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Strategic Policy Sector

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INSIGHTS

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Recent Developments of Interest to ISED

Canada's ranking in the World Economic Forum's Global Competitiveness Report increases two spots

- Canada's overall competitiveness ranking edged upward to 13th place from 15th place in the World Economic Forum's Global Competitiveness Report for 2015-16 (see the Hot Chart). Canada improved its ranking mainly because of a lower budget deficit (based on 2014 data) and a more favourable assessment of its financial market development.
- Strengths and weaknesses for Canada have been relatively consistent over the past few years. Among the 12 indicators used to construct the overall ranking, Canada performed well in financial market development (4th) and labour market efficiency (7th). Canada's main weaknesses were in the areas of macroeconomic environment (39th), business sophistication (22nd), and innovation (22nd).
- The top five countries were Switzerland, Singapore, the United States (US), Germany, and the Netherlands. Within the G-7, Canada maintained its rank of 5th behind the US, Germany, Japan and the United Kingdom (UK).

International Monetary Fund releases its updated World Economic Outlook

- The International Monetary Fund released its updated World Economic Outlook (WEO) providing projections for the global economy and individual countries.
- Compared to the previous WEO in July, the growth outlook for the global economy in 2016 was downgraded 0.2 percentage points to 3.6%. The outlook for growth in 2015 was also downgraded 0.2 percentage points to 3.1%.
- They stated that "prospects across the main countries and regions remain uneven", finding that downside risks to the outlook have risen, particularly for emerging markets and developing economies.
- The outlook for Canada was downgraded to 1.0% in 2015 and 1.7% in 2016, a decrease of 0.5 and 0.4 percentage points, respectively, from the July 2015 WEO.

The Conference Board of Canada expects a significant slowdown in Canada's potential economic growth

- In December, the Conference Board of Canada released its Long-Term Economic Forecast for Canada, which states that Canada failed to achieve expectations for stronger growth after emerging relatively quickly from the 2008-09 recession.
- Over the next few years, the trade sector is expected to be a significant driver of Canadian economic growth as a result of dollar depreciation combined with strong demand from the U.S.
- Immigration will facilitate population growth of 0.9% per year during the forecast period, which will partially offset the exodus of baby boomers from the labour force.

Ocean Technology Industry Cluster

Highlights

- Ocean technology firms serve a large range of industries including marine transport, defence and seabed mining.
- The sector is knowledge intensive and many of the firms have either been spun-out of a research organization or have collaboration with one.
- Firms generate a high percentage of revenue from export sales and often have a multi-use technology that they apply to diverse niche markets.
- The National Shipbuilding Procurement Strategy is an opportunity to get more ocean technology companies in the supply chains of multi-national original equipment manufacturers and continue to drive innovation.

Introduction

Canada is a maritime nation with over 250,000 kilometres of coastline, twenty percent of the world's total freshwater resources and bordering three oceans. Delivering innovations to protect and prosper from our water resources is what Canada's marine technology firms are all about. Canada's shipbuilding and industrial marine sector, with total sales revenues of $2.9B in 2011, includes diverse sub-sectors (e.g., ocean technology, offshore oil/gas equipment and mission systems) each with unique characteristics and challenges.

Ocean technology (OT) is an important and growing sub-sector. The Canadian OT sector is comprised of companies and research/academic

Box 1: A Brief History of Ocean Technology

- Dr. Ernie Pallister initiated interdisciplinary exploration for petroleum in Canada's Arctic Ocean in the 1950s. This led to his promotion of the Ocean Technology (OT) model of consortia among government, industry and academia in support of resource exploration and research.
- The pursuit of oil in the Beaufort Sea through Pallister's consortia "Quest" expeditions drove the creation of a cluster of OT companies in Calgary including Canatec International who today are leaders in instruments for the detection and management of sea ice.
- Pallister worked collaboratively with Dr. Angus Bruneau, the first Dean of Engineering at Memorial University through the Science Council of Canada to establish the Centre for Cold Ocean Resources Engineering (C-CORE) focused on developing resources in harsh environments.
- BC's OT sector had its start in the 1970s, catalyzed by federal policies, oil and gas exploration in the Beaufort Sea, and the establishment of the Department of Fisheries and Oceans' Institute of Ocean Sciences in 1977.
- Dr. David Barber, Director of the Centre for Earth Observation Science at the University of Manitoba has been conducting Arctic field experiments annually since 1981. His work has led to the soon to be established Churchill Marine Observatory that will study the impact of oil spills in sea ice and investigate issues related to shipping in the Arctic.

