 25-34 (Figure 2.2, Panel B), portending potential future competitiveness losses.

Tertiary graduation rates (number of graduates as a share of the graduation-age population cohort) depend on various factors, including the degree of access as well as the demand for and returns to higher skills in the labour market (OECD, 2011a). In 2008, Canada's college graduation rate was 28.6%, much higher than the OECD average of 10.4%, whereas its university graduation rate was slightly below the OECD average (38.6%) at 36.6%

Figure 2.2. **Population with tertiary education, 2009**

Percentage of the population that has attained tertiary education by age group



Source: OECD (2011), *Education at a Glance 2011.*

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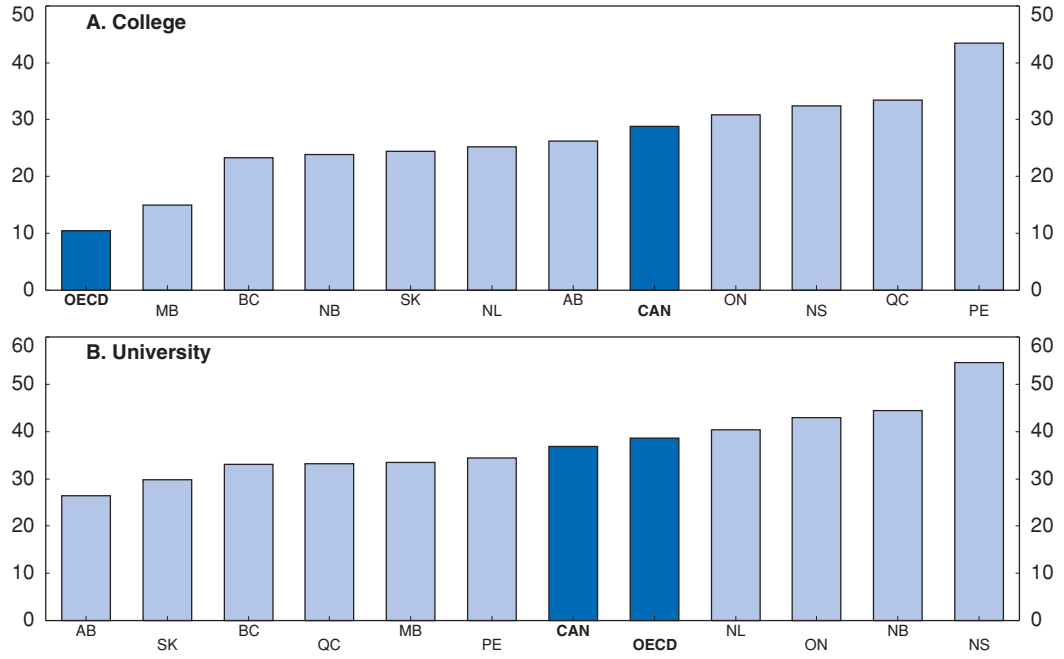
(Figure 2.3). However, university graduation rates have increased substantially from 23% in 1988. Furthermore, the average university graduation rate exceeds that of the college in Canada (Figure 2.3). While Canada's master's and PhD graduation rates have risen considerably since the early 2000s, they still ranked in the bottom half of OECD countries as of 2008-09.

Figure 2.3. **Graduation (attainment) rates for college and university programmes**[1]

2008



1. The term graduation rate is used in its OECD sense of attainment rate for a specific cohort.

Source: Canadian Education Statistics Council (2011), *Education Indicators in Canada: An International Perspective.*

StatLink http://dx.doi.org/10.1787/888932618215

Canada's high community college participation rates relative to many other OECD countries likely reflect several factors. One is the structure of education systems in Canada. The systems of public non-degree-granting institutions in Canada were, for the most part, created by provincial and territorial governments in the 1960s to provide labour market preparation programmes as alternatives to the more theoretically oriented programmes of universities. Public universities tend to be concentrated in large urban centres, while colleges in Canada are much more geographically dispersed and are therefore more accessible for Canadians living in rural areas or small towns (note, however, that the percentage of the population that lives within commuting distance of a university varies across provinces and territories). Some degree of measurement discrepancy must also be taken into account when looking at educational attainment: Statistics Canada data on tertiary education attainment includes those with community college diplomas, which does not permit the distinction of some adult education and occupational preparation programmes. Because the latter would be classified as non-tertiary post-secondary education for other OECD countries, Canada's community college attainment rates are inflated in cross-country comparisons. A second factor is the unique *cégep* system in Québec (Box 2.3). While that system likely explains why Québec's college attainment rates have always exceeded the Canadian average, it is also the case that college graduation rates in almost all provinces and territories are above the OECD average.

Box 2.3. **Québec's education system**

The Québec education system differs from that of other Canadian jurisdictions in that its students finish schooling after 11 years, compared to 12 elsewhere. After completing high school, Québec students then enter a free public *cégep (collège d'enseignement général et professionnel)*, where they can pursue either a two-year pre-university stream or a three-year technical training stream. Completion of either stream leads to a College Education Diploma (DEC), which allows admission into a university programme. Both streams contain a general education component, which is equivalent to the twelfth grade of secondary school, while the pre-university stream is equivalent to the first year towards a bachelor's degree. As a result, most Québec university undergraduate programmes last three rather than four years. Since the last year of college technical training is equivalent to the first year of a bachelor's degree programme, various Québec universities have entered into agreements with *cégeps* to recognise courses from the *cégep* technical stream for university credit.

Degrees from Québec universities are generally recognised as equivalent to those in other Canadian and foreign universities from the perspective of both the universities themselves and the labour market. When assessing credit transfer eligibilities, universities outside Québec normally recognise credits earned by students who have completed the pre-university *cégep* stream in the same way as those from other first-year university courses. Students who have completed only one year of a *cégep* programme may also apply to enter the first year of any four-year undergraduate programme outside Québec.

Historical and cultural context to education policy in Québec

The *cégep* and the Université de Québec systems were created in the late 1960s primarily to promote geographical and financial accessibility to post-secondary education at a time when the province was less advanced with respect to the rest of Canada. To fully appreciate the Québec system, it is important to note that Québec defines itself as a society in its own right and not merely as one province among others within the Canadian federation, and therefore made its own educational choices, informed by the most innovative models at the time (Trottier and Bernatchez, 2005).

Québec's higher education policy did and continues to consider accessibility very important, in recognising Article 13 of the 1967 UN International Covenant on Economic, Social and Cultural Rights (of which Canada is a signatory) which states: "Higher education shall be made equally accessible to all, on the basis of capacity, by every appropriate means, and in particular by the progressive introduction of free education". The government has pursued this goal systematically by offering free *cégep* education and maintaining low university tuition fees. University tuition was frozen from 1972-89, 1990-91 and 1994-2007.

Over time, the Québec government's policy objectives of promoting geographical and financial accessibility have expanded to include quality assurance (Trottier and Bernatchez, 2005). In this context, it decided to maintain free *cégep* education but to implement minor increases in university tuition of CAD 100 per year from 2007-08 to 2011-12, along with further increases of CAD 325 per year from 2012-13 to 2016-17. These increases are complemented by an expansion of student financial aid. These tuition increases will result in a return to 1968 tuition levels in real terms and are intended to increase the student contribution to university financing with a view to a more "equitable" distribution of costs, without worsening the province's standing relative to where it was when the UN pact was signed (Comité consultatif sur l'accessibilité financière aux études, 2011). Nonetheless they have met with resistance from the population.

Canada has a large community college sector, accounting for over half of Canada's TEIs, as compared to about 40% in the United States (Skolnik, 2004). The sector was developed in the 1960s to provide cost-effective access to tertiary education for the baby-boom generation. Over time the college sector has continued to expand and broaden its mandate by diversifying its student base and educational offerings. Some colleges have now become recipients of certain federal research grants, traditionally the realm of universities. Such developments mirror the growth of non-university sectors in other OECD countries in order to meet the increasingly diverse needs of the labour market, given profound structural changes, while allowing governments to limit the cost of providing tertiary education to a growing student body through shorter programmes (Santiago *et al.*, 2008).

Over time there has also been an increasing flow of student transfers between the university and college sectors. The community college systems in British Columbia and Alberta allow students to complete either a diploma programme or two years of academic course work towards a bachelor's degree. Those who choose the latter stream may then complete the third and fourth years at a university to earn the degree. The colleges in these provinces thus operate as hybrid institutions, providing not only technical education but also general academic education that can be applied towards a university degree. This system grew out of perceived changes in the skill mix demanded by the labour market, as well as governments' approach to expanding access to university at a lower cost. In other provinces, college courses must be evaluated for credit equivalency during the university admissions process. In Ontario, colleges have traditionally been permitted to operate only in areas not covered by university programmes, although individual partnerships have been formed between universities and community colleges.

University graduates are also complementing their degrees with college diplomas to improve their employability. These so-called "reverse transfers" began in the early 1990s as the economy's changing occupational structure and skill requirements drove up labour-market demands for individuals possessing a combination of technical/vocational and traditional analytical skill sets (Crocker and Usher, 2006). In general across OECD countries, workers are increasingly seeking to update their skills, and many choose to select a variety of courses from the most suitable providers, rather than committing to a fixed curriculum at any one institution (Santiago *et al.*, 2008).

The rapidly changing needs of the knowledge economy make it increasingly important to have a flexible tertiary education system that can provide continuous learning opportunities to students with a diverse range of backgrounds throughout their entire career. This system should allow for various entry and re-entry pathways for adult learners seeking to upgrade their skills. Longitudinal data from the *Youth in Transition* survey reveals that roughly 20% of college and university students in Canada leave their studies by the fourth year of their programme, but about half to two-thirds of these individuals return within four years of leaving (Finnie *et al.*, 2012). Of those that return, 30-50% switch to a different institution. These findings suggest that Canada's tertiary education system appears to already accommodate a variety of student trajectories, but flexibility could be improved further.

Flexibility could be enhanced by improving the "articulation" between and among colleges and universities to facilitate credit transfer where complementarities exist. First- and second-year university credits are transferable among nearly all Canadian universities in keeping with CMEC's Pan-Canadian Protocol on Credit Transfer (1995). However, the ease

with which credits can be transferred between colleges and universities, and between provinces varies across regions. Certain provinces such as British Columbia and Alberta have taken positive steps in this direction. For example, Alberta has developed the Campus Alberta model to recognise the particular needs of its learners, who tend to be older due to attractive employment opportunities in the resource-based economy.[1] The model allows credit transfers across institutions, including recognition of trades training and online learning, so students can design their own programmes from the different institutional offerings available in the province. Inter-provincial transfer agreements have also been established among western and among Atlantic provinces. These developments should serve as a model for other provinces to strengthen transfer arrangements both within and across jurisdictions.

In recognition of this need, a CMEC Working Group on Credit Transfer was established in 2002 to move towards a Pan-Canadian system over time, with a current focus on improving coordination within individual provinces and territories. Cross-country consultations have been carried out through the Pan-Canadian Consortium on Admission and Transfer, facilitating a multitude of reciprocal arrangements for credit transfer between TEIs. As proposed by Skolnik (2004), transfers could also be greatly facilitated if colleges and universities employed a common course numbering system, as exists in several US states.

The imminent retirement of baby boomers implies that tertiary participation rates will need to rise in order to maintain the supply of skilled workers, as discussed later. Statistics Canada projections indicate that the population of 15-19 year-olds reached a peak in 2009 and is set to decline steadily until almost 2020, suggesting the supply of new tertiary graduates will decline at constant participation rates.[2] Many provinces have recognised this challenge and set explicit objectives to increase post-secondary education (PSE) attainment rates. For example, the 2010 Ontario budget sought to raise the attainment rate from 62% to 70% by 2020. Given that overall participation rates are already quite high, there is a growing consensus that achieving such growth will need to come from greater inclusion of currently under-represented groups, such as students from families with low incomes and/or no history of PSE, Aboriginal students, students with disabilities and mature students.

