IC Insights
Issue 2, Fall 2013

Industry Canada Industrie Canada

IC Insights

Information and analysis from across Industry Canada

Fall 2013

Inside this issue...

Editorial team

Pierre Therrien (SPS-ERPA)
Jeff Pappone (SPS-OCA)
Amy Corbett (SPS-ERPA)
Stephen Fertuck (SPS-SPB)
Keltie Chapman (SPS-ERPA)

Is there an issue or an analysis that you would like to see in a future issue of *Insights*?
If so, please share your suggestions with the planning team by emailing amy.corbett@ic.gc.ca

Recent Developments of Interest to IC

Horizontal mergers may lead to cost savings and little price change in the long run

- Competition authorities around the world (e.g., *Competition Bureau* in Canada) occasionally allow a merger involving two firms targeting the same market (a horizontal merger) despite potential for a higher price as a result of the merger.
- Such transactions are often approved under the argument that cost savings from the merger would offset any increase in the price as a result of enhanced market power.
- Using the merger between the Coors and Miller breweries, Ashenfelter, Hosken and Weinberg in *Efficiencies Brewed: Pricing and Consolidation in the US Beer Industry* provide robust (and rare) empirical evidence that a horizontal merger could indeed lead to cost savings and little price change over the long run.

World Economic Forum (WEF) world competitiveness index

- The World Economic Forum (WEF) released its annual Global Competitiveness Report on September 4, 2013. Canada retained its ranking as the 14th most competitive nation economically among the 148 countries ranked. Switzerland ranked 1st.
- According to the WEF "Canada's competitiveness would be further enhanced by improvements in its innovation ecosystem such as increased company-level spending on R&D and government procurement of advanced research products."

Innovation in an innovation index

- A new innovation index by Cornell, the French business school INSEAD and the World Intellectual Property Organisation (WIPO) innovates in how it measures innovation.
- Instead of objectively counting the inputs and outputs, it relies on nuance. For example, rather than ranking overall education, it looks at the top three universities, since elite institutions may be more important than the average.
- Instead of counting each patent, it tracks only those filed in at least three countries, which suggests it is a more valuable technology. And rather than look at scientific journal articles en masse, the index includes how often they are cited.
- Among the interesting findings is that Canada jumps ahead of France in university ranking (see the Hot Chart, page 23).

Co-operative Week 2013

- Every year in October, Canada has celebrated Co-operative Week to bring attention to the economic, social and environmental contributions of the co-operative business model to Canadians. This year's celebrations (Oct. 13-19) focused on bringing attention to how co-operatives are a key alternative business model that is sustainable, democratic, socially-conscious and rooted in their communities.
- IC welcomes Co-operative Week and its new responsibility for non-financial co-operatives. Please read the article on the following page about co-operatives in Quebec.

Non-Financial Cooperatives in Quebec

Highlights of Quebec's non-financial cooperative sector

- 2,860 non-financial cooperatives active in 2012.
- 1.3 million members (2009)
- 42,700 jobs (2010)
- $12 billion in sales (2010)
- Cooperatives have a higher survival rate than traditional businesses, after three years or ten years.
- They endure: 16 non-financial cooperatives have been around for over 75 years.

Background

Pursuant to the recommendations of the House of Commons Special Committee on Cooperatives (September 2012), the responsibilities of Agriculture and Agri-food Canada regarding non-financial cooperatives were transferred to Industry Canada (IC) in March 2013.[1] This transfer of responsibilities is in keeping with IC's mandate for the economic and social well-being of Canadians and provides a one-stop window for government action to encourage innovation and growth of cooperatives.

Cooperatives: businesses like no others

A cooperative is an association of persons voluntarily banding together to meet their shared economic, social and cultural aspirations and needs through an enterprise which is collectively owned and where authority is exercised democratically (International Cooperative Alliance, 2012). Cooperatives differ from corporations in that they are groupings of individuals and entities, not capital. They are also unique owing to their primary mission, which is to meet the needs of their members, rather than maximize their shareholders' wealth. The democratic governance system of cooperatives (one member = one vote) also sets them apart from corporations. Although this system promotes the long-term survival of cooperatives, it can nevertheless slow down the cooperatives' decision and response times, in relation to other types of businesses.

Cooperatives in Canada (2009)

Canada has some 9,020 cooperatives and credit unions, employing about 156,000 people and active in many sectors of the economy, especially housing, agricultural services, financial services and retail trade. Cooperatives have recently made their way into non-traditional sectors, such as renewable energy and fair trade. Canadian cooperatives provide products and services for approximately 18 million members, have assets estimated at over $266 billion and sales of about $47 billion.

Non-financial cooperatives in Quebec (2010)

In Quebec, the first cooperative ventures date back to 1835, chiefly in the regions. Since then, they have held pride of place and contributed actively to Quebec's social and economic development in all

1 Finance Canada is responsible for financial cooperatives.

parts of the province. With 36% of all incorporated non-financial cooperatives in 2009, Quebec is the Canadian province with the most non-financial cooperatives.

Non-financial cooperatives are active in many sectors of the Quebec economy. In 2010, with 1,199 cooperatives, the housing sector alone accounted for 51% of Quebec's active non-financial cooperatives. Other large sectors include agriculture and fisheries, (208), technical and professional services (159), health and social services (120) and food services (108). Agriculture and fisheries sector cooperatives achieved the most sales, with 82.9% of the total sales of non-financial cooperatives in Quebec, followed by food services (5.3%) and services to Aboriginal communities (2.3%). The manufacturing sector (included in the "other sectors" category in the figure) is underrepresented in the cooperative movement; it had only 26 reporting cooperatives in 2010, and its revenues accounted for 0.1% of all sales of non-financial cooperatives in Quebec.

Labour force

In comparing the cooperative sector with the Quebec economy overall, it becomes clear that, over the long haul, employment growth in non-financial cooperatives was considerably higher than in the Quebec economy as a whole.

From 2000 to 2009, the number of jobs in cooperatives increased by 25%, compared with 13% overall. Since 2005, employment has grown more modestly, rising by 1% for the cooperative sector (4% for the economy overall). In terms of job concentration, 60% of workers are employed in the regions and 40% work in the Quebec City, Montreal and Laval urban areas.