institutions that invent, develop and produce technological products for ocean specific use, or provide knowledge-intensive technology-based services unique to the ocean. OT products range from marine robotics and subsea vehicles to communications and electronic navigation equipment, whereas OT services comprise professionals with enhanced engineering, environmental and computer knowledge. These firms serve ocean industries such as marine transportation; defence and security; coastal and ocean management; fisheries; offshore oil and gas; seabed mining; and ocean renewable energy.

The ocean technology sector is:

- **Export oriented**. The majority of Canadian companies in the sector earn a high percentage of their revenue from international sales;
- **Knowledge intensive**. The sector is characterized by highly innovative companies with an R&D agenda.
- **Collaborative.** There is a strong network of Canadian university and government research centres active in the sector.
- Characterized by **dual or multiple use technologies** which has led to many companies diversifying into several niche vertical markets.
- **Highly clustered** in regions. Dominated by SMEs (small and medium-sized enterprises), typically each cluster also boasts a few multi-national defence systems integrators and at least one regionally-based R&D organization/academic institution that supports technology development and commercialization efforts.

Drivers of growth and collaboration

As a major customer, the Government of Canada has driven innovation in OT through procurement. For example, Virtual Marine Technologies, CARIS, International Submarine Engineering, Rutter, OSI Maritime System and Canatec are all small firms that have benefited from federal procurement that stimulated innovation and helped commercialize their technology internationally.

Box 2: Civil Ocean Technology

Civil OT, the segment of OT not being sold into the defence market, represents the majority of revenue of Canadian small and medium-sized enterprises (SMEs). However, many SMEs are identifying opportunities for their niche products related to the National Shipbuilding Procurement Strategy through the associated Industrial and Technological Benefits policy.

Going forward, the National Shipbuilding Procurement Strategy (NSPS), an approximately $40B investment to renew the Canadian Coast Guard and Royal Canadian Naval fleets in Canadian shipyards, should continue to drive innovation in the OT sector. The Industrial and Technological Benefits policy and its predecessor, the Industrial and Regional Benefits policy, apply to defence and major Coast Guard procurements, including NSPS projects. Obligations from these policies have resulted in new technology, highly-qualified personnel, technology transfers that move companies up the value chain, and increased scientific and

technological know-how opening up new business opportunities. For example OSI Maritime Systems in Burnaby, BC has been selected by Lockheed Martin to design the Integrated Bridge and Navigation System for the Arctic/Offshore Patrol Ships being built by Irving Shipbuilding of Halifax. This new technology is crucial for safe navigation and enhanced situational awareness in Canada's North. It will enhance ice detection capability and help both Irving and OSI Maritime Systems to commercialize the technologies for a bridge system for harsh ice capability.

As part of their long-term strategic sourcing arrangement with the Government of Canada, the NSPS shipyards have committed to provide NSPS Value Proposition investments equal to 0.5% of their resultant contracts to benefit the Canadian marine industry. For instance, Irving Shipbuilding has already invested $1M in offshore research at the Marine Environmental Observation and Response Network (MEOPAR). Through a national call for proposals, MEOPAR will select research projects in areas such as offshore response capable vehicles, oil spill detection and modelling, and the efficient use of marine industry assets.

Internationally, as maritime nations continue to invest in marine sectors such as transportation, defence, resource exploration and renewable energy, the Canadian OT industry can bring their expertise and innovations to these wealth generating ocean industries that make up the blue economy. Canada's primary competitors are generally countries with well-established marine technology sectors supported by strong R&D programs and infrastructure, such as the United States, the United Kingdom, Norway, Germany, France, the Netherlands, Finland and Japan.