Access to higher education

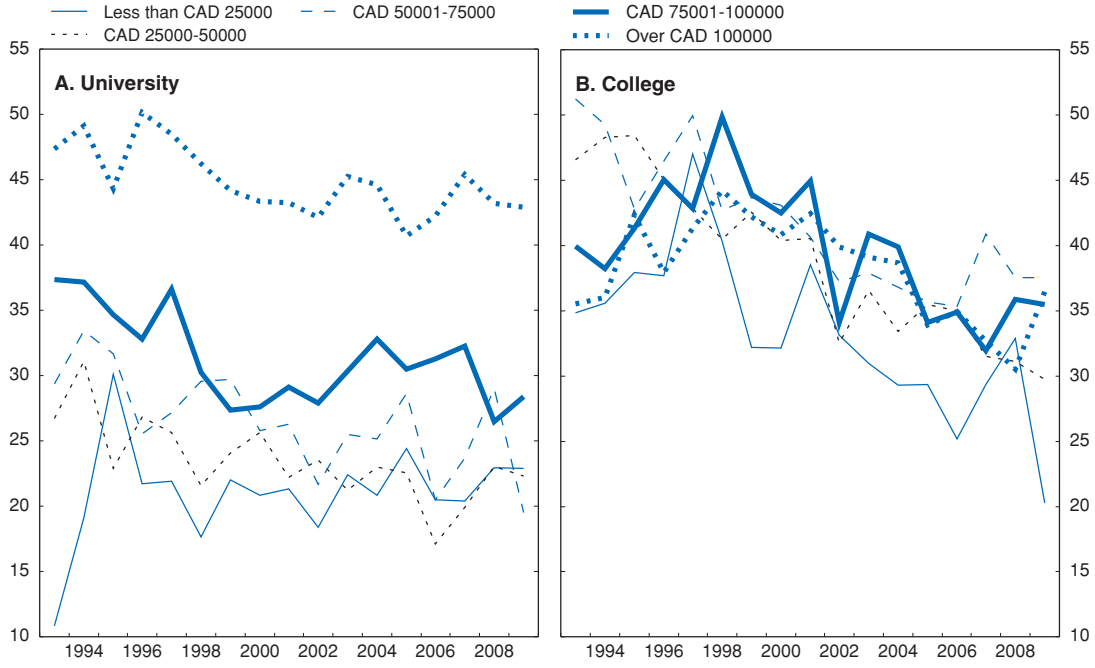
The decision to pursue tertiary education depends on several factors, including labour-market conditions, parental attitudes towards higher education, academic performance and literacy skills, the presence of motivational teachers in schools, the geographic location of TEIs and financial barriers. Results from Statistics Canada's 1999 *Youth in Transition Survey* found that 18-20 year-olds perceived financial barriers as the most important factor affecting their decision to pursue tertiary education (CCL, 2009). Indeed, wealthier Canadians are nearly twice as likely to go to university as poorer ones: while 46% of 19 year-olds from high-income families enrol in university, only 25% from low-income backgrounds do so, a gap that has been largely unchanged over the past 15 years (Berger *et al.*, 2009). However, as research on access to tertiary education progressed, it became more evident that barriers such as family background (particularly parental educational attainment) and high-school performance were among the strongest predictors of tertiary education participation in Canada.

Community college participation is more evenly distributed across socio-economic groups and less linked to family income (Figure 2.4). This outcome may reflect the greater geographic dispersion of colleges compared to universities (although, in some provinces, a large majority of the population lives within commuting distance of a university). For rural and low-income students, the costs of higher education can depend to a large extent on their proximity to a TEI. Students located beyond commuting distance would necessarily face greater financial obligations in the form of accommodation costs. Indeed, students from rural and urban areas are equally likely to attend college, but urban students are significantly more likely to attend university (OECD, 2010a). Furthermore, most inhabitants of northern regions do not have TEIs within commuting distance (CCL, 2009), which may explain why Canada offers a relatively high proportion of tertiary education courses conducted online (OECD, 2005). The data also indicate that college participation rates for young adults trended down from the late 1990s to 2008 for all family income groups (Figure 2.4, Panel B), although overall college enrolments increased slightly. This may reflect strong labour-market conditions over this period: the unemployment rate for secondary school graduates dropped from 9.8% to 6.4% (although it has since moved back up to 7.9% in 2011), with a similar sized improvement for those with less than high school credentials. Cyclical fluctuations in the economy may have a larger impact on enrolment in college than in university, given the sector's greater focus on applied training for the labour market.

More equal participation in college education across socio-economic groups may also reflect a greater responsiveness of college programmes to the needs of students from rural, low-income and Aboriginal backgrounds. Given their greater presence in rural areas, community colleges can more easily cater to the training needs of local communities.

Figure 2.4. **Participation rates in university and college**

By family income among 18 to 24 year-olds, per cent



Source: Statistics Canada, from Survey of Labour and Income Dynamics.

StatLink http://dx.doi.org/10.1787/888932618234

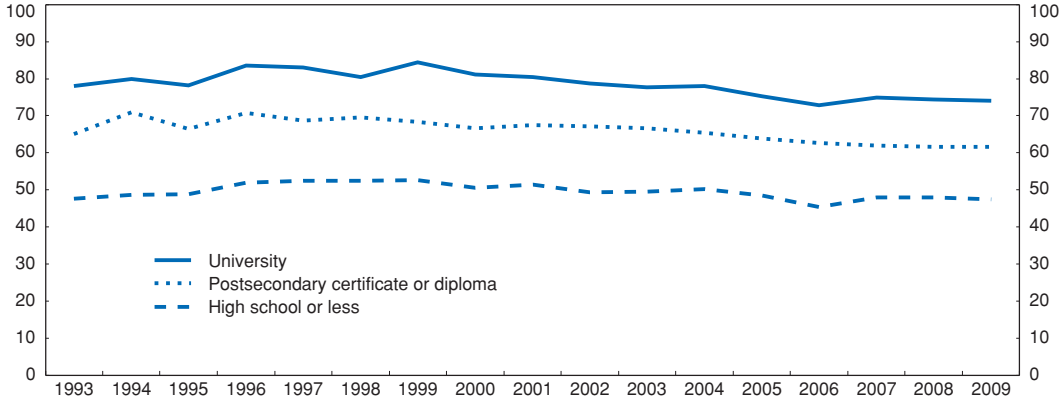
Compared to universities, colleges' shorter-term focus on developing skills for current industry and labour-market demands may also provide a greater appeal to students from financially disadvantaged families.

More recent research suggests that it is non-financial factors such as family background and high school performance that have the greatest influence on tertiary participation in Canada (Finnie and Mueller, 2008; Johnson, 2008). While family income plays a significant role in determining tertiary participation, its effect appears to be dominated by parental education levels, which is in turn highly correlated with students' academic performance in high school (Finnie and Mueller, 2008). Results from an OECD (2010a) study indicate that among Canadian students from the 2000 PISA cohort, those with university-educated parents were 4.6 times more likely to enter university after accounting for other factors, whereas the effects of parental income and occupation were small. Among 18-24 year-olds whose parents completed a university degree, about 80% consistently enrol in tertiary studies (Figure 2.5). These findings could reflect the possibility that highly educated parents expect more of their children, provide a more intellectually engaging environment for them and teach them better work habits.

The importance of family income in determining tertiary participation reflects in part the greater liquidity constraints facing lower-income households, which can largely be addressed by an effective student-loan system. The finding that family income is only weakly associated with tertiary education attendance suggests that Canada's financial-aid system is generally successful at providing funds to qualified students who are otherwise unable to pay, and/or that tuition levels are at a level that do not constitute an effective barrier to studying. However, a number of studies find support for the proposition that disadvantaged students face a different demand curve for higher education and require a higher financial rate of return to enrol than those from wealthier backgrounds (Carmichael and Finnie, 2008; Palameta and Voyer, 2010). These students may also undervalue education due to a lack of information on its benefits and costs. This difference in "willingness to pay" makes students from poorer families more sensitive to changes in the cost of education and potentially more averse to taking on debt, neither of which can be addressed by even an ideal student-loan system.[3] These findings imply that achieving equal access may additionally require the provision of grants to students from disadvantaged backgrounds.

Figure 2.5. **Post-secondary participation rates by parental education**

Among 18 to 24 year-olds, per cent



Source: Statistics Canada, from Survey of Labour and Income Dynamics.

StatLink http://dx.doi.org/10.1787/888932618253

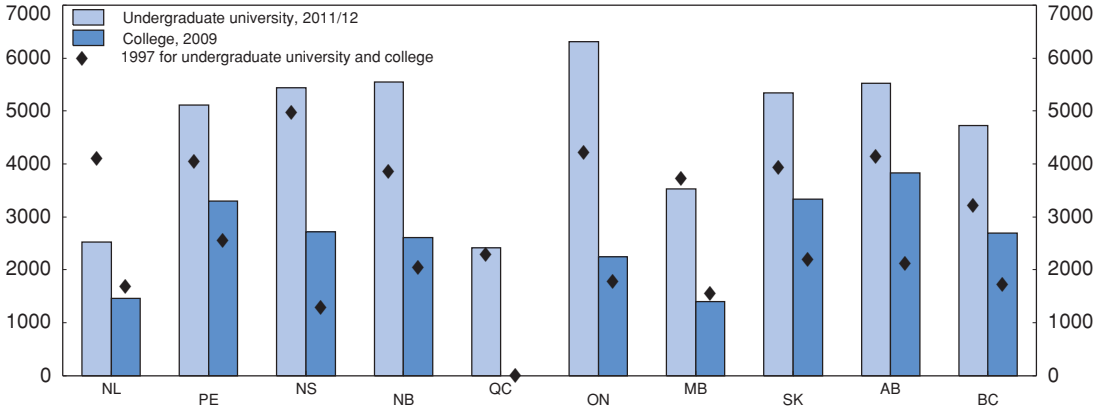
Overcoming barriers to equitable access

According to the 2003-04 Canadian Post-Secondary Student Financial Survey, tuition accounts for the largest share of student expenses at 34%, followed by accommodation and food at 30%, with other costs such as books, computers and transportation forming the remainder. In general, tuition fees at TEIs are regulated provincially, with significant differences in the level and variation over time across the country (Figure 2.6). Between 1997-98 and 2010-11, but especially in the early years of that period, university tuition fees increased in real terms in most provinces, by an average of about 40%, although declines took place in Newfoundland and Labrador, and Manitoba where tuition freezes were in effect. By 2008-09, average university tuition fees in Canada were roughly in the middle of the range for OECD countries reporting on this measure (Figure 2.7).

One way of addressing the issue of the impact of rising costs on access to tertiary education would be to move to an income-contingent loan repayment system, as in Australia and the United Kingdom. Under this system in its pure form, students do not face

Figure 2.6. **Average tuition fees by province**

2008 CAD



Source: Canada Millennium Scholarship Foundation (2009), *The Price of Knowledge*; Manitoba Council on Post-Secondary Education (2011), Statistical Compendium; and Statistics Canada.

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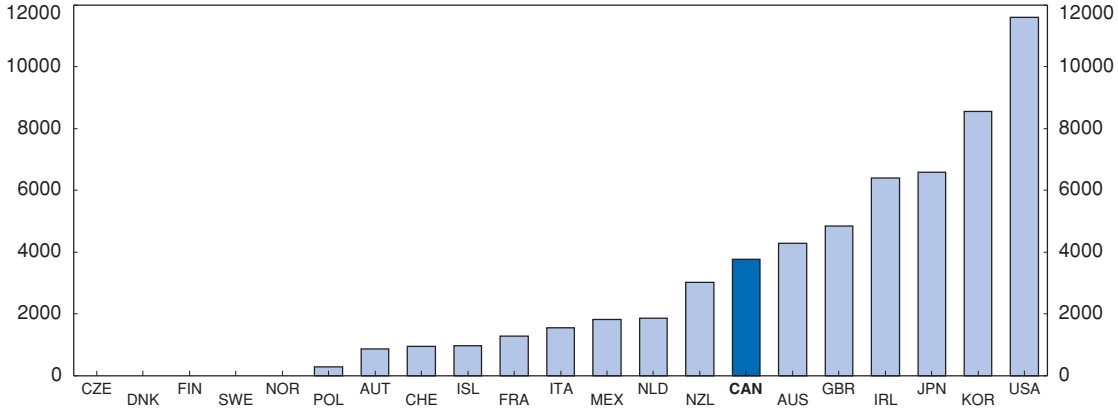
Figure 2.7. **Average annual university tuition fees for full-time students**

2008/09, in equivalent USD converted using PPPs



Source: OECD (2011), *Education at a Glance 2011*, Table B5.1.

StatLink http://dx.doi.org/10.1787/888932618291

any upfront tuition costs; the fees are covered by the government through a loan that is paid back after graduation. Because loan repayments are dependent on income levels, the amount of subsidy increases for those with lower lifetime earnings, as long as unpaid loan balances are discharged after a given amount of time. Evaluations of Australia's loan system a decade after its introduction found that socio-economic background had become less important in determining tertiary education participation (Santiago *et al.*, 2008). However, moving to such a system involves very high initial costs to cover student tuition fees until repayments begin to take effect, which may create challenges for provinces that presently face high public debt levels.

High or rising tuition fees on their own may not pose a significant barrier to low- or modest-income students if they are adequately matched by financial assistance to support them. In general, tuition differentials across Canadian provinces do not appear to drive variations in tertiary education participation (Johnson, 2008), again suggesting that the student financial-aid system is effective and/or that tuition levels are not high enough to pose a financial barrier. Nonetheless, despite evidence indicating that tertiary participation in Canada is price inelastic after accounting for other socio-economic factors, several studies suggest that increases in the cost of education may have a larger impact on students either from low-income families or whose parents have no higher education (Junor and Usher, 2004; Corak *et al.*, 2003; Coelli, 2005; Johnson, 2008). Reducing the price of tertiary education could therefore boost demand among these groups. Rather than blanket tuition cuts, this would be achieved most efficiently by increasing the provision of non-repayable grants directly to socio-economically disadvantaged students, once again given their greater debt aversion. Since university attendance increases with family income levels, the alternative of lowering or freezing tuition fees would act regressively to provide greater benefits to the affluent.