FIGURE 1: Distribution of Reporting Non-financial Cooperatives by Sector of Activity (2010)

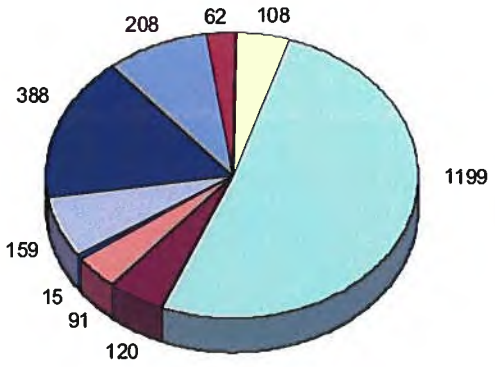
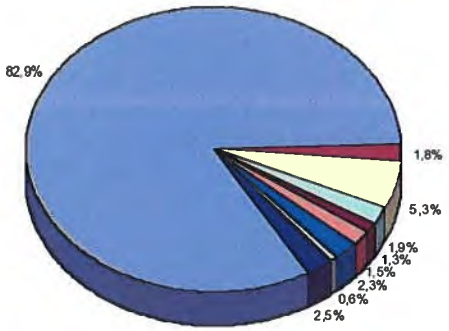
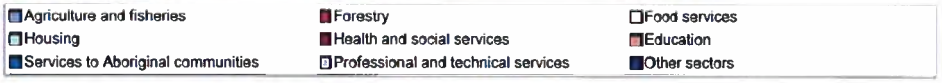


FIGURE 2: Distribution of Reporting Non-financial Co-operatives by Sector of Activity and Revenues (Percentage) (2010)



Source: Industry Canada (2013), *Co-operatives in Canada in 2009*



Survival rate

Non-financial cooperatives have a higher survival rate after three years (75%) and ten years (44%) than Quebec businesses overall (48% after three years and 20% after ten years). Even if only those Quebec cooperatives with five or more employees at start-up are considered, the average survival rate is higher. Cooperative survival rates reach or exceed 50% after ten years in seven sectors: housing, farming, forestry, food and accommodation, social and personal services, education and telecommunications.

In contrast, the manufacturing sector constitutes a challenge for the cooperative formula. The ten-year survival rate of cooperatives is only 17.2%, as opposed to 26.4% for all businesses in the industry.

Environment and outlook

The Quebec cooperative movement has a highly diversified range of activities and makes a positive contribution to the Quebec economy in all regions. It posts net growth in activities while maintaining sound financial health in the majority of sectors. Its robustness is one of its assets. For example, cooperatives stood the test better than traditional businesses when the world economy stalled in 2008 and 2009.

The success of cooperatives reflects their close commitment to the needs of the communities from which they stem, that they network and that solidarity requires them to manage their affairs differently. According to a study by the Government of Quebec, seven key factors account for the high survival rate of cooperatives in Quebec: (1) they focus on services to members rather than return on capital; (2) members are investors, but also clients; (3) democratic management requires them to regularly report to members and adopt more open governance; (4) they are rooted in their communities; (5) cooperative entities are heavily represented in basic economic sectors closely associated with the needs of individuals (agri-food, forestry, household services, etc.); (6) most of them operate in regional and sectoral networks; and (7) there are sponsoring organizations ready to support start-up or development projects.

The cooperative movement confronts the same challenges as the rest of the economy (for example, demographic change and industry transformation). The organization of the first International Summit of Cooperatives, held in Quebec City in 2012 (a second edition will take place in October 2014), enabled the Quebec cooperative movement to set in motion its *Vision 2020* initiative. This is a vast undertaking bringing together the entire cooperative and fraternal system and leading to a strategic review of the movement so as to make it an integral component of Quebec's economic and social development. As part of this exercise, the movement is addressing the issue of entrepreneurial succession, resulting from the aging of the population. The cooperative movement is seeking to position itself as an advantageous solution to this issue through worker/shareholder cooperatives.

Vision 2020 also addresses the impact of the forestry crisis on the manufacturing industry as a whole, which has affected

cooperatives operating in manufacturing sectors. The movement, which has developed cooperatives mainly in service industries (for example, home health care) in recent years, now needs to revitalize traditional sectors through innovation. A number of partners, including the Business Development Bank of Canada and the Government of Quebec, have joined forces to create the *Co-investissement coop*, which aims to make "patient capital" available to cooperatives while providing them with specialized expertise so that they can carry out their innovation projects.

Industry Canada recognizes the economic and social benefits of the cooperative business model and has implemented a work plan to support the cooperative movement across Canada, which consists of: 1) assessing the cooperatives' level of access to department programs and services; 2) promoting a government-wide network with other federal departments responsible for cooperatives; 3) developing a sector mobilization strategy by increasing networking and meetings with stakeholders in the cooperative community; and 4) establishing partnerships with its counterparts in the provinces and territories.

Sources

Special Committee on Cooperatives (2012), *Status of Cooperatives in Canada*, House of Commons.

Industry Canada, *Co-operatives in Canada in 2009*.

Industry Canada Policy on Cooperatives, *Non-financial Cooperatives by Province/Territory.*

Institut de la statistique du Québec, *Indicateurs du marché du travail : nombre d'emplois total (moyennes annuelles).*

Government of Quebec, Ministère des Finances et de l'Économie, direction des coopératives (2013), *Évolution des coopératives non financières par secteur d'activité.*

Government of Quebec, Ministère des Finances et de l'Économie, direction des coopératives (2013), *Faits saillants sur les coopératives non financières au Québec.*

Government of Quebec, Ministère des Finances et de l'Économie, direction des coopératives (2008), *Taux de survie des coopératives au Québec.*

Pour plus de précisions sur cet article, communiquer aves les auteurs aux adresses ou aux numéros indiques:

Julie Aubut, *SPS – Québec Region*
Julie.Aubut@ic.gc.ca
+1 (514) 283-9539

Pascal Lemay, *SPS – Québec Region*
Pascal.Lemay@ic.gc.ca
+1 (514) 283-1833

IC Insights
Issue 2, Fall 2013

Industry Canada Industrie Canada

The Demand for Skilled Workers in the US and Canada

- A recently published research paper offers a new explanation for the decline of US domestic employment rates in combination with slow real wage growth over the 2000s.
- The paper suggests that the cause was a large reversal in the demand for high-skilled workers in the U.S. after the tech bust of 2000, which led high-skilled workers into jobs typically performed by lesser-skilled workers. In turn, this pushed some lesser-skilled workers out of the labour force all together.
- Symptoms of the "great reversal" model in the U.S. are less clear cut in Canada. The authors are expected to publish more findings of this model for Canada.

Introduction

Although the decline of domestic employment rates in combination with slow real wage growth over the 2000s continues to vex US policy makers, a team of Canadian and Danish professors has a new explanation.

In a recent paper "The Great Reversal in the Demand for Skills and Cognitive Tasks," Professors Beaudry and Green from the University of British Columbia and Professor Sand from the Copenhagen Business School suggest the cause was a large reversal in the demand for high-skilled workers in the U.S. after the tech bust of 2000.

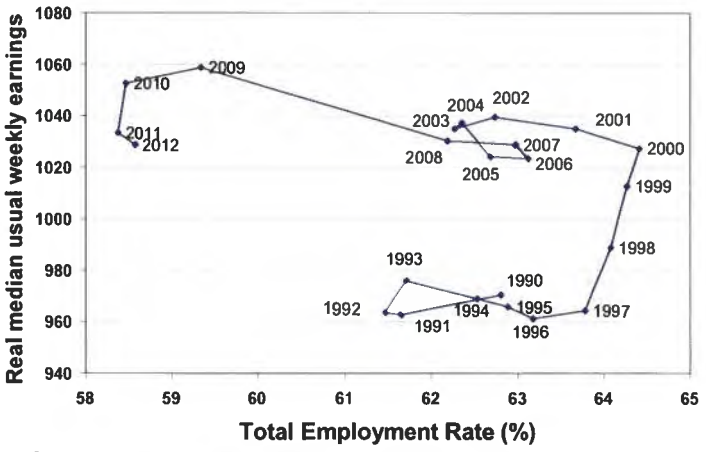
When these workers were forced to look for less technical positions at a lower wage, they ultimately pushed lesser-skilled workers into the unemployment line causing the double setback of a lower employment rate combined with shrinking average real earnings for the labour market as a whole.