Regional highlights

Canadian firms have established themselves as world leaders in several OT niches such as marine remote sensing (sonar & radar) and digital signal processing; intelligent systems and robotic vehicles; simulation and training; seabed mapping; harsh/cold environment technologies and services; and ocean observing systems.

There are significant clusters of companies, government research institutions, and university research across the country. Over half of the companies are located in Atlantic Canada and British Columbia. Below is a summary of the highlights by region (Table 1).

In **Atlantic Canada**, the economic importance of the OT sector far exceeds its size as measured by number of companies and the typically small size of the companies. It is one of the region's largest advanced technology sectors, with high levels of research, development and innovation, a highly skilled labour force, and an export focus. A distinguishing characteristic of the Nova Scotia cluster is the presence of a few multi-national anchor companies (Rolls Royce, Lockheed Martin, L-3 & Ultra Electronics) that act as systems integrators and provide access to global value chains. The initial driver for the Newfoundland cluster was offshore oil and gas development dating back to the early 1970s and while there has been market diversification it is still the primary driver. The Atlantic sector generates an estimated $1.5B in revenue per year.

Table 1: Sector at a Glance

Location	Key Companies	Research Hubs	Specialization	# of Firms	Associations
Atlantic (major clusters in Halifax and St. John's with about 75 firms each)	Satlantic; Virtual Marine Tech; Rutter; Provincial Aerospace; GeoSpectrum Tech; CARIS; Aspin Kemp; Ultra Electronics; SubC Imaging	DRDC-Atlantic; Bedford Institute of Oceanography; C-CORE & Faculty of Engr. Memorial University; NRC-OCRE; University of New Brunswick's Ocean Mapping Group; Institute for Ocean Research Enterprise	Oil and Gas Defense Scientific Ocean Observation Harsh Environment Technology	~150	Oceans Advance; NOIA; NATI; Ocean Technology Council of Nova Scotia; ADIANL; Maritime Energy Association
British Columbia (major clusters in Victoria and Vancouver)	ASL Environmental; JASCO Sciences; AXYS Technologies; International Submarine Engineering; OceanWorks; Kongsberg; OSI Maritime	University of Victoria's Ocean Networks Canada; VENUS and NEPTUNE; ONC Innovation Centre; Smart Oceans BC	Robotics/Vehicles Sensor Tech Ocean Observation Defense/ Security Renewable Energy	~150	Ocean Initiatives BC
Ontario	General Dynamics; L-3 WESCAM; Nautel C-Tech; COM DEV; Knudsen Engineering; Maritime Way Scientific; GeoSensors; Sensor Technology; Guideline Instr.; 2G Robotics	9 Research Institutions, 6 with wave generators; Canadian Innovation Centre University of Waterloo; Maritime Emergency Research Centre; Georgian College; Seneca College	Communications Navigation Surveillance Marine Electronics Radar Sonar Oceanography Meteorology	N/A	CADSI
Quebec	Multi-Electronique; Sygif International; AXSUB; OpDAQ Systems	Interdisciplinary Centre for the Development of Ocean Mapping; Institut Maritime du Québec; Innovation Maritime; St. Lawrence Observatory; ArcticNet	Ocean Mapping Instrumentation Waterway Navigation Sensors Marine Electronics Diving Technology	~40	Technopole Maritime du Québec (TMQ)
Prairie and Northern Region (PNR)	Canatec Associates; LIDAR Services; North/South Consultants; Boreal Laser; C-FER Technologies; GEOSEIS	University of Calgary; University of Alberta; TECTERRA; University of Manitoba Centre for Earth Observation Science; Churchill Marine Observatory	Ice Sensors Mapping Remote Sensing Search & Rescue Remote/Harsh Environments	N/A	CAPP

BC's OT sector had its start in the 1970s, catalyzed by federal policies, oil and gas exploration in the Beaufort Sea, and the establishment of the federal Institute of Ocean Sciences. The sector has grown into a knowledge-intensive, export-driven sector of around 150 companies, mostly SMEs with fewer than 50 employees and sales less than $10M. Sector gross output was estimated at $1.1B and employment at 5,700 FTEs (based on 2005 numbers). Today, the sector benefits from the University of Victoria's Ocean Networks Canada (