A large fraction of student financial assistance in Canada is provided in the form of subsidised loans and universal tax credits (Box 2.4) (OECD, 2011a). Student loans account for the largest share of aid provided, although it is worth noting that since the majority ends up getting repaid, the net cost of outstanding loans is substantially lower than their value. The actual cost of a student loan, which includes the interest subsidy (see Box 2.4) and cost

Box 2.4. **Financial support for students in Canada**

Federal, provincial and territorial governments provide financial aid in various forms for students to pursue tertiary education:

- Loans: With the exception of Québec, the Northwest Territories and Nunavut which operate their own programmes, students submit a single application to be considered for both federal and provincial/territorial financial assistance to the programme in their province or territory of residence and eligibility is determined based on an assessment of their level of need (*i.e.* educational costs incurred less financial resources). While provinces/territories (with the exception of those noted above) follow the same basic approach to assessing need, differences exist in the types of student expenses and resources that are recognised, as well as in the cost of living across the country and hence, in the amount of assistance awarded. The amounts provided through these programmes are shared between governments, with 60% of the aid provided by the federal government and 40% by the provincial government. Students are not charged interest on loans while studying and are required to begin repaying their debt six months after leaving school. Interest begins to accumulate on federal and provincial loans from the month after the completion of studies, at either a fixed rate (prime + 5%) or a floating rate (prime + 2.5%) for federal student loans (interest rates vary for provincial student loans).

Box 2.4. **Financial support for students in Canada** *(cont.)*

- Grants and loan remissions: Applicants for student loans are automatically assessed for eligibility to receive various federal and provincial non-repayable grants and provincial loan remissions. Eligibility conditions vary according to the province or territory of residence. Up-front grants are available for low- and middle-income students from the Canada Student Grants Program (CSGP) and several provincial programmes. Loan remissions, which are offered at the end of a year of study or following the successful completion of a programme, and which reduce the amount owing on a student loan, also comprise a significant portion of the available aid. Several other kinds of grants are available for under-represented students such as, for example, those with disabilities and dependents, those from rural areas, Aboriginal students and adult learners.
- Repayment Assistance Plan (RAP): This was introduced in August 2009 to offer relief on student debt repayments during periods of low income due to unemployment or under-employment. Borrowers under financial distress must opt into the RAP, and eligibility is determined by income and family size. The programme determines the repayment amounts on a sliding scale; they must not exceed 20% of the borrower's income. Persistent eligibility for the RAP for 15 years can also lead to complete forgiveness of the debt.
- Merit scholarships: The federal government, and all provinces and territories offer merit based scholarships based on various academic and other criteria.

The following federal programmes and grants are universal and are eligible to all students for full- or part-time studies in a university, college, and in some cases, a trade or apprenticeship programme:

- Registered Education Savings Plan (RESP): Introduced in the early 1970s, this measure allows individuals to make after-tax contributions to a savings account, which can be used to fund a child's tertiary education. Investment income earned within the RESP is taxed in the hands of the student at the time of withdrawal (note that some provinces now also provide a grant to match a portion of RESP contributions).
- Canada Education Savings Grant (CESG): Implemented in 1998, applicants to the CESG can have up to CAD 7 200 directly deposited by the federal government into an RESP. There are two types of CESG: Basic and Additional. Through the Basic CESG, the federal government makes payments of 20% on RESP contributions made in respect of an eligible beneficiary until the end of the year in which the beneficiary turns 17. The Additional CESG is a payment (over and above the Basic CESG amount) of either 10% or 20% on the first CAD 500 or less of annual RESP contributions up until the end of the year in which the beneficiary turns 17.
- Apprenticeship Grants: Created in 2007, the Apprenticeship Incentive Grant is a taxable grant of CAD 1 000 per year for registered apprentices who have successfully completed their first and/or second year of an apprenticeship programme in a designated Red Seal trade, up to a maximum of CAD 2 000 per apprentice. The Apprenticeship Completion Grant is a CAD 2 000 taxable grant available to registered apprentices who successfully complete their training and obtain a journeyperson certification in a designated Red Seal trade.
- Canada Learning Bond (CLB): This was introduced in 2005 and grants low-income families up to CAD 2 000 in the form of RESP contributions that can be used to finance a child's tertiary education.
- Tax credits: Tax credits are available to tertiary students in recognition of the costs associated with tertiary study, including tuition fees, months of full- or part-time study and textbooks. Additionally, tax credits that refund a portion of tuition fees paid are available following completion of studies for students who choose to stay or relocate to other provinces. Unused tuition, education and textbook tax credits of up to CAD 5 000 annually may be transferred to a parent, grand-parent or spouse, and any excess amount may be carried forward indefinitely.

associated with default, is estimated to be 30-40% of the loan value (Berger *et al.*, 2009).[4] According to Berger *et al.* (2009), government spending on educational tax credits represents roughly one-third of all student support and has grown faster than any other form of public financial assistance since the 1990s.

In principle, these tax credits offset some of the disincentive to personal skills acquisition that is created by a progressive tax system, since the earnings premium that normally results from higher education credentials is taxed at a higher rate. The withdrawal of in-work tax credits when full-time studies are pursued may additionally raise marginal effective tax rates, creating an overall under-investment in skills. However, because tax credits can be claimed only upon filing an income tax return and are non-refundable, students do not benefit from them until after the academic year is over; many students may not begin to claim taxable income until well after graduation. As a result, tax credits do not provide financial support to many students at the time of their greatest need. Based on analysis by Usher and Duncan (2008), about 45% of all tax credits are used by the student in the year they are earned, whereas 35% are transferred to other family members and 20% are carried forward to future years. Like all universal support for students, tax credits are used disproportionately more by high-income families because their children are more likely to pursue tertiary studies. Furthermore, because the size of the tax credit varies with the level of tuition fees, students in higher-cost programmes are able to claim a larger benefit.

The federal government offers various savings incentives as well (Box 2.4), which also disproportionately benefit high-income families, given that others are less likely to have the means to save. In 2008, about 230 000 individuals benefited from RESP withdrawals to fund their studies, representing 11% of eligible students. Some provinces have followed suit in recent years by offering their own top-ups to the RESP savings of families. While the Canada Learning Bond (CLB) targets low-income families, the take-up rate remains low (at 21.8% of eligible beneficiaries in 2010, compared to 42.8% for the Canada Education Savings Grant), although it has increased steadily since the programme's inception.

In recognition of the fact that individuals' ability to service their student debt following the completion of their studies is contingent upon their labour-market outcomes, the federal government introduced the Repayment Assistance Plan (RAP) (Box 2.4) in 2009 (most provinces now offer RAP as well). The RAP is an opt-in programme, and eligible candidates are subject to a more affordable monthly payment based on their family income and family size. Governments in Canada provide funding to non-government organisations, such as Pathways to Education Canada, which work to provide targeted support to individuals facing non-financial and financial barriers. The federal government funds as well a variety of groups through the Education Savings Community Outreach Program.

Increase the targeting of financial aid to those in need

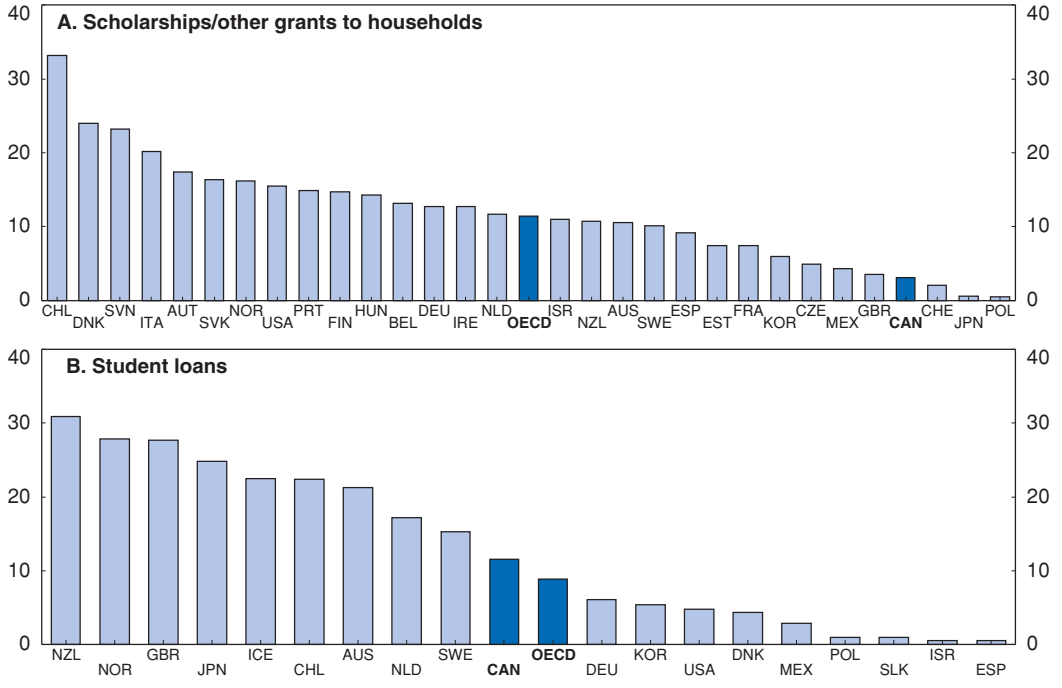
The value of need-based aid provided has risen since 2001-02, after falling in the late 1990s. Between 2004 and 2008, the amount of non-repayable need-based aid climbed substantially, reflecting the introduction of new government grant programmes designed to improve support for under-represented groups. Limits on the amount of aid that can be provided per student are not indexed to inflation but are re-adjusted periodically. In 2007-08, federal and provincial governments provided a total of CAD 4.4 billion in need-based aid, an average of CAD 10 500 per recipient, of which two-thirds represented net loans, 22% grants and 12% loan remissions.

In general, a student's assessed need is covered through loans and grants. For the federal portion of assistance, grants are awarded first to those who are eligible, and any outstanding need is met with loans up to a maximum loan limit. Where loans are awarded first, in some cases provincial grants reduce the amount of the loan to a predetermined maximum. Canada provides a relatively low share of total direct subsidies (*i.e.* excluding tax credits) in the form of grants: 3.1%, compared to the OECD average of 11.4% (Figure 2.8, Panel A). Meanwhile, the share distributed in the form of loans is somewhat above average, at 11.6% (Figure 2.8, Panel B). These calculations underestimate the share of non-repayable assistance provided, however, since they do not incorporate loan remissions, which become a form of grant.

The current aid system views financing for tertiary education as a shared responsibility, and so students are expected to make personal or family contributions towards the cost of their studies. Only about one third of college and university undergraduate students receive a government loan or grant in any given year of their studies, and no more than half of all students from families earning less than CAD 50 000 per year receive financial aid (Berger *et al.*, 2009). While government financial assistance does not always fully fund the cost of studies, since 2005 student-aid limits have been increased, expected parental contributions reduced, and additional assistance provided in the form of grants to improve the coverage of need, reducing the proportion of student aid recipients receiving the maximum amount of the federal student loan from over 50% to less than 30%. Single parents accounted for the largest share of such students, while more generally students with unmet needs tended to be older and female. Unmet needs can lead students to take on private debt or increase hours worked at part-time jobs, while adversely affecting persistence and completion (McElroy, 2004). These findings indicate that, while the proportion of those at assistance limits is lower than in previous years, student assistance

Figure 2.8. **Public subsidies for education to private entities for tertiary education**

2008, percentage of total public expenditure on tertiary education



Source: OECD (2011), *Education at a Glance 2011*, Table B5.3. StatLink http://dx.doi.org/10.1787/888932618310

policies should be re-evaluated periodically to ensure that aid limits realistically address the costs faced by students, in particular those with dependents.

Improving equality of access to tertiary education depends on the ability to deliver information to low-income families to help them plan and understand the costs and benefits of higher education, and to do so at an early enough stage to influence their aspirations and preparations. As proposed by Berger *et al.* (2009), one way to do this is through the Canada Child Tax Benefit (CCTB) and National Child Benefit Supplement (NCBS) programmes. These measures automatically provide monthly financial support to families earning below a certain income threshold (provided that they file income tax returns) who have children under the age of 18. Even though eligibility for the Canada Student Grants Program is not based on precisely the same income thresholds as the CCTB and NCBS programmes, they could be used to identify potential aid recipients early on. These families could then be delivered information about tertiary education and financial-assistance options well in advance of the application point. They could furthermore be automatically enrolled in the Canada Learning Bond (Box 2.4), which is currently an opt-in programme.

Changing the aid application process to separate loans from grants could also help lower financial barriers. Currently, tertiary students are required to apply for a student loan and a government grant in one application. Given evidence that low-income students are more likely to be debt-averse, they may rely more heavily on non-repayable student grants to finance their studies. Under the current system in which grants can be accessed only via a loan application, many who would benefit from a grant may not even apply due to a lack of awareness or willingness to take on debt. While current needs assessments for student assistance take into account parental income, parental education levels should also be considered, with greater targeting of so-called "first-generation" students. For example, Ontario offers a first-generation grant for students demonstrating financial need whose parents have no history of PSE.