This effect is indicated by the reversed C-shaped graph (Fig. 1). As is shown, between 1990 and 2000, the employment

What is the employment rate? And why is it important?

The employment rate is the percentage of *working-age people* (15-64 in the US) with jobs. This number is a commonly used indicator of labour market conditions. A higher employment rate means more *working-age* people have jobs, which is usually linked with higher standards of living.

Fig. 1: US real weekly earnings vs. employment rate, 1990-2012



Source: IC calculations based on publicly available data. This figure is not sourced from the Beaudry et al. paper, but follows similar patterns.

rate and wages increased in tandem. After 2000, the employment rate decreased from 64% to 58% in 2011. This negative movement was accompanied by slow growth in wages during the same period.

Beaudry et al. note that economists have previously advanced two main explanations: the long-lasting negative effects of the 2008 financial crisis and the disappearance of medium-skilled jobs resulting from globalization and automation.

The "Great Reversal"

The explanation advanced by Beaudry et al. instead focus on the labour market conditions faced by high-skilled workers. They argue that during the 1990s, U.S. firms invested heavily in organizational capital to capture productivity gains made possible by information and communications technology. This process increased the demand for cognitive skills. Highly-skilled workers easily found employment, and therefore, did not need to compete with lesser-skilled workers in jobs with lesser requirements for cognitive skills.

By 2000, the process of investment in organizational capital was largely completed. As a result, the transitional strong demand for cognitive skills decreased and some high-skill workers were unable to find high-skilled employment. In response to this "great reversal" in demand, these high-skilled workers competed for and occupied jobs typically performed by lesser-skilled workers. In a cascading or de-skilling process, high-skilled workers forced lesser-skilled workers further down the occupation ladder. As a result, some lesser-skilled workers exited the labour force completely. The result was to lower the overall U.S. employment rate.

Beaudry et al. provide evidence of the "great reversal" in demand for highly-skilled workers by pointing out that employment in cognitive jobs reached a plateau in the 2000's, even though the supply of highly-skilled workers increased in the same period. Cognitive jobs require critical thinking skills, technical know-how and tend to be in the professional, management and technical fields. This matches the typical job description of high-skilled workers that tend to perform such cognitive tasks.

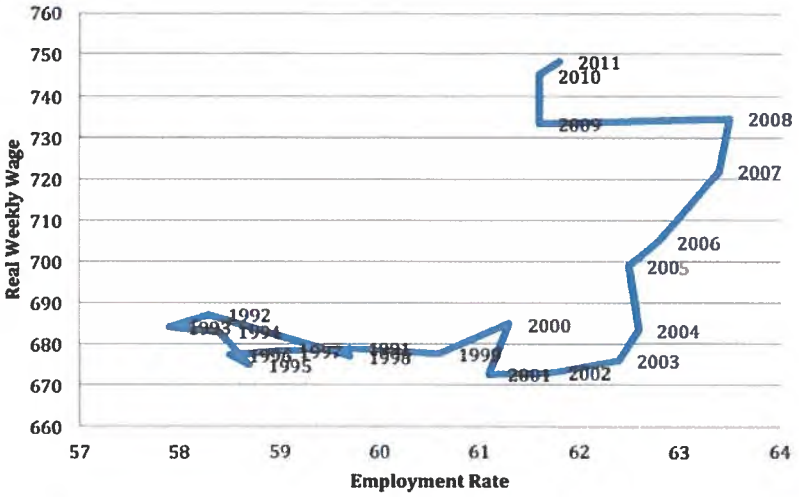
What about Canada?

While their paper was based on U.S. data, one of the authors did discuss this model in the Canadian context at a recent Bank of Canada presentation.

The author suggested that the classical symptoms of the "great reversal" model in the U.S.—rising real wages and employment rates in the 1990s followed by stagnant real wages and falling employment rates in the 2000s—is less clear cut in Canada as a whole (Fig 2).

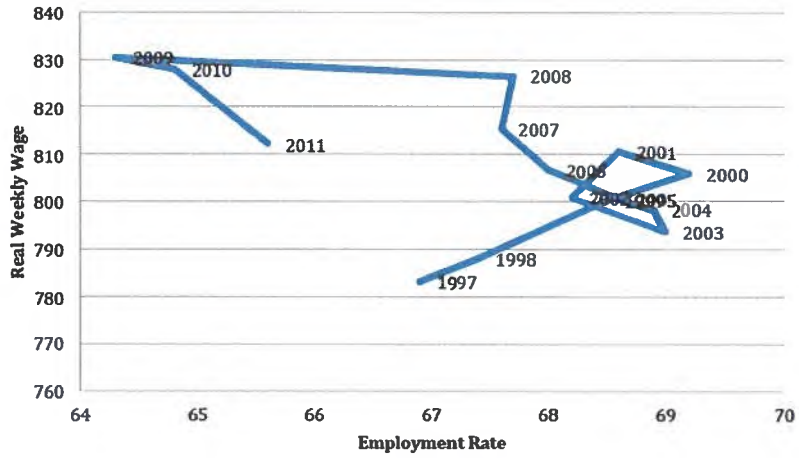
As Figure 2 suggests, the Canadian labour market recovered quickly following the Great Recession with an increase in real weekly wages starting in 2010. Employment rates, while still not at the level of 2008, also started to increase in 2011. However, when Beaudry et al. focus on specific labour markets in some regions in Canada, the symptoms of the "great reversal" model does appear for some subgroups. For

Fig. 2: Canada real weekly wage vs. employment rate, both genders, 1997-2011



Source: Professor Beaudry's presentation to the Bank of Canada, 2013.

Fig. 3: Ontario real weekly wage vs. employment rate, males, 1997-2011



Source: Professor Beaudry's presentation to the Bank of Canada, 2013.

males followed the reversed C- shaped U.S. pattern (Fig. 3).

Policy Insights

The explanation of Beaudry et al. appears to fit well with the evidence from the U.S. labour market. It illustrates that a relative decline in the demand for highly-skilled workers may not only have direct impacts on the wages and employment rates of more skilled workers, but might also have significant impacts on less skilled workers.

However, it seems like the story in Canada may be more complex and may vary by province. The authors are expected to publish more findings for Canada in the future.

Source

Beaudry, P., Green, D.A., and Sand, B.M. (2013), *The Great Reversal in the Demand for Skills and Cognitive Tasks*. *NBER Working Papers* No. 18901.