Outcomes of the education system

Skills to meet labour-force needs

The rise over time in educational attainment in Canada corresponds broadly to demands from the labour market. The shift from a manufacturing-based to a knowledge-based economy over the past few decades has significantly affected the way businesses operate and the skills that they seek in their employees. It is now widely believed that tertiary graduates require both generic and specialised technical skills to remain competitive and adapt to changing job requirements (Axelrod, 2002). A government report (HRSDC, 2008) found that between 1987 and 2007 the employment share of occupations usually requiring university education rose from 13.1% to 17.8%. Although occupations normally requiring only college or apprenticeship training account for almost twice as many jobs in the economy, their share in total employment declined slightly from 35.8% to 33.6%.

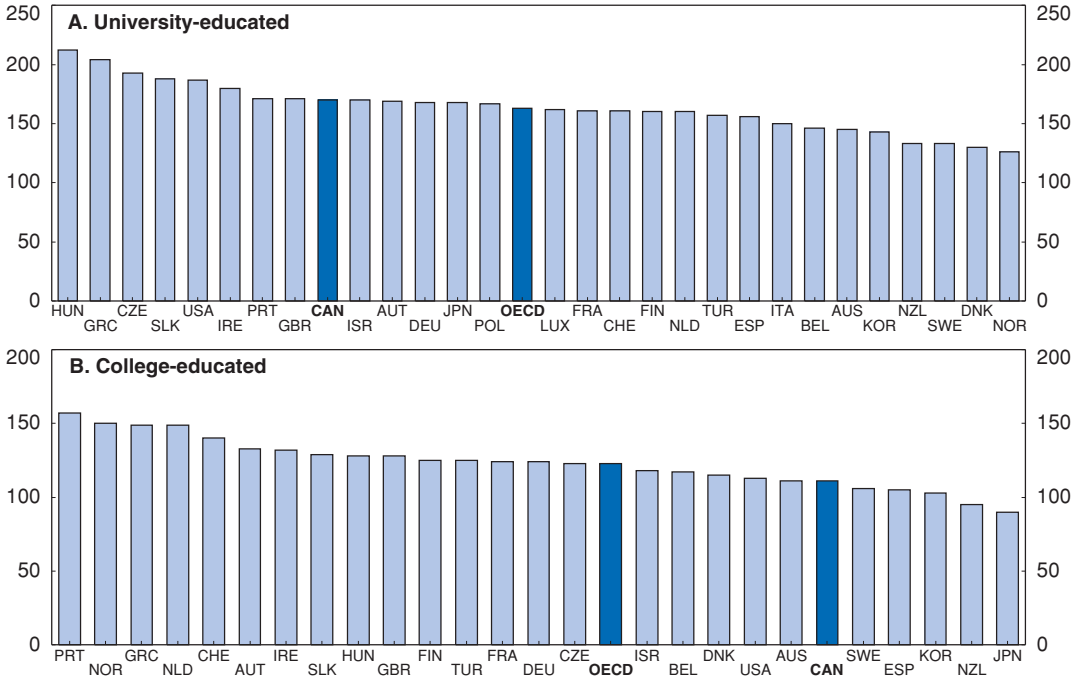
In Canada, as elsewhere, individuals' labour-market outcomes generally improve with higher educational attainment. The average earnings advantage for employees with college education was only 11% relative to those with upper-secondary or non-tertiary post-secondary education in 2008, ranking Canada 21st out of 26 OECD countries for which data for this indicator were available (Figure 2.9). The below-average premium may again reflect Canadian colleges' inclusion of programmes that would be defined as "non-tertiary post-secondary" by international convention. It may also reflect comparatively high earnings possibilities for those with no post-secondary credentials, particularly in the

resource sectors. Indeed, in 2008 college graduates in Alberta and Saskatchewan had negative or near-zero earnings advantages over those with only high-school education. Another factor that may explain the relatively low premium for college graduates is the large number available in the labour market. Canada is somewhat unique in having such a large portion of its tertiary graduates with college level credentials. Meanwhile, the 70% premium earned by university graduates in Canada is slightly higher than the OECD average of 63% (Figure 2.9). After taking into account the costs of training (including the opportunity cost of foregone earnings), the annual private returns to tertiary education are calculated to be 11.9% for men and 11.1% for women, slightly below the OECD averages of 12.4% and 11.5%, respectively (OECD, 2011a). These estimates may again reflect the lower earnings of a relatively large share of community college graduates in Canada, combined with a low share of university graduates compared to other countries.

The evolution of relative earnings and employment rates over time can signal any imbalances in the demand and supply of different skill levels in the labour market. When the entire population with tertiary credentials is considered, the earnings premiums of those with college and university education relative to high-school graduates appear to have remained fairly stable since the late 1990s, with a slight uptick observed in the advantage of university graduates in 2009 (Figure 2.10, Panel A). While at first glance these patterns suggest that the supply of different skill levels has generally kept pace with demand over this period, they mask diverging trends at the disaggregated level. For example, Bonikowska *et al.* (2011) find that the earnings premiums of Canadian-born university graduates have increased significantly since 1991, whereas those for university-educated immigrants have declined over the same period.

Figure 2.9. **Relative earnings of 25-64 year-olds with tertiary education, 2009**

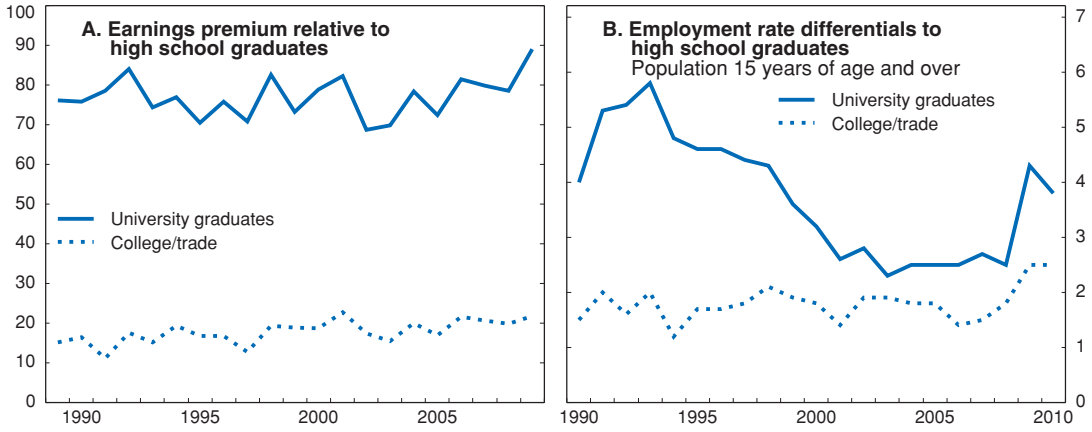
Upper secondary and post-secondary non-tertiary education = 100



Source: OECD (2011a), *Education at a Glance 2011*, Table A8.1. StatLink http://dx.doi.org/10.1787/888932618329

Figure 2.10. **Earnings premium and employment rate relative to high school graduates**

Per cent



Source: Statistics Canada, *Cansim Database*, Tables 202-0106 and 282-0003; and *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program*, April 2011.

StatLink http://dx.doi.org/10.1787/888932618348

Whereas comparatively high and rising earnings premiums of university graduates suggest there could be net private benefits to boosting rates of participation at this level relative to colleges, a number of other indicators paint a less clear picture. First, while university graduates enjoy higher employment rates relative to those with either high school, college or vocational education, this margin declined substantially from 1993 to 2003 (Figure 2.10, Panel B). This pattern reflects sharper improvements in the employment rates of those with secondary school and college or trades education over this time period than those with university degrees. Although the reasons for this are uncertain, it may reflect strong growth in the manufacturing sector, where workers have predominantly high school, college or trades qualifications. This sector accounted for almost one quarter of all jobs created over this period of exchange-rate depreciation. As the currency began to appreciate in the early 2000s, relative employment rates of university graduates steadied and have improved considerably since the global financial crisis in 2008.

Also, the proportion of university-educated workers in lower skilled jobs increased from 35% in 1997 to 39% in 2007 (Table 2.1), although this share also rose for college-educated workers (34% to 37%). These developments may signal an over-supply of both university and college graduates, at least in certain fields, relative to employer needs, in other words some mismatch. The findings may alternatively be explained by: temporary transitions after graduation; high levels of immigration; job loss; skills deficiencies among some graduates; or certain graduates choosing fields of study for which there is limited demand (Leuven and Oosterbeek, 2011; Quintini, 2011). These outcomes may also reflect better wage prospects in sectors requiring lower skill levels, such as oil sands development (HRSDC, 2008). Nonetheless, even in lower skilled occupations, university graduates tend to earn higher wages than those with less education, presumably reflecting higher productivity (HRSDC, 2008). Compared to the OECD average, Canada has a below average rate of over-qualification and a considerably above average rate of under-qualification (Quintini, 2011).

Table 2.1. **Employment of tertiary graduates by skill level**

Per cent

University graduates	1997	2007
Management or occupations usually requiring university	65.0	60.8
Occupations usually requiring college or apprenticeship training	19.2	20.2
Occupations usually requiring high school	13.1	15.4
Occupations usually requiring on-the-job training	2.8	3.6
College graduates		
Management or occupations usually requiring university	22.1	20.2
Occupations usually requiring college or apprenticeship training	43.9	43.1
Occupations usually requiring high school	26.2	29.5
Occupations usually requiring on-the-job training	7.8	7.2

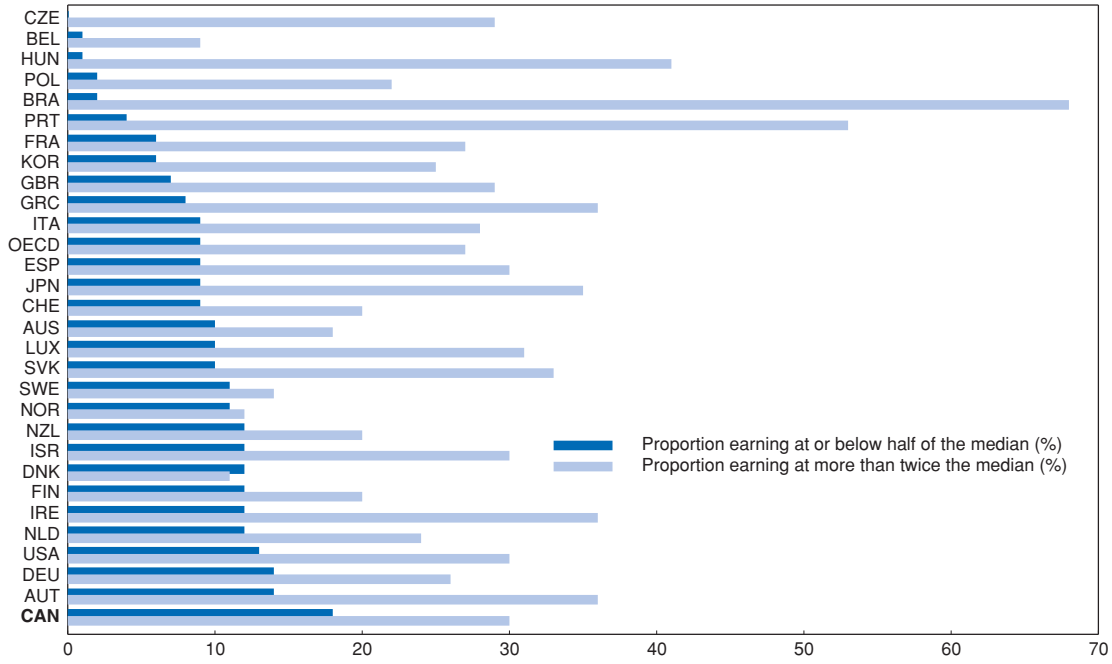
Source: HRSDC (2008).

Finally, among OECD countries, Canada has the highest share of university graduates earning at or below half the median level of earnings (18% in 2009) (Figure 2.11). Although the reasons for this are not clear, it may reflect in part relatively poor labour-market outcomes of immigrants, who account for almost one quarter of the adult population and are an important fraction of resident tertiary graduates. Based on the 2006 census, the share of recent immigrants with university degrees was almost twice that of native-born Canadians. Among those aged 25-34, 51% of immigrants who had arrived in the preceding five years held a university degree, compared to 29% for the native born. Immigrants also account for half of all doctorate holders in Canada and 40% of master's graduates. Nonetheless, on aggregate immigrants tend to have higher rates of unemployment and significantly lower earnings than Canadian-born workers, and the earnings gap is even larger for recent immigrants with tertiary education. This limits the relevance of comparisons of Canadian outcomes with those of other OECD countries in which immigrants make up a considerably smaller portion of resident tertiary graduates.

A recent study reveals better labour-market outcomes for immigrants who undertook their post-secondary education in Canada rather than abroad (Rollin, 2011). Pursuing higher education in Canada may facilitate labour-market integration for immigrants (Sweetman and Warman, 2009) by reducing barriers associated with language, social networks and perceived differences in the quality of prior education, while providing access to job-search services. These immigrants also tend to be younger on average than those admitted through the normal immigration system, thus allowing them to contribute to the country's economic prosperity over a longer period of time. Canada has room to expand the number of foreign students it accepts: only 6.5% of all students in Canadian TEIs were from abroad in 2009, near the OECD average (OECD, 2011a), but that share has fallen from 8.9% in 2004. Furthermore, Canada hosts only 5% of the world market for international students (Figure 2.12), well below the United States (18%), the United Kingdom (10%) and Australia (7%). While recognising that Canada already receives a high number of international tertiary students (about 170 000 in 2010), it is recommended that a greater enrolment of international students in Canadian TEIs be promoted. Such initiatives could be accompanied by continued efforts to expand opportunities for international students to work and obtain permanent residency after graduation, such as the Canadian Experience Class programme introduced in 2008.