For further information about this document contact the author at the following e-mail address or telephone number:

Amy Corbett
Economic Research and Policy Analysis Branch
Amy.Corbett@ic.gc.ca
+1 (613) 941-7255

Canadian Small Business Financing Gaps

Highlights

- IC regularly conducts surveys of Canadian small businesses to produce snapshots of business trends in borrowing and financing gaps.
- During 2000-2012 about 26% of small businesses (average per year) requested financing to support their operations.
- Small businesses sought financing to purchase fixed assets and to support working capital needs.
- Survey findings support the idea that partial gaps in financing for specific types of businesses may exist.

Introduction

It has been suggested that small businesses[2] face market gaps that make it difficult to access the required capital to finance their operations[3].

Industry Canada conducts regular surveys to build quarterly, semi-annual, and annual snapshots of business trends in borrowing and financing gaps, including data on debt, lease and equity financing request rates and approval rates. The goal in conducting the surveys and in showcasing the results in this summary is to help to better understand and respond to trends in financing gaps at the small business level.

Should All Businesses Be Approved?

It is important for policy-makers to remember that efficient lending is not about approving loans for every business that requests one. The competitiveness of the small business sector in particular and the business sector more generally depends on an efficient allocation of financial resources and a healthy balance between capital demand and capital supply.

If lender underwriting standards are too loose, borrowers could take on more debt than what they could comfortably service when interest rates rise or the economy slows. In deciding whether to approve a loan, lenders must carefully weigh expected risks against expected returns.

Some businesses are noncredit worthy and regardless of what interest rate they claim to be willing to pay, they will not be able to do so. The refusal to approve some businesses for loans must at times be accepted as the correct decision.[4]

However, the refusal to approve a business' request for financing becomes a concern when the refusal decision results in an underallocation of financing to credit worthy businesses or when certain categories of businesses are systematically denied access to capital. Such occurrences could signal a major, and potentially chronic, inefficiency in the small business financing market and would justify the continued need for

[2] For the purpose of this article a 'small business' is defined as having less than 100 employees

[3] Such gaps have been identified in research conducted by the Organisation for Economic Co-operation and Development (OECD), Industry Canada, and the Business Development Bank of Canada (BDC), among others.

[4] OECD. The SME Financing Gap—Theory and Evidence (Vol I). (2006).

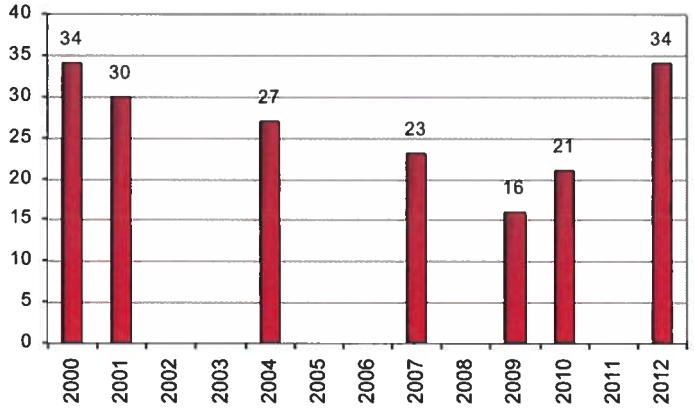
government intervention through such mediums as the Business Development Bank of Canada (BDC) and the Canada Small Business Financing Program (CSBFP).

The information presented below provides a starting point for discussions about such concerns.

Financing Needs

From 2000-2012, about 26 percent of small businesses (average per year) requested financing to support their operations (Figure 1). The two most common reasons cited by business owners for seeking financing were to purchase fixed assets, such as land and buildings, and to support working capital needs.

Figure 1: Aggregate small business financing request rates (%)



Source: Industry Canada *Credit Conditions Survey*, 2009, 2010 and 2012: Statistics Canada *Survey on Financing of Small and Medium Enterprises*, 2000, 2001, 2004 and 2007.

The decade started with request rates at their highest level (34 percent). Request rates fell to 30 percent in 2001 following the tech-bus and the 9/11 terrorist attacks. Over the next six years (2002–07), economic growth remained strong in Canada and small business financing request rates continued to decline, falling to 27 percent in 2004 and 23 percent in 2007. Essentially, small businesses had fewer needs for externally generated funds as growth projects and working capital needs could be more cheaply financed through company profits and retained earnings.

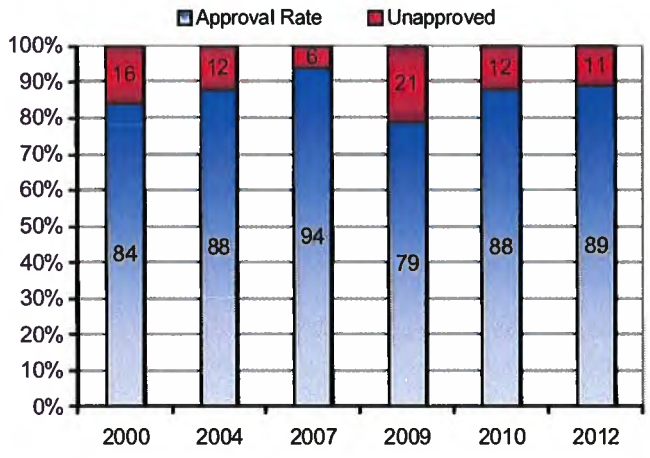
Request rates hit a decade low of 16 percent in 2009 following the American and European financial crisis of 2007 and 2008 and ensuing global recession. As the economy started to recover in 2010, request rates rebounded to 21 percent and, as of 2012, rates have returned to levels observed at the start of the decade.

Financing Availability

Loan "approval rates" (Figure 2) help researchers gain supply-side insights into the presence of financing gaps, as debt-financing is the most heavily relied on instrument for small business financing.

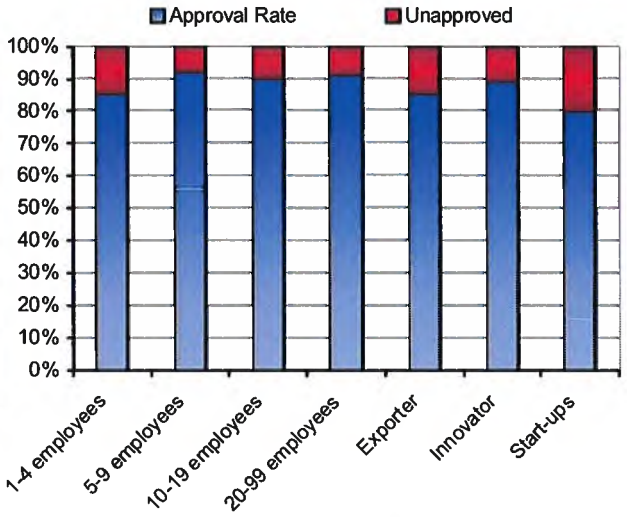
A fairly small percentage of debt requests were turned down in most years. On average, about 87 percent of small businesses' debt financing requests were approved each year. Also, though not shown here, about 86 percent of the value of funds demanded by small businesses was supplied by lenders. These results suggest that, in the aggregate, most small businesses get their loan approved, and get close to the value requested.

Figure 2: Aggregate small business loan approval rates (%)



Source: Industry Canada *Credit Conditions Survey*, 2009, 2010 and 2012: Statistics Canada *Survey on Financing of Small and Medium Enterprises*, 2000, 2001, 2004 and 2007

Figure 3: Sub-category loan approval rates, 2012 (%)



Source: Industry Canada *Credit Conditions Survey*, 2009, 2010 and 2012: Statistics Canada *Survey on Financing of Small and Medium Enterprises*, 2000, 2001, 2004 and 2007.

Sub-Sector Availability of Financing

There is a broad array of small businesses in Canada, varying in size, industry, region and growth intention. Some are highly innovative and driven by growth, while others want to generate a steady stream of income. Depending on the competitive nature of a business, its resource base, the stage of development, the degree of industry competition and the overall economic climate, small business financing needs and the financing supply likely vary.

The smallest businesses (businesses with 1-4 employees) faced relatively greater difficulties accessing financing, with an average 85 percent approval rate in 2012 (Figure 3); compared to about a 91 percent approval rate for all other size categories

A similar relationship was observed for start-ups (businesses that are less than 3 years old), with an 82 percent approval rate in 2012; compared to an average 89 percent approval rate for older businesses.

The findings in this article support the notion that partial gaps in financing for specific types of businesses may exist, namely among Canada's smallest and youngest.

For further information about this document contact the author at the following e-mail address or telephone number:

Daniel Seens
Small Business Branch
Daniel.Seens@ic.gc.ca
+1 (613) 954-3538

IC Insights
Issue 2, Fall 2013

Industry Canada Industrie Canada

Quantum Valley

Highlights

- Kitchener-Waterloo (Ontario) is becoming known as 'Quantum Valley', a term which has been used not just locally, but nationally and internationally.
- Since 2002, Industry Canada and the Industry Portfolio have invested over $200 million in key elements of the Quantum Valley, such as the Perimeter Institute for Theoretical Physics and the Institute for Quantum Computing.

What is Quantum Valley?

Thanks to its excellence in quantum physics research, a vibrant entrepreneurial culture, and effective commercialization support systems, the Waterloo Region is becoming known as Quantum Valley. A new pool of investment capital is seen as the final ingredient that may enable Kitchener-Waterloo to emulate the economic and technological powerhouse of California's Silicon Valley. In March 2013, BlackBerry Inc. co-founders Mike Lazaridis and Douglas Fregin announced the creation of a $100-million Quantum Valley Investment Fund. This was a logical progression from investments that Industry Canada and the Industry Portfolio have made in partnership with Mr. Lazaridis over more than a decade.

At the announcement, Mr. Lazaridis made it clear that he sees quantum computing as the next big thing in the global high-tech sector. "Nothing you see in the classical technology world can prepare you for what you will see in the quantum technology revolution," he said in a press release.

Industry Canada's Support

A series of Industry Canada and Industry Portfolio investments have helped establish the Quantum Valley innovation system (Table 1).

What is Quantum Science?

At its most basic level, quantum physics is being applied to computing to create computers and communications devices that may be substantially more powerful and faster and, well . . . different. Today's computers use bits of data that can only be coded as either a 1 or a 0. Quantum research, looking at the tiniest parts of nature – atoms, electrons, photons and the like, has revealed a behaviour called superposition. When applied in the computing world, this allows a bit of data in quantum computing to be 1 and 0 at the same time, offering the possibility of exponentially increased processing speeds.

Another unique aspect of quantum science is that particles can be so closely correlated that, even after being separated, they behave as one. This *entanglement property* is what Albert Einstein famously described as "spooky action at a distance." Entangled particles offer opportunities, for instance, in quantum cryptography. Cryptography technologies that harness the power of quantum entanglement could allow for secure communications by enabling us to see and react when an eavesdropper tries to intercept messages.

Table 1 Major Investments in the Creation of a Quantum Valley Innovation System, 2002-2013			
	Perimeter Institute (PI)	**Institute of Quantum Computing (IQC)**	**Quantum Valley Investment Fund**
Total Federal	**$142,000,000**	**$74,000,000**	
IC	$100,000,000	$50,000,000	
NSERC	$25,000,000	$6,000,000	
CFI	$17,000,000	$18,000,000	
Province of Ontario	**$135,000,000**	**$68,000,000**	
Private Sector	**$215,000,000**	**$105,000,000**	**$100,000,000**
Total	**$492,000,000**	**$247,000,000**	**$100,000,000**

Source: Industry Canada calculations

In 2002, the Natural Sciences and Engineering Research Council (NSERC) provided $25 million to the Perimeter Institute for Theoretical Physics to establish a centre that could attract the world's best theoretical physicists. This was added to a $33.3 million initial commitment from Mr. Lazaridis as well as provincial support.

Since then, $117 million has been provided to Perimeter by Industry Canada and the Canada Foundation for Innovation, including a $50 million contribution in 2012 toward its research, education and public outreach activities.

These investments in Perimeter are beginning to bear fruit, with a recent independent performance evaluation concluding that, "Perimeter Institute has vaulted Canada into a highly visible and respected world player in theoretical physics, with Canadian science capacity and reputation markedly improved mainly due to PI."[5]

The Perimeter Institute's international stature also continues to grow. During a visit from Cambridge University, world-renowned physicist Stephen Hawking declared it to be "one of the world's leading centres in theoretical physics, if not the leading centre".

In 2006, the Industry Portfolio began contributing to the development of the Institute for Quantum Computing (IQC) at the University of Waterloo, housing one of the world's largest concentrations of quantum information researchers. Industry Canada provided $50 million in 2009 to support IQC.

The work at IQC bridges the theoretical research from facilities such as Perimeter with experiments that can drive technological innovations. It has already proven itself to be useful in collaborative research being done at such venues as Communitech, which helps propel breakthrough technologies through the commercialization process of a number of fledgling start-up companies in the region and across Canada.

How Does This All Come Together?

One example is a project that includes the development of a functional, prototype receiver and quantum payload.

[5] KPMG (2011), *Program Evaluation and Performance Audit of Perimeter Institute for Theoretical Physics*.

It would be part of a low earth orbit satellite constellation. The project involves IQC as well as several Waterloo tech firms. It is coordinated by Communitech and backed by an additional $6.4 million funding from the Federal Economic Development Agency for Southern Ontario (FedDev Ontario). Cambridge-based exactEarth Ltd, a satellite services provider and subsidiary of satellite manufacturer Com Dev International, is both an investor and technical participant in this initiative.

With Industry Portfolio investments having helped create the key building blocks of a Quantum Valley innovation system, there is now potential for reinvigorated job creation and economic growth from entrepreneurs that can harness quantum information technologies to establish and develop globally competitive firms.