Figure 2.11. **Earnings distribution of 25-64 year-olds with university education**

2009 or latest available year

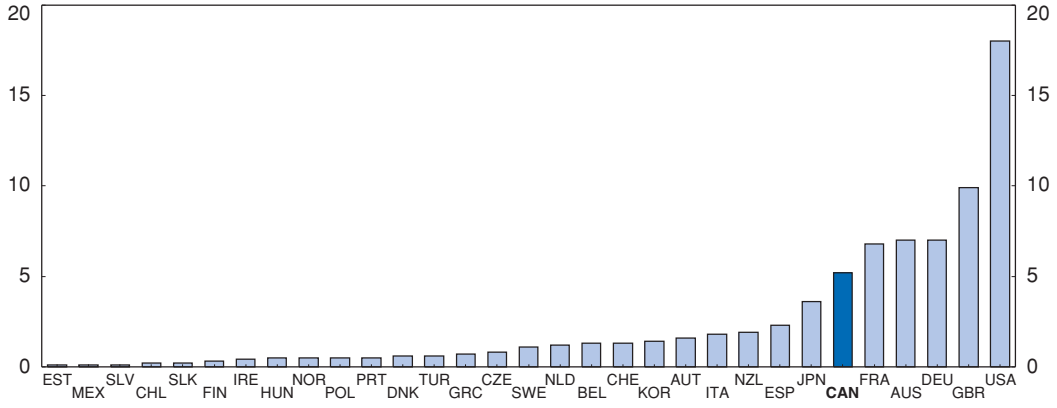


Source: OECD (2011), *Education at a Glance 2011*, Table A8.4.

StatLink http://dx.doi.org/10.1787/888932618367

Figure 2.12. **Citizens studying abroad in tertiary education, by country of destination, 2009**

Number of foreign students enrolled in tertiary education in a given country of destination as a percentage of all students enrolled abroad, based on head counts



Source: OECD (2011), *Education at a Glance 2011*, Table C3.3.

StatLink http://dx.doi.org/10.1787/888932618386

Comparatively low earnings of the university educated may also be related in part to measurement discrepancies. A study by Statistics Canada (2009) reported that the outcome largely reflected the earnings of university graduates who were either self-employed or working part-time, whereas many other OECD countries excluded part-time workers from data shown in Figure 2.11. When considering just full-time workers, only 5% of university graduates and 8% of college graduates earned less than half the median, placing Canada *below* the OECD average.

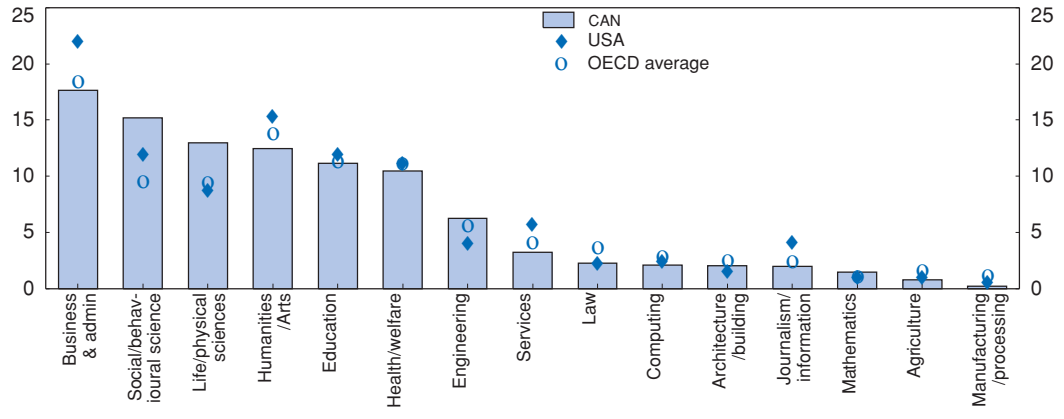
Returns to university education are found to vary considerably by field and also depend on the availability of jobs in the field of study following graduation. The wage premium for employed university graduates is generally higher in knowledge-intensive industries (Morissette *et al.*, 2004). Graduates from engineering, health, business, mathematics and computer sciences are consistently found to enjoy higher earnings than those from other fields, such as arts and humanities (Stark, 2007; Walters and Frank, 2010). These findings suggest that the labour market continues to place greater value on applied and technical skills than more general skills provided in the liberal arts (Walters and Frank, 2010), where Canada produces comparatively few graduates (Figure 2.13). The relatively low earnings of Canada's university graduates by international standards may relate in part to the country's lower share of business and computer specialists relative to other OECD countries, combined with a comparatively high share of those studying social and life sciences (who tend to reap lower returns than graduates of other science fields (Stark, 2007)).

The value of a liberal arts degree should not be underestimated, however. Despite their earnings disadvantage at any given point in time, liberal arts graduates may enjoy greater long-term employability over their lifetimes compared to those with more vocational training. Whereas very specialised training may act as a limitation during times of rapid structural change, those with more general education may possess stronger skills associated with continuous learning, such as literacy, numeracy and problem-solving. Individuals who lack such foundation skills are less likely to engage in continuous learning and are placed at an economic disadvantage throughout their working lives (OECD, 2011d). Indeed, several studies find that the earnings of liberal arts graduates actually tend to catch up and sometimes surpass those of graduates from applied programmes over time (Giles and Drewes, 2001; Admuti-Trache, 2006).

The monetary benefits of upgrading credentials also depend on the field: for example, using 1996 census data, Stark (2007) finds that men with master's degrees in either engineering or humanities actually earned negative returns compared to those with bachelor's degrees in the same fields. However, it should be noted that in 2005 immigrants accounted for 63% of those with master's degrees in engineering in Canada, so it may be their immigrant status that is depressing such returns calculations. Nevertheless, men with trades certificates have often been found to earn more than their counterparts with

Figure 2.13. **Share of university graduates by field**

2009



Source: OECD.stat, *Education Database*.

StatLink http://dx.doi.org/10.1787/888932618405

community college diplomas (Walters and Frank, 2010), which may reflect skills shortages. Furthermore, doctorate holders in sciences and engineering in Canada tend to have higher rates of unemployment than in many other OECD countries (Auriol, 2010). These outcomes may again reflect the employment challenges faced by immigrants, who constitute half of all PhDs in the country (many of which were earned abroad), more than in most other OECD countries. They may also signal an under-utilisation of science skills in the economy relative to their supply. While the evidence is sometimes contradictory, in general studies suggest that the graduates of engineering, computer science, business and health fare much better than graduates of other fields in terms of earnings, employment rates and job-education matches (Drewes, 2010; Walters and Frank, 2010; Yuen, 2010; Boudarbat and Chernoff, 2009)

The variability in labour-market outcomes by field highlights the importance of making information on labour-market conditions for each field of study publicly accessible so that students can make informed decisions about their education and career paths. Various studies (Gunderson and Krashinsky, 2009; Boudarbat, 2004) find that expected earnings and employment prospects factor significantly into the field of study chosen by tertiary students, which may suggest that individuals are generally informed about projected future wages and labour-market opportunities. The federal government regularly conducts a Canadian Occupational Projection exercise to produce a 10-year labour-market outlook. This exercise feeds into *Working in Canada*, an online career-planning tool that reports a wealth of information on 520 different occupations, including national and regional employment conditions, wages, and skill and educational requirements. Links are also provided to educational programmes that lead to each occupation, as well as Canadian TEIs that offer them. This information is used in education planning by policymakers and TEIs, as well as by students and job seekers, although concerns have been expressed about its timeliness and reliability (Advisory Panel on Labour Market Information, 2009).

Going forward, demographic trends are projected to push the ratio of older, inactive people to workers from 38% in 2000 to over 70% in 2050 in OECD countries, with much the same for Canada (OECD, 2006). This means that the demand for skills will continue to expand in the health sector and in services that provide leisure and well-being activities (OECD, 2011d). The federal government's most recent 10-year Canadian Occupational Projection predicts that the retirement of baby boomers will account for 70% of all job vacancies from 2011 to 2020. During this period, two thirds of all job openings are projected to be in management occupations or in those normally requiring university, college or vocational education. Management and high-skilled occupations in health care, oil and gas, and trade, transport and equipment sectors are expected to experience the most pronounced labour shortages by 2020.

Labour shortages created by demographic ageing are likely to surface more slowly in the skilled trades, where the average age tends to be younger than for those employed in other occupations (Pyper, 2008). As of 2007, the ratio of young workers to near-retirees in the skilled trades was one on average, compared to 0.7 for other occupations (Pyper, 2008). Nonetheless, regional imbalances in the demand and supply for workers in skilled trades have grown as a result of the impacts of both the oil boom in western provinces and the manufacturing bust in Ontario. These adjustment costs are likely to persist in the near term to the extent that skills are not transferable between the two sectors and labour is not fully mobile. The government has taken steps to address such issues by offering training incentives through apprenticeship grants (see Box 2.4) and by working to harmonise interprovincial standards and certifications for skilled trades through the Red Seal Program and Chapter 7 of the Agreement on Internal Trade.

Supply of innovation skills

Human capital contributes to innovation through the generation of new knowledge used to create new products and processes, and the empirical literature provides evidence of a positive link between education levels and innovative activity. Higher skill levels raise the economy's capacity to absorb and diffuse new ideas or technologies. Innovation also draws upon a wide range of skills, including domain-specific skills (such as computer science or architecture), thinking and creativity skills (such as problem-solving), as well as social and behavioural skills (such as risk-taking).

There is thus no one level of educational attainment or field of study that is optimal for fostering the skills that drive innovation. Different skill mixes are likely to be required, depending on the stage of the innovation process or the type of innovation that prevails in an economy. According to the model of Vandenbussche *et al.* (2006), countries close to the world technology frontier such as Canada will see the largest marginal impact on productivity growth come from advanced education, given their higher R&D intensities (OECD, 2011b). Other countries may engage primarily in adopting existing technologies rather than actual invention, which may instead require a skill set that is best obtained through general education and on-the-job training. Multi-disciplinary skills may also be more important, given the changing nature of innovation, which is increasingly driven by user needs and collaboration across sectors (OECD, 2011b). Furthermore, since innovation is the creative process of putting new ideas into action, it is important that teaching and student assessment practices at all levels of education do not inhibit risk-taking, but rather create an environment for curiosity-driven inquiry.

Canada's relatively high rate of tertiary educational attainment implies a workforce with a solid skill base to adapt to the changing needs of the digital age. As for advanced degrees, however, Canada ranks less favourably with a graduation rate of 9.0% of all adults for master's degrees and 1.2% for PhDs in 2008 (compared to OECD averages of 12.7% and 1.5%, respectively) (OECD, 2011a). This may reflect in part low demand for advanced skills in the labour market. For example, a survey of over 1 000 Canadian R&D-performing firms for the Review of Federal Support to R&D (2011) revealed that only 18% of such firms reported employing researchers with doctoral degrees. Canadian businesses also employ a smaller share of PhDs than their US counterparts, which the Council of Canadian Academies (2009) attributes to lower business demand for advanced research skills.

Canada appears to also fall short in supplying business skills. Although business graduates account for the largest proportion of all university degrees awarded (17.7%), they represent even larger shares in the United States (at 22%) and in other OECD countries (an average of 18.4%). A significant body of empirical work finds that the quality of management and leadership heavily influences the adoption of continuous innovation strategies and the effective use of knowledge and technology. Even if it is not clear whether such skills are inherent *versus* learned, it is becoming commonly accepted that managerial and entrepreneurial skills should be part of education curricula from an early stage (OECD, 2011b). Entrepreneurship training should also closely involve the business community through student interactions with local entrepreneurs and internships with start-up companies (OECD, 2010b). At Canadian firms, managers and leaders tend to be less educated than their US counterparts – fewer managers and CEOs in Canada possess a university degree or MBA than south of the border (Institute for Competitiveness and Prosperity, 2009). This managerial education gap is widest in small and medium-sized enterprises, which are also found to be slower to adopt new advanced technologies than

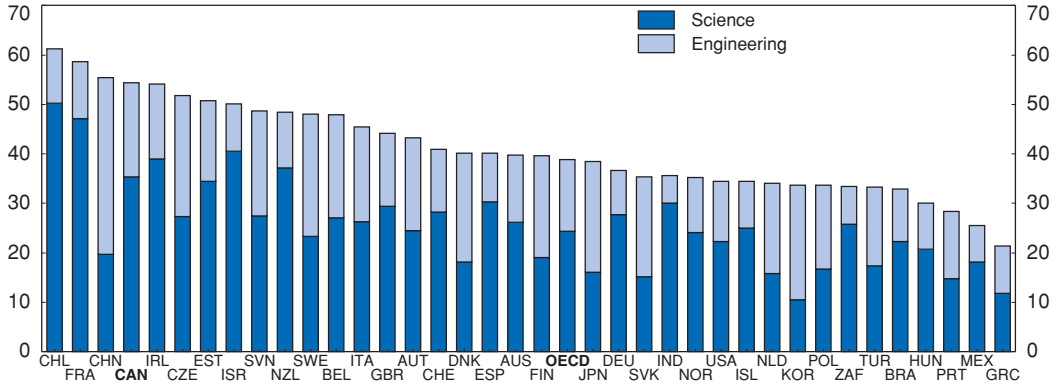
those in the United States (Sharpe, 2005). The Council of Canadian Academies (2009) argued that this lower level of business education may lead to less effective management practices and generally weaker business demand for innovation in Canada.