Sources

Canada's Technology Triangle Inc. (n/a), *At a Glance Waterloo Region*. eSolutions Group. http://www.techtriangle.ca/en/ataglance/AtAGlanceWaterlooRegion.asp

Canadian Digital Media Network, *Home*. http://www.cdmn.ca/network/

Communitech, *About the Communitech Hubb*. http://www.communitech.ca/connect/the-communitech-hub/

Hardy, Quentin (2013), *Creating Canada's 'Quantum Valley'*. Bit Blogs, The New York Times.

Institute for Quantum Computing, *About the Institute*. http://iqc.uwaterloo.ca/institute

KPMG (2011), *Program Evaluation and Performance Audit of Perimeter Institute for Theoretical Physics*.

Marlow, Iain (2013), *Mike Lazaridis's new quantum leap*. The Globe and Mail.

Mercer, G. (2013), *Investing in quantum is a no-brainer: Lazaridis*. Waterloo Region Record.

Networks of Centres of Excellence of Canada (2012), *Centres of Excellence for Commercialization and Research (CECR)*. Funded Networks and Centres, Government of Canada. http://www.nce-rce.gc.ca/NetworksCentres-CentresReseaux/CECR-CECR_eng.asp

Perimeter Institute for Theoretical Physics (2012), *2011-12 Achievement Highlights*.

Quantum Valley Investments (2013), *Mike Lazaridis and Doug Fregin Unveil $100 Million Quantum Valley Fund, Focusing on Commercializing Quantum Technology Breakthroughs*. http://quantumvalleyinvestments.com/media/

Wikipedia, *Quantum entanglement*, Wikimedia Foundation, Inc. http://en.wikipedia.org/wiki/Quantum_entanglement

Waterloo's Tech Sector

Waterloo has developed a culture of innovation that pervades firms in the region, from small start-ups to well-established publicly-traded firms with hundreds of employees and millions in revenue. Before Blackberry began to revolutionize communications, the University of Waterloo was planting the seeds of the region's tech industry boom and nourishing an entrepreneurial culture. Its longstanding policy of letting researchers retain the rights to intellectual property created through their research is partly credited for its success in fuelling technological innovation.

Today, nearly 1,000 technology companies call the region home. These companies employ 30,000 people and their combined revenues total $30 billion (according to Communitech). Waterloo boasts a number of leading tech companies such as OpenText Corp., Christie Digital Systems and Desire2Learn Inc.

For further information about this document contact the author at the following e-mail address or telephone number:

Roman Cooper, *Science and Innovation Sector*
Roman.Cooper@ic.gc.ca
+1 (613) 960-7082

IC Insights
Issue 2, Fall 2013

Industry Canada Industrie Canada

Economist's Corner

Measuring Trade in Value Added

A New Tool to Assess Trade Flows

- The OECD and World Trade Organization (WTO) have partnered to create the Trade in Value Added (TiVA) database, which attempts to allocate value-added in the production chain to its country and industry of origin.
- This allows us to better understand global value chains (GVCs), and provides a new way to examine Canada's trade performance.
- TiVA also enhances our understanding of the importance of services in Canadian trade, revealing that 30% of manufactured exports represents services value added.

Introduction

Figuring out the total amount of trade by a country sounds simple: record the gross value of goods every time they cross the border.

With today's increased use of and reliance on global supply chains, this traditional trade measure often results in 'multiple-counting' of the value of products that may cross the border more than once for further processing before the final product goes to the consumer.

From a policy perspective, it is not sufficient to know how much we export and import. We also need to understand how much domestic value added is created by the export of a good or service to better understand how trade contributes to economic growth and competitiveness.

That is why Canada and other countries supported the OECD to work on global value chains (GVCs) and collaborate with the World Trade Organization (WTO) on a joint initiative to develop a trade in value-added database to enhance the analysis of the movement of goods and services across borders.

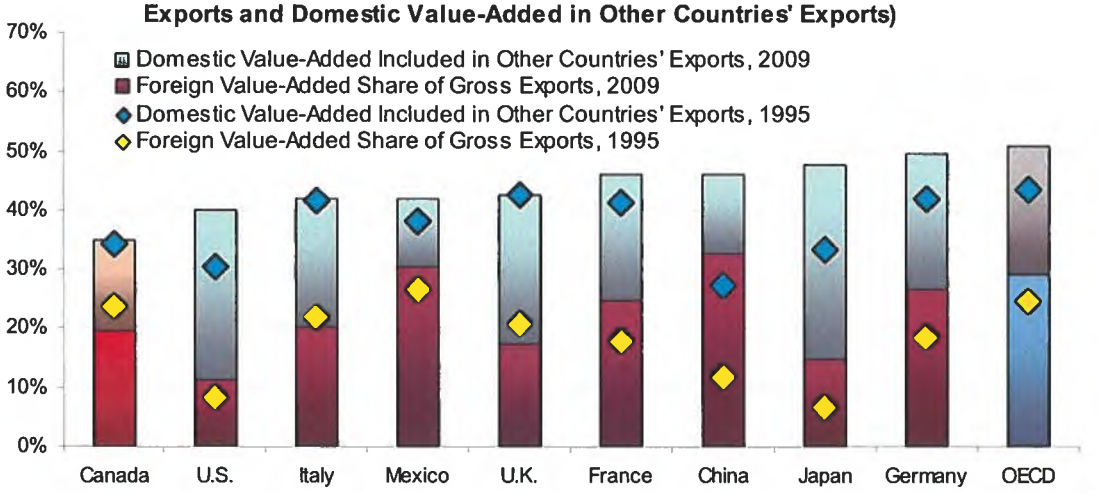
What's in the TiVA Database?

- 39 indicators of gross exports, value-added (VA) in gross exports, VA created by final demand, service VA content, revealed comparative advantage, and origin of VA
- Reports on 34 OECD countries, 23 non-OECD countries (including Brazil, Russia, India, China, Indonesia and South Africa), the rest of the world and economic zones such as ASEAN, NAFTA
- Includes the years 1995, 2000, 2005, 2008 and 2009
- Covers 18 industries
- Frequently updated with new variables and countries
- Based on OECD Input Output tables linked using bilateral trade databases
- Freely accessible, the database can be accessed using the following link: http://stats.oecd.org/Index.aspx?DataSetCode=TIVA_OECD_WTO

What is TiVA?

Released in January, the OECD-WTO TiVA database uses national input-output tables linked with bilateral trade data to create an international input-output table that allocates value-added in the production chain to its country and industry of origin. The value-added

Figure 1: Participation in GVCs (Foreign Value-Added Share of Gross Exports and Domestic Value-Added in Other Countries' Exports)



Source: OECD-WTO TiVA database

approach provides a better picture of the role of intermediate imports in export performance and the scale of GVCs. GVCs include all the activities undertaken by firms to take a product to market, from the original idea through its final use. Value-added trade also captures the contribution of service inputs embedded in exports.

To illustrate how TiVA can be used, several indicators are highlighted next, starting with Canada's links to GVCs.

TiVA and Canada

TiVA provides indicators that estimate a country's participation in GVCs, both upstream and downstream. The upstream link can be illustrated using the share of foreign value-added that is included in a country's exports. The downstream link can be illustrated using the share of one country's value-added that is included in other countries' exports.