Canada scores relatively well in the sciences, technology, engineering and maths (STEM) fields, where its proportion of tertiary graduates exceeds both the OECD average and that of the United States (Figure 2.13 above). These shares also increased over the 1998-2009 period (with the exception of maths, which saw a slight dip from 1.6% to 1.4%). Although Canada has a low share of PhDs by international standards, 54% of its doctorate degrees awarded in 2008 were in science and engineering, placing it fourth highest among a sample of 38 OECD and emerging market economies (Figure 2.14). Canada also has a higher-than-average share of researchers in total employment (8.6%), but a below-average share of the workforce in science and technology occupations (30%) (OECD, 2011c). Women tend to be underrepresented in the STEM fields, however, as in other OECD countries. In an effort to strengthen human capital in STEM fields, the 2011 federal budget announced that HRSDC would reallocate CAD 60 million over three years to fund the development of "digital skills" among youth and Aboriginal groups, and to promote enrolment in key disciplines such as STEM disciplines.

Skills shortages have nevertheless been reported in information and communications technology (ICT) occupations, which are expected to persist in the medium term, according to the Information and Communications Technology Council (2008). This shortage is related not to an under-supply of individuals with the necessary educational qualifications, but rather to a lack of graduates possessing the right "package" of core technical skills, industry experience, communications skills and business acumen that is increasingly sought by employers. It is believed that the lack of practical and business components in computer science courses has damaged the employability of graduates, causing university and college enrolments in this field to decline since 2001. This imbalance would best be addressed by expanding the offerings of tertiary programmes that integrate ICT with business and communications elements, while strengthening academic-industry links to increase internship and co-op opportunities within these studies. While many colleges have made advances in this area, progress has been slower at universities.

Figure 2.14. **Science and engineering graduates at doctorate levels, 2009**[1]

As a percentage of all new degrees awarded at doctorate level



1. Or latest available year.

Source: OECD (2011), *OECD Science, Technology and Industry Scoreboard 2011*.

StatLink http://dx.doi.org/10.1787/888932618424

The higher education system: aligning institutional incentives with policy priorities

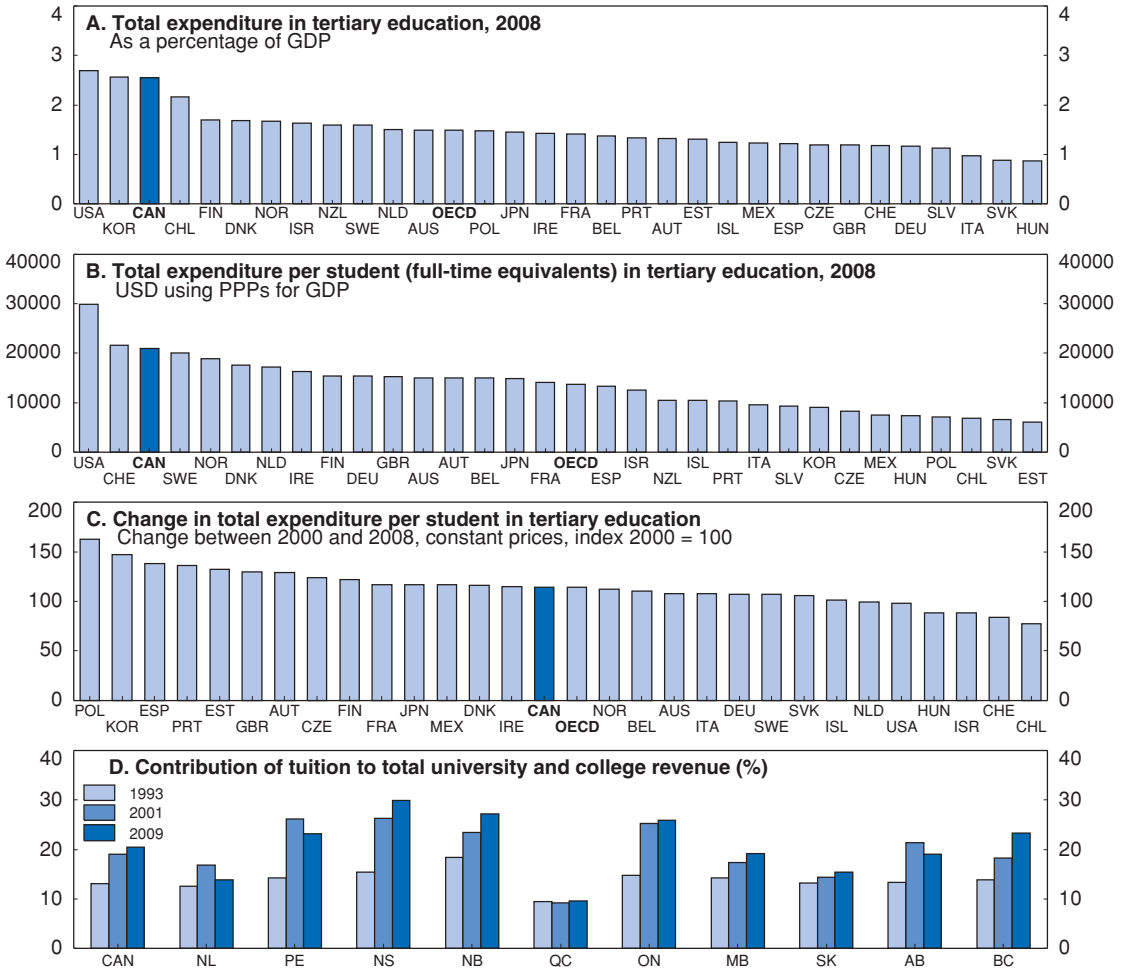
From governments' perspective, the ultimate goal of education policy is to ensure that public resources are spent efficiently on a system that is meeting the broad social and economic objectives of the country. A number of widely accepted economic objectives are to produce a skilled, adaptable and inclusive workforce able to meet the country's labour-market needs and to create knowledge and innovation that feeds into business and community development. Globalisation has also raised the importance of having the tertiary system contribute to the country's international competitiveness.

Financing tertiary education institutions

The capacity of TEIs to produce high-quality education clearly depends in part on the amount of funding available to them. Canada devotes a relatively large share of its GDP to tertiary education by OECD standards at some 2.5% (Figure 2.15, Panel A). By 2007, TEIs received average total funding of about CAD 20 000 per student (Panel B), up moderately since 2000 (Panel C), with increases observed in all provinces. Both public and private expenditure shares exceed the OECD average (Figure 2.16). Governments generally fund the provision of tertiary education because of market failures associated with capital markets, imperfect information and positive externalities. Externalities identified in the literature include: greater innovation leading to faster income gains, reduced crime rates, and improved health outcomes and civic engagement. However, the ample evidence that individuals enjoy substantial private benefits to higher education argues in favour of sharing the cost of provision between governments and students, and indeed tuition represents 10 to 30% of total TEI revenues, depending on the province (Figure 2.15, Panel D); that share has been rising over time in most provinces. Direct public funding accounts for 59% of total TEI revenues, compared to an OECD average of 69%. Household expenditures account for 20%, also below the OECD average of 25%, whereas other private entities (such as private donors and enterprises) contribute a comparatively high share of 21% (Table B3.2 in OECD (2011a)).

Levels of public funding should ideally be set to reflect the magnitude of externalities relative to private benefits (Santiago *et al.*, 2008), although it is difficult to quantify the value of non-monetary social benefits such as stronger communities or greater overall life satisfaction. However, OECD (2011a) provides estimates of both public and private *monetary* rates of return per individual obtaining tertiary education using a net present value approach based on investment theory. This approach generates an efficiency measure of the decision to invest in tertiary education and is to be distinguished from the earnings-function method (Mincer, 1974), which estimates the contribution of education to gross earnings while controlling for other factors. The private rates of return incorporate the benefits of higher after-tax lifetime earnings and lower unemployment rates relative to secondary school graduates, net of costs such as tuition and foregone wages during studies. The public rate of return is derived from the benefits of increased future tax receipts net of the cost of direct expenditures on TEIs and student aid. These estimates suggest that the public internal rate of return on investment for an individual obtaining tertiary education in Canada is 9-11% per year, while the private rate of return is 11-12%; both are close to their respective OECD averages (OECD, 2011a). The ratio of public to private rates of return can be viewed as a measure of the degree of public subsidisation of tertiary education (Psacharopoulos, 2008). These estimates are necessarily rough and do not take into account its full public financial costs and benefits.

Figure 2.15. **Funding to tertiary education**

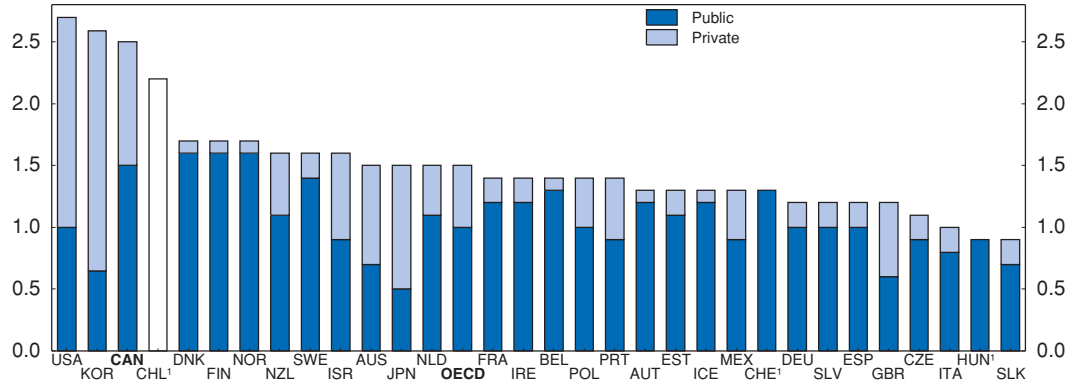


Source: Statistics Canada and OECD (2011), *Education at a Glance 2011*, Tables B6.1, B1.5 and B1.1a. For Canada, the reference year is 2007.

StatLink http://dx.doi.org/10.1787/888932618443

Figure 2.16. **Expenditure on tertiary education institutions**

2008, percentage of GDP



1. Total expenditure for Chile; only public expenditure for Hungary and Switzerland. For Canada, the reference year is 2007.

Source: OECD (2011), *Education at a Glance 2011*, Table B2.3.

StatLink http://dx.doi.org/10.1787/888932618462

There are, however, wide variations across the country in the extent to which students share the cost of tertiary education. The share of tuition in total college and university revenues ranged from 10% in Québec to 30% in Nova Scotia in 2009 (Figure 2.15, Panel D). These numbers overestimate the student share of the cost of tertiary education, since they do not take into account government subsidies provided directly to students to offset their costs. From the early 1990s to 2009, the share of tuition funding in total revenues of TEIs increased in all provinces except Québec, on average by about half. These variations reflect different provincial tuition policies over time: tuition declines were imposed in Manitoba, and Newfoundland and Labrador, in the early 2000s, while other provinces have implemented tuition freezes at various times during the last two decades. Québec has had the longest tradition of keeping tuition levels low. A provincial parliamentary committee noted in the early 2000s that Québec universities were less competitive as a result of chronic underfunding compared to other Canadian universities, which it considered to be related to the province's tuition policy. Although recent policy changes will increase the student contribution over the next five years (see Box 2.3), the resulting average undergraduate tuition by 2016-17 (about CAD 3 820 in nominal terms) will remain considerably below the 2011-12 country-wide average of CAD 5 370.

With the exception of Québec, caps on tuition increases generally exclude international students as well as professional programmes such as law, medicine, dentistry and business. Such fee differentiation can be advantageous in that it reflects costs and facilitates more equitable cost sharing, with greater contributions from those expected to reap the largest private returns to their studies. Policies that keep tuition levels fixed at a low level may also erode institutional incentives to improve quality by, for example, competing for the best professors, while weakening student incentives to successfully complete their studies in a timely fashion. More generally, stronger price signals can improve efficiency in tertiary education by making the system more responsive to student and labour-market demands. Such an outcome is conditional, however, on having undistorted labour markets and students who are well informed about the costs, quality and future income prospects of each field of study.

However, complete deregulation of tuition fees would subject public costs to the unpredictability of institutional pricing strategies, particularly if governments wish to maintain access for disadvantaged groups through non-repayable grants to cover the cost of tertiary studies. Striking the right balance could therefore involve allowing tuition fees to evolve in line with household income levels or a cost index such as the Higher Education Price Index, used in the United States and the United Kingdom, while ensuring that student financial-aid policies are correspondingly adjusted to ensure low-income students are not adversely affected.