In Figure 1, Canada is compared to its G7 peers and trading partners China and Mexico. Canada ranks lower than its G7 counterparts and G7 countries rank in

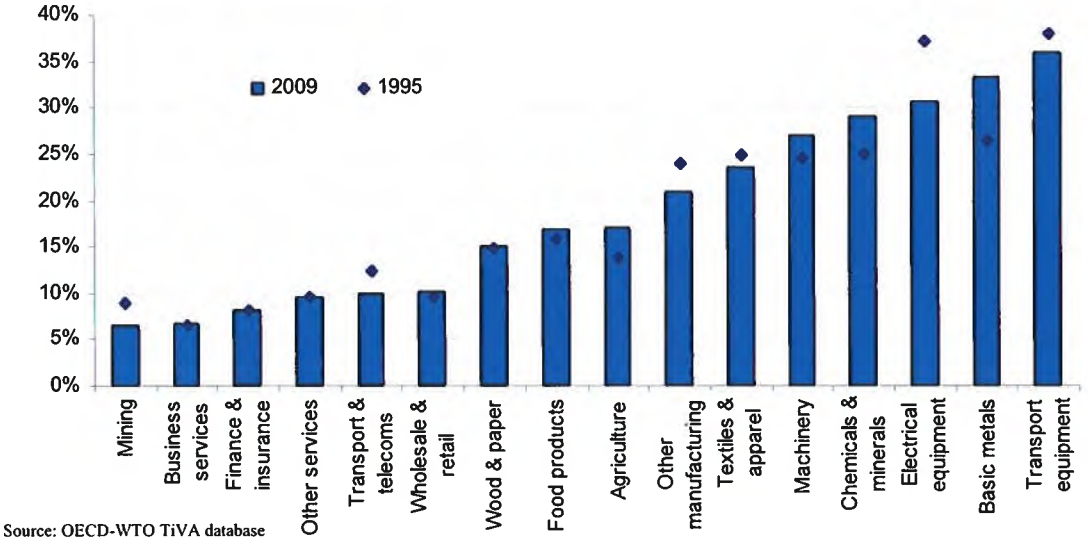
What are Global Value Chains (GVCs)?

A GVC consists of all the activities undertaken by firms to take a product to market, from the original idea through its final use. It includes activities such as design, logistics, fabrication, and marketing and after sales support. These activities can be undertaken within a single firm or spread out across businesses and countries.

Firms use GVCs to be more efficient, productive, and gain access to new markets as well as tap into local knowledge. GVCs have become more prevalent with the increased fragmentation of production, enabled by rapid advances of information and communication technologies, and the liberalization of trade and investment.

GVCs challenge the traditional perception of company, sectoral, and country competitiveness. With the fragmentation of manufacturing, increased contribution of services to economies and the internationalization of supply chains, we need to better understand where value is derived, the contribution of different industries across countries, the drivers of GVCs and their implications for trade and industrial policy.

Figure 2: Canada's Foreign Value-Added Share of Gross Exports for Selected Industries



Source: OECD-WTO TiVA database

the lower half of OECD countries. Canada is one of the few countries which experienced a decrease in foreign value-added share of gross exports from 2005 to 2009. This is due in part to the increased share of domestic value-added exports from intensive export industries such as mining (not shown in figures).

TiVA also provides indicators of the foreign content of exports by industry based on their International Standard Industrial Classification. With more than 35 percent of foreign content in its exports, the transportation equipment industry in Canada has the highest level of participation with upstream linkages in GVCs, as seen in Figure 2. This reflects the transportation equipment industry's integrated nature in North America.

Bilateral Trade

Assessing bilateral trade through value-added indicators provides a different picture of Canada's performance compared to gross trade statistics (Figure 3). For example, Canada's bilateral trade surplus with the U.S. decreases when measured using value added instead of gross trade. Conversely, Canada's bilateral value-added trade deficit with China is lower than its gross trade deficit. This is likely due to the important share of foreign value-added included in China's gross exports (Figure 1). For example, an electronic good imported from China contains components from other countries, such as Korea, the U.S., Germany, and Japan. The gross value of the whole product is attributed to China in traditional trade measures, whereas TiVA allocates

A Caveat on Comparing Countries

Direct comparisons between countries are complicated by factors including the size of an economy (larger economies tend to have lower import content in their exports), industrial composition (such as natural resources representing a larger share of economic activity) and distance from foreign markets and suppliers.

value-added by components of the product to their country of origin.

Role of Services

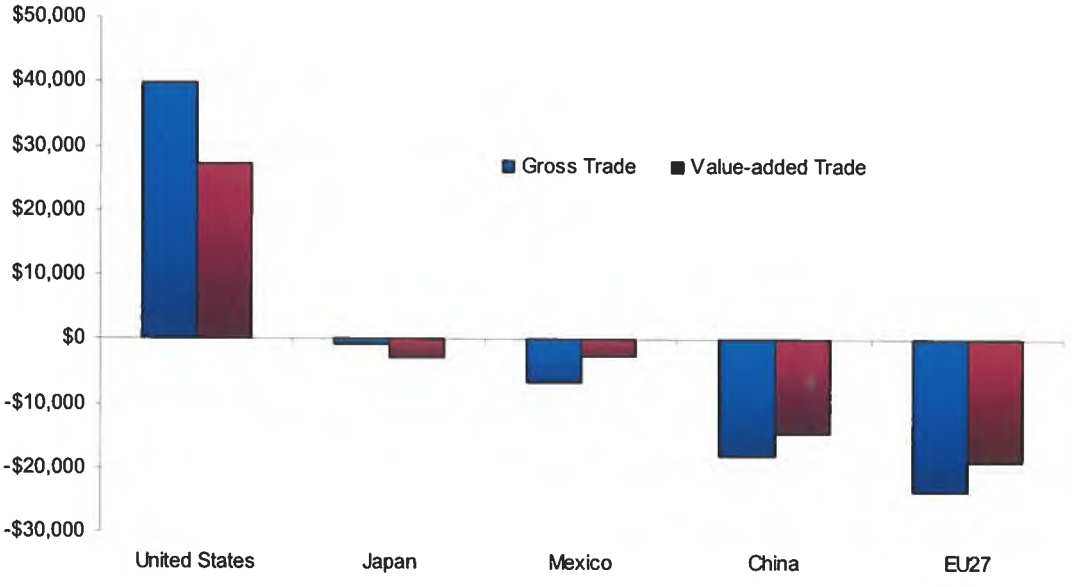
While services account for only 16 percent of the total of gross exports in 2009, value-added trade measures provide an altogether different picture of the importance of services in exports, attributing an overall value-added share estimate of about 37 percent for services in Canada's exports. This can be attributed to the significant contribution made by services as intermediate inputs in goods that are exported.

The increased integration of services and manufacturing in Canada and other OECD countries is difficult to quantify, but the OECD TiVA database furthers our understanding of the services component of manufacturing value-added. Services are an important part of Canadian manufacturing, since its activities, including product design, financial and distribution services, are embedded in sales and export values. In manufacturing, the services content of gross exports was highest in the transport equipment and food product industries with shares of 34 and 36 percent, respectively.