The impact of public funding strategies

Because the financing of higher education is shared among provincial governments, the federal government, students and industry, TEIs are accountable for meeting the needs of a variety of "clients", whose objectives and priorities may differ substantially. With governments contributing the largest share to revenues, the design of public funding mechanisms can greatly influence the incentives of TEIs. In general, public funding mechanisms should be designed in such a way as to steer institutions' incentives to meet policy priorities, for example with respect to access, quality, efficiency and responsiveness (Santiago *et al.*, 2008). Funding strategies should, however, allow TEIs to remain sufficiently

empowered to innovate and take their own initiatives to improve quality. The general aim of policy is to create conditions for a sustainable and coherent system of diverse, high-quality TEIs responsive to external demands and accountable for the outcomes they produce. Federal and provincial governments also need to coordinate their funding strategies to maximise the effectiveness and complementarity of their contributions.

Government support and tuition fees account for 90% of university operating and special purpose funds, which finance the primary activities of teaching, core (unsponsored) research and student support services. During the 1990s, fiscal restraint combined with regulated tuition fees significantly reduced growth in general operating expenditures of TEIs, and the number of full-time university faculty declined by 10% from 1992 to 1998 (AUCC, 2011). Between 2000 and 2008, provincial operating funding to universities rebounded, in large part to support a substantial increase in student enrolment. Surging student populations from 1998 onwards reflected in large part the "echo boom" generation (the offspring of baby boomers). A number of larger universities have recently begun to address funding shortfalls through greater foreign-student enrolment, since international student fees are not subject to regulation in most jurisdictions.

Provinces provide TEIs with operational support primarily through either incremental funding or formula funding mechanisms. Incremental (or block) funding determines the amount allocated to each institution based on historical amounts provided plus some percentage increase. Under formula funding, the amount allocated depends on institutional characteristics such as student population, programme mix and campus locations. Both types of funding offer desirable features in the form of transparency and predictability, which allow TEIs to implement long-term strategic planning. However, historically based block funding creates no meaningful incentives to improve quality or efficiency. To the extent that formula funding rewards TEIs for enrolment, it may generate incentives to create innovative programmes or improve teaching quality to attract students. However, formula funding may also introduce distortions, for example by encouraging TEIs to shift admission rates in favour of lower-cost programmes to improve finances (Pakravan, 2006).

Targeted funding mechanisms

Across OECD countries, a trend has been observed towards allocating public funds through greater targeting, performance-based funding, competitive mechanisms and expanded student-support systems (Santiago *et al.*, 2008). Public funding for tertiary education in Canada has evolved in a similar fashion since the early 1990s, which has had an important influence on institutional incentives. For example, financing for student assistance and targeted research grants has increased considerably since the late 1990s. Provincial governments have also earmarked an increasing share of operating funds for specific purposes in an attempt to influence institutional incentives to meet certain policy objectives or improve performance (Snowdon, 2005). For example, certain provinces have legislated requirements that allocate a portion of tuition increases for student financial assistance, while some have used "performance-based" or "outcomes-based" funding. The latter approach allots a specific amount of provincial funding to TEIs conditional on the achievement of various outcomes.

A number of provincial governments also allocate a portion of tertiary investments through strategic funding to expand spaces or provide scholarships in areas of high priority or labour-market shortage, such as science and technology or nursing. While such

strategies may promote enrolment in these fields, they do not guarantee that graduates will seek employment in related occupations if labour-market signals do not function properly. For instance, wages in science and technology-intensive sectors may not adequately capture the wider societal benefits associated with innovation, leading the private sector to under-value those skills. Furthermore, international experience shows that attempts to expand enrolment in specific fields in contradiction to wage signals often lead to an oversupply of graduates who then seek employment outside of the country or in other fields (Santiago *et al.*, 2008). A more effective approach may be to use demand-side measures such as loan waivers for students who enter such occupations (Santiago *et al.*, 2008).

Strengthening the tertiary education sector's contribution to innovation

The tertiary education sector can contribute to the economy's innovative performance through two main avenues: research and skills formation. Since 1998, the federal government has introduced a number of strategic initiatives to strengthen the country's capacity for research and innovation (Box 2.5). Through the three federal granting councils, sponsored research funds more than doubled from 2000 to 2010 (AUCC, 2011). Provincial and territorial governments have also been increasingly active in supporting research and innovation. The nature of recent research funding initiatives has also created incentives to shift institutional resources towards research projects with some commercial value or industry application, and many universities now commonly employ offices for technology transfer and industry liaison. While this may allow academic research to provide a more valuable contribution to the country's innovation performance, it has also generated concerns among parts of the academic community over the potential ramifications for basic research activities.

Because external grants cover only a portion of the cost of designated research projects and some federal grants require matching provincial contributions, provincial governments have also increased direct support for sponsored research. Universities have furthermore had to draw upon general operating funds to cover the related unfunded costs when their faculty succeed in procuring research grants. Although the Indirect Costs programme was introduced to address this issue (Box 2.5), an independent evaluation conducted in its sixth year of operation reported that the amounts provided were insufficient to cover the institutional costs of research, particularly for research-intensive universities (Circum Network and Malatest, 2009). Such costs include operating and maintaining research facilities, ensuring regulatory and safety compliance, managing intellectual property and developing capacity for technology transfer and industry liaison.

The shift in public funding away from core operating activities towards targeted research appears to have increased the quality of research in the tertiary sector. By 2010, higher education accounted for 38% of the country's total R&D activity, up from 27% in 1998. Between 2000 and 2007, the number of scientific articles per million population increased from 745 to 844, placing Canada in the world's top ten. The various federal research funding initiatives are likely to lead to a greater contribution by TEIs to the innovation performance of the economy, while also strengthening the development of advanced skills among graduate students supported by research grant recipients.

The development of innovation skills could be further enhanced by modifying curricula to ensure that STEM, ICT and other technically oriented programmes fully integrate elements of communication, business and entrepreneurial training. This could be accomplished through review processes within provincial quality-assurance

Box 2.5. **Initiatives to support research and innovation**

Federal, provincial and territorial governments are active in supporting research and innovation.The three federal granting agencies – the Natural Sciences and Engineering Research Council (NSERC), the Social Sciences and Humanities Research Council (SSHRC) and the Canadian Institute of Health Research (CIHR) – together provide the largest source of external funding to TEI research programmes and scholarships for graduate students and postdoctoral researchers. In recent years, the federal government has also introduced a number of major initiatives to strengthen the environment for research and innovation in Canada, including:

- Canada Foundation for Innovation (CFI): established by the federal government in 1997, the CFI funds infrastructure costs for research projects in Canadian universities, colleges, research hospitals and non-profit research institutions. The CFI provides up to 40% of funding, with the balance covered by institutions and their funding partners. The 2012 budget provided an extra CAD 500 million over five years.
- Canada Research Chairs programme: created in 2000, it provides funding of CAD 200 000 annually for seven years to 1 000 Tier-1 chairs selected for outstanding research contributions, and CAD 100 000 annually for five years to 1 000 Tier-2 chairs with exceptional emerging research potential. Institutions submit nominations based on strategic research plans, which are then assessed by international experts.
- Indirect Costs programme: introduced in 2003, it provides annual grants to universities and colleges to help fund a portion of indirect institutional costs of federally funded research projects, including costs such as maintaining facilities, ensuring regulatory and safety compliance, and managing intellectual property.
- Centres of Excellence in Commercialisation and Research programme (CECR): launched in 2007, it is investing CAD 285 million over five years in centres to advance research and assist the commercialisation of new technologies, products and services within four priority areas of the federal government's science and technology strategy: environment, natural resources and energy, health and life sciences, and information and communications technologies. CECR funds must be matched by industrial partners.
- Canada Excellence Research Chairs (CERC): created in 2008 to award world-renowned researchers and their teams up to CAD 10 million over seven years to establish research programmes at Canadian universities. Chairs are selected through a rigorous peer-review process in the four priority areas of the federal government's science and technology strategy.

Provincial and territorial governments have also been increasingly active in supporting research and innovation: selected examples include: the Leading Edge Endowment Fund (LEEF) in British Columbia, which attracts world-class researchers to the province; the Ontario Centres for Excellence, which foster the training and development of the next generation of innovators and entrepreneurs; the Manitoba Research and Innovation Fund (MRIF), which provides funding for provincial research and innovation; and Alberta Innovates, which consists of four corporations that coordinate efforts and resources in key areas where Alberta has a competitive advantage.

frameworks (Box 2.6). For example, the province of Ontario has developed benchmarks for degree-level expectations and learning outcomes by field of study, which are used to approve new programmes and evaluate existing ones during periodic reviews. Student assessment practices should also be included in these reviews to ensure students are being evaluated on higher-order thinking skills and not just content. Expanding cross-disciplinary programmes combining arts fields with business education should also be encouraged.

Box 2.6. **The quality-assurance framework for higher education in Canada**

In Canada the provinces and territories are responsible for their own educational systems, therefore no single pan-Canadian body exists to quality assure TEIs or programmes. In 2007 a degree-level standards framework was endorsed through the Council of Ministers of Education, Canada (CMEC) by provincial and territorial ministers to provide guidance on quality assurance and learning outcomes for all bachelor's, master's and doctoral degrees. In practice, quality assurance of degree-granting institutions generally involves adherence to provincial requirements enunciated within legislation while respecting TEIs' autonomy. Ontario, Alberta and British Columbia have established external quality assurance boards and agencies to review TEIs' new programme proposals. Prince Edward Island, Nova Scotia and New Brunswick have agreed to a degree-level Qualifications Framework under the aegis of the Maritime Provinces Higher Education Commission. In Québec all undergraduate and graduate programmes undergo quality review through the Conférence des recteurs et des principaux des universités du Québec's (CREPUQ)'s New Program Evaluation Commission (CEP), which assesses the quality of undergraduate, graduate and doctoral study programmes. In Manitoba the Council on Postsecondary Education is responsible for programme approval.

Certain professional programmes at the tertiary level are accredited by external agencies, which are recognised by or associated with regulatory professions that are responsible by law for licensing certain professionals in the provinces and territories. Quality assurance in the trades and apprenticeship programmes usually centres around the Red Seal designation, which facilitates mobility between provinces and territories and which requires passing standardised inter-provincial examinations developed in association with the Canadian Council of Directors of Apprenticeship who represent the provinces and territories.

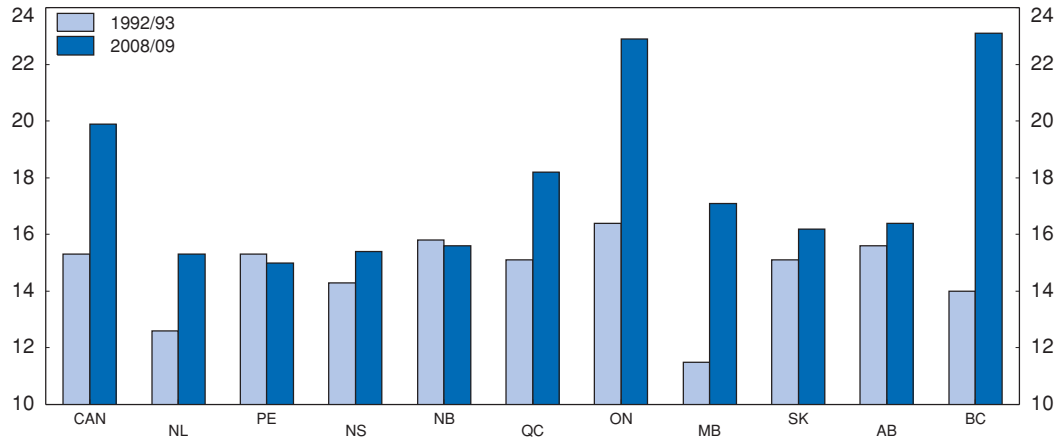
A potential consequence of raising the amount of research funding that is allocated on a competitive basis is that scientific research may become increasingly concentrated on fewer "star" academics who receive larger grants. Whereas previously research grants were awarded in smaller amounts to a larger number of recipients, the recent changes aim to target funds where the impact on knowledge creation and innovation is likely to be greatest. The result may be a concentration of grants to large universities with big laboratories, forcing other institutions to become primarily teaching universities. Such a result would increase the degree of differentiation among Canadian universities, moving the system closer towards that observed in the United Kingdom or the United States (Vajoczki *et al.*, 2011).

Fostering a high-quality system

Greater institutional differentiation could improve quality and efficiency

Creating a formal distinction between TEIs that engage in research and those that emphasise teaching may help promote overall quality and competitiveness by concentrating institutional resources where comparative advantages exist. In the current environment of rapid enrolment growth and constrained public funding, a possible cost of the expansion of faculty research incentives over the last several years has been in the time spent teaching the broader student population. Between 1992-93 and 2008-09, swelling enrolments boosted the ratio of full-time students to full-time teaching staff at universities (Figure 2.17), most notably in British Columbia (from 14 to 23) and in Ontario (from 16 to 23). Many professors in Ontario report allocating more time to research than teaching,

Figure 2.17. **Ratio of university full-time students to full-time teaching staff**



Source: Statistics Canada.