Limitations

While TiVA improves the understanding of trade flows, it is not perfect. Limitations arise from assumptions made in creating the international input-output table underlying TiVA indicators. Input-output tables are harmonized to a set of 37 industries, using the "Production Assumption", which states that all firms allocated to an industry use the same inputs to produce the same outputs. In reality, the share of foreign inputs used to produce goods that are exported varies across firms in an industry. Specifically, firms involved in international activities are generally more likely to rely on foreign inputs. This means that this assumption might lead to downward biases in the estimates

Figure 3: Canada's Bilateral Trade Balances, 2009 ($USD millions)



Source: OECD-WTO TiVA database

of foreign content shares.

In addition, a "Proportionality Assumption" is used. This assumption means that the share of imports in a product is the same whether it is used as an intermediate input or as a final product. This assumption requires that bilateral trade estimates in TiVA be interpreted with greater care than other indicators

TiVA is an important complement to traditional trade measures rather than a substitute for them. TiVA improves our understanding of upstream and downstream participation in GVCs by individual countries and the contribution of services in GVCs. TiVA can also be used to examine economic interdependencies and interrelationships and the impact of shocks to supply or demand on downstream and upstream production.

What's Next?

The database will be improved by adding new countries, industries and time series, and more bilateral trade in services.

To complement TiVA, the OECD is exploring the development of "Trade in Jobs" estimates to see what type of employment is created by trade. It is also considering "Trade in Income" to examine the role of knowledge-based assets in creating value-added, particularly in the case of foreign affiliates when value-added is recorded in one country and profits repatriated to another.

In addition, some of the indicators available in the database provide interesting starting points for further analysis on the subject of trade in value-added. The share of imported inputs used in exports can be used to highlight the importance of access to imports for export competitiveness and can help bring new insights to the discussion on how import penetration impacts domestic industries. TiVA provides additional indicators—and opportunities for investigation—on trade in services, including its value-added embodied in a country's gross exports which helps reveal the extent of the role it plays in exports.

Sources

OECD/WTO (2013), *OECD-WTO: Statistics on Trade in Value Added*, (database). 10.1787/data-00648-en

OECD/WTO (2013), *OECD/WTO Trade in Value-Added Indicators – Canada* www.oecd.org/sti/ind/TiVA_CANADA_MAY_2013.pdf

OECD/WTO (2013), *OECD-WTO Database on Trade in Value-Added FAQs: Background Note.* www.oecd.org/sti/ind/TIVA_FAQ_Final.pdf

For further information about this document contact the author at the following e-mail address or telephone number:

Sylvain Ganter, *Manufacturing and Life Sciences Branch*
Sylvain.Ganter@ic.gc.ca
+1 (613) 954-3263

John Szabo, *Manufacturing and Life Sciences Branch*
John.Szabo@ic.gc.ca
+1 (613) 957-1242

Industry Canada Industrie Canada

IC Insights Databoard

	Monthly Economic Indicators						
		Month-over-month growth (at monthly rates)			Q-o-q growth	Year-over-year growth	
	Reference period	Latest month	Prev. month	2 Months before	2013Q2	2012	2011
Manufacturing shipments (current $)	Jun '13	-0.5	0.6	-2.3	-1.4	3.5	8.0
Manufacturing shipments (constant $)	Jun '13	-1.3	0.6	-1.6	-0.8	3.0	3.5
Retail trade (current $)	Jun '13	-0.6	1.8	0.2	1.4	2.5	4.1
Retail trade (chained $)	Jun '13	-1.2	1.7	0.6	1.4	1.8	1.9
Real GDP	Jun '13	-0.5	0.2	0.1	0.4	1.8	2.6
-Services	Jun '13	-0.3	0.4	0.4	0.7	1.8	2.2
-Manufacturing	Jun '13	-1.3	0.0	0.0	-0.4	1.4	2.5
Exports (bop) (current $)	July '13	-0.6	1.2	-2.0	0.2	1.3	13.1
Imports (bop) (current $)	July '13	0.6	-1.1	-1.3	1.0	4.1	10.2
All-items CPI	July '13	0.2	0.2	0.2	0.0	1.5	2.9
LFS employment (change in 000s)	Aug '13	59.2	-39.4	-0.4	56.3	200.7	262.5
Unemployment rate (%)	Aug '13	7.1	7.2	7.1	7.1	7.3	7.5
	Monthly U.S. Indicators						
U.S. CPS employment (change in 000s)	Aug '13	-115.0	227.0	160.0	478.3	2,587.2	804.7
U.S. unemployment rate (%)	Aug '13	7.3	7.4	7.6	7.6	8.1	8.9

	Financial Indicators						
			Monthly average			Annual average	
	Reference period	Current value	Latest full month	Prev. month	2 months before	2012	2011
Bank rate (%)	Sep 12 '13	1.25	1.25	1.25	1.25	1.25	1.25
Exchange rate (Can. Cents per $U.S., spot rate)	Sep 12 '13	103.2	104.1	104.0	103.1	99.9	98.9

	Quarterly Economic Indicators					
		Quarter-over-quarter (at annual rates)			Year-over-year growth	
	Reference Period	Latest quarter	Prev. quarter	2 Quarters before	2012	2011
Real GDP	2013Q2	1.7	2.2	0.9	1.7	2.5
Final consumption expenditure	2013Q2	3.3	1.3	2.2	1.6	1.9
Gross fixed capital formation	2013Q2	-1.2	-1.5	2.8	4.3	4.2
-Machinery & equipment	2013Q2	-2.1	-0.1	3.1	5.2	8.6
Imports	2013Q2	0.9	5.2	0.8	1.5	4.7
Imports	2013Q2	1.5	2.4	-3.1	3.1	5.7
Final domestic demand	2013Q2	2.2	0.6	2.4	2.3	2.4
Labour productivity	2013Q2	2.0	0.2	0.4	-0.2	1.2
Unit labour cost	2013Q2	2.3	-0.2	2.4	3.0	2.3
Industrial capacity utilization (%)	2013Q2	80.6	80.8	80.4	80.8	79.7
	Quarterly U.S. Indicators					
Real U.S. GDP	2013Q2	2.5	1.1	0.1	2.8	1.8

Industry Canada Industrie Canada

Abbreviation Guide	
GDP	Gross Domestic Product
BOP	Balance of Payments
CPS	Consumer Price Index
CPS	Labour Force Survey
CPS	Current Population Survey
000s	Thousands
Q-o-q	Quarter-over-quarter
IMF	International Monetary Fund
OECD	Organisation for Economic Co-operation and Development
WTO	World Trade Organisation
Sources for the IC Insights Databoard	
Statistics Canada	www.statcan.gc.ca
Bank of Canada	www.bankofcanada.ca
U.S. Bureau of Economic Analysis	www.bea.gov
U.S. Bureau of Labour Statistics	www.bls.gov

IC Insights Hot Chart