StatLink http://dx.doi.org/10.1787/888932618481

based on perceptions that this would improve their chances for tenure and promotion (OCUFA, 2008). Moreover, the average pay for full-time Canadian university teachers seems rather high on an international comparison (Altbach *et al.*, 2012). As a result, more undergraduate courses are now being taught by temporary lecturers ("sessionals"), who constitute over one-quarter of full-time teaching staff in some universities (CAUT, 2011).

These trends have raised concerns that the quality of undergraduate education has declined, at least in certain provinces (see for example, AUCC, 2011 and Clark *et al.*, 2010). High student-teacher ratios may reduce student engagement and necessitate different assessment methods, for example favouring multiple-choice testing rather than open-ended writing assignments, which may limit the development of higher-order skills such as critical thinking and reasoning (Looney, 2009). Contract instructors may teach few classes, and receive lower wages with little job security, leading to limited institutional commitment and campus presence to engage with students beyond classroom hours (Farr, 2008). Teaching quality is, however, difficult to measure and observe in practice. There is furthermore little hard evidence proving that the quality of undergraduate instruction has fallen over time, given generally good labour-market outcomes of university graduates and favourable student evaluations.

Formally designating universities to be either research- or teaching-focussed may improve accountability by clarifying the public's expectations for institutions' outcomes and their criteria for quality assessment (Weingarten and Deller, 2010). However, it is not clear whether increasing the separation between the research and teaching functions of universities would affect student learning. The correlation between faculty research output and quality of instruction is not well established; studies based on student satisfaction surveys find an inverse relationship between research productivity and teaching quality, while others suggest that research positively affects teaching, but that teaching adversely affects research (Vajoczki *et al.*, 2011).

Student choice and overall quality of tertiary education could also be enhanced by encouraging greater institutional competition. This could be promoted by recognising new types of institutions, including greater openness to the establishment of private universities, which exist to a very limited extent and only in British Columbia, apart from religiously affiliated or exclusively online institutions.

Funding based on performance

Continuing to provide a substantial proportion of public support to TEIs through formula funding can provide benefits in the form of autonomy, stability and predictability that allow them to engage in strategic long-term planning. Additionally, allocating some portion of core funding to TEIs based on performance can be a useful tool to align incentives with policy priorities. However, whereas quantifiable outputs permit the systematic evaluation of research quality, assessing performance in teaching is less straightforward.

Use of performance-based or outcomes-based funding has thus far had limited success in driving institutional improvements in Canada. In many provinces, publicly funded colleges and universities must collect and report data that are common and comparable across institutions, such as Ontario's key performance indicators (KPIs). Performance indicators can include measures of student retention, graduation, employment, graduate satisfaction, student-loan default and access for under-represented groups. Provinces vary in the way they use these data, and only a few (Alberta, Ontario and Québec) have ever tied even a small fraction of TEI funding to the outcomes they measure; Ontario is the only one that still does so. However, the conditional funding provided has been too limited to finance improvements, with the end result being less predictability and stability of TEI funding, combined with more reporting requirements (Snowdon, 2005). Meanwhile, Québec has introduced "performance commitments", which formally designate all tuition and public funding increases to universities between 2012-13 and 2016-17 to meet objectives based on the attainment of 13 target indicators (Finances Québec, 2011). Such funding mechanisms normally form part of an overall quality-assurance framework (Box 2.6).

Performance-based funding needs to be carefully implemented and the indicators designed in such a way to avoid generating perverse incentives (Santiago *et al.*, 2008). Although performance indicators such as the KPIs can provide useful information both for institutions to gauge progress or identify weaknesses and for students to make decisions about their educational paths, they are crude measures. Many of the outcomes they measured, such as graduation rates or employment rates, may be highly correlated with the initial characteristics of students entering the particular institution and do not necessarily reflect the quality of education provided.

Tying significant financial rewards or penalties to institutions' performance on a set of crude indicators may stifle the risk-taking and intrinsic motivation necessary for innovation. It may encourage instructors to emphasise student outputs that are easily observable, while neglecting the development of less measurable but important skills such as creativity (Santiago *et al.*, 2008). For example, linking funding to graduate employment rates may generate short-sighted incentives to limit student enrolments in fields with lower immediate employment prospects. The selected indicators should measure only those outcomes for which it is appropriate to hold institutions accountable and may vary with each institution based on its declared goals. While it is reasonable to expect certain professional, technical or vocational programmes to ensure graduates are employable in their field of study, it is equally important for tertiary education to provide broader intellectual development and foster the wide range of skills needed for innovation and good citizenship. As technologies change and skills become outdated at a faster pace, graduates may work in a number of different fields over their careers that do not necessarily correspond to their initial training. Proficiency in many skills needed for innovation (such as creativity) cannot be easily assessed through an indicator or large-scale standardised tests.

Given such shortcomings, the use of performance-based funding in Canada should be expanded only if an improved set of indicators can be developed. Part of the challenge relates to poor data availability and more broadly a lack of system-wide data linking student outcomes to indicators of institutional quality that are comparable across provinces or even institutions, although some provinces such as British Columbia appear to have made encouraging advances in this dimension. This creates obstacles for students to make informed decisions about their education and career paths, as well as for governments to demonstrate accountability for public funds. While institutional rankings exist (for example, the annual Maclean's University Rankings and Shanghai-based Academic Ranking of World Universities), these normally focus on input or output measures, which may depend heavily on the amount of resources available to the institution or initial characteristics of entering students. Competing views about the purpose of higher education can also complicate the assessment of quality.

Rather than assessing performance based on a set of outcomes, Finnie and Usher (2005) emphasise that quality should be measured by the "value added" institutions contribute to achieving their stated objectives. Their approach recognises that educational outputs are closely correlated to inputs (such as teaching salaries or library resources) as well as the initial student characteristics, and institutions should be rewarded based on the impact they have on outcomes such as student learning. Assessing value added would entail estimating how different educational inputs affect learning outcomes, while controlling for students' beginning characteristics, in order to identify and quantify the types and combinations of inputs associated with high quality (Finnie and Usher, 2005). Funding could then be awarded to institutions that utilise such desirable inputs.

The set of performance indicators used could also be widened to include measures of student learning. Since no single indicator offers a comprehensive, exact measure, it would be necessary to consider a number of different sources. Statistics Canada's National Graduates Survey has provided useful information on short- to medium-term labour-market outcomes of graduates from public universities, community colleges, and trade or vocational programmes; however, they are conducted on an irregular basis, most recently in 2007, and ongoing funding may be an issue in light of current financial constraints. The highly successful National Survey of Student Engagement (NSSE) and Community College Survey of Student Engagement (CCSSE) provide precise and quantitative data on student learning experiences that can be compared across institutions.[5] While over 80 Canadian universities have taken part in NSSE on a voluntary and irregular basis, participation could be expanded and made a requirement for eligibility to receive such performance-based funding. Another promising avenue for the future is the OECD's international Assessment of Higher Learning Outcomes (AHELO), which is currently in development (with the province of Ontario among the participants) and aims to evaluate the capacity of final-year bachelor's degree students to use, apply and act on their knowledge and reasoning.

Labour-market responsiveness could be encouraged by using public funding to reward tertiary institutions based on student placements in co-op or internship posts, and to encourage career-guidance services. Co-op and internship opportunities can provide valuable practical training for the workplace that may enhance student learning, while allowing institutions to strengthen industry linkages through technology transfers.[6] The prominent co-op programme at the University of Waterloo, for example, has been credited with helping to create the hi-tech innovation cluster that has developed around the campus (Crocker and Usher, 2006). Employer feedback on student performance can

furthermore provide guidance to TEIs on skills sought by industry, which can be used to adapt programme curricula. Whereas co-op and internship programmes are well integrated into the curricula of most community colleges and polytechnics, they are not widespread across university campuses. Incentives to tap student resources should also proceed from the business demand side, for example through vouchers for academic research (Chapter 1).

Greater co-ordination would strengthen overall performance

Overall, strengthening the quality of the system will require greater funding to co-ordinate data collection on TEIs and student outcomes at a nation-wide level, to ensure comparability across regions. As discussed earlier, these are areas that face considerable implementation challenges due to the decentralised nature of the system, and should thus be coordinated through Statistics Canada, working in partnership with CMEC through the Canadian Education Statistics Council.

Promoting the international competitiveness of the system would also benefit from greater coordination across jurisdictions. In recent years, Canadian TEIs have recognised the importance of internationalisation by developing partnerships with their foreign counterparts, establishing foreign campuses, increasing global research collaboration and faculty and student exchanges, and promoting the "Education in/au Canada" brand to international students. In 2010, provincial and territorial premiers, acting through the Council of the Federation, released an international education marketing action plan that had been prepared by CMEC in collaboration with provincial and territorial ministers of immigration (CMEC, 2011). In 2011, the federal government announced funding and appointed an advisory panel to develop an international education strategy. Canada sends a high proportion of tertiary students to study abroad compared to its peers (UNESCO, 2011) but could stand to benefit from accepting more international students, as discussed earlier. To improve the global visibility of the country's higher education system, it will be important to improve the interface for foreign students so they can navigate easily through the education information offered by the different governments and institutions, while coordinating with Citizenship and Immigration Canada to ensure immigration programmes allow space for foreign students wishing to remain in the country after graduation.

The current system of heterogeneous provincial strategies and policies, combined with the patchwork of information available on the system's quality and performance, may hinder the country's ability to stay competitive and adapt quickly to changing global trends. Making greater use of CMEC intergovernmental body could help tackle the unique challenges of a system governed by 13 different jurisdictions, particularly for: *i)* establishing a set of common system priorities and providing leadership to meet policy objectives; *ii)* collecting and reporting data on TEIs across Canada; *iii)* establishing a national academic credit registry to coordinate credit transfers and facilitate inter-provincial student mobility; *iv)* co-ordinating federal and provincial funding strategies to meet common objectives and ensure consistency; and *v)* designing a comprehensive internationalisation strategy to strengthen policy coherence across education and immigration authorities, such as through CMEC (2011).

Box 2.7. **Policy recommendations for improving tertiary education**

Improve access for disadvantaged and under-represented groups

- Increase targeted need-based financial assistance, which may be funded through reduced education tax credits where public finances are constrained. Consider moving fully to an income-contingent student loan repayment system if high initial costs are not prohibitive. Re-evaluate student aid limits to ensure they realistically address the costs faced by students, in particular those with dependents. Reduce barriers for debt-averse financially disadvantaged students by changing the aid application process to separate loans from grants. Consider greater targeting of financial assistance programmes on students with no family history of higher education. Further, reduce barriers for risk- and debt-averse students by providing relevant and reliable information to support their learning and career choices.

Enhance responsiveness of the tertiary system to changing student and labour-market needs

- Attract a greater share of foreign students in the tertiary education system, and expand opportunities for them to work and obtain permanent residency after graduation.
- Promote a more flexible delivery model of higher education to encourage skills upgrading through continued efforts to strengthen credit-transfer arrangements across TEIs (both within provinces and between them), and greater integration and recognition of online and distance learning resources as well as apprenticeship training.

Align institutional incentives with policy priorities

- In provinces with constrained public finances, evaluate whether tuition policies undermine institutional quality and competitiveness. Consider using fee differentiation by programme or allowing tuition levels to evolve in step with increases in household income or an appropriate education cost index.
- Consider implementing, according to the particular needs and priorities of each province or territory, greater differentiation between institutions that engage in research and those that focus primarily on teaching so as to promote greater quality and efficiency based on comparative advantage.
- Allocate more funding to Statistics Canada to co-ordinate data collection on TEIs and student outcomes at a nation-wide level. Undertake efforts to develop a better set of indicators upon which to base performance funding to institutions. Use a value-added approach to select indicators more closely linked to institutions' impact on student learning. Use public funding to reward tertiary institutions based on student placements in co-op or internship posts and the number of students assisted by career-guidance services.
- To strengthen the development of innovation skills, use review processes within provincial quality-assurance frameworks to ensure that: *i)* programmes in science, technology, engineering and mathematics fully integrate elements of communication, business and entrepreneurial training; and *ii)* student-assessment practices evaluate students on higher-order thinking skills and not just knowledge of content.

Notes

1. Emery *et al.* (2011) find evidence that resource booms tend to lower PSE enrolment in Alberta in the short term but only change the timing of schooling, with no long-lasting negative effects on attainment.
2. Statistics Canada Medium Growth Scenario, CANSIM Table 052-0005.
3. Palameta and Voyer (2010) find that while disadvantaged groups may be more prone to loan aversion, that may be linked to lower numeracy skills, a tendency to discount future benefits excessively and doubt about the returns to university education.
4. Student-loan default rates have declined substantially to 14.7% in 2008-09, from 38% in 2001-02. Students in private career colleges have the highest default rates at 29%, followed by those from community college at 17% and university graduates at 9.5%.
5. Originated in the United States, these simple surveys ask students a number of questions (including frequency of contact with faculty, average frequency and duration of homework, etc.), and results are converted into a score which measures the average learning experience acquired at an institution (Finnie and Usher, 2005).
6. Co-op postings are normally full-time paid arrangements that often extend over three work terms alternated with school terms. Internships are typically one-time assignments that may be part time or full time, and paid or unpaid.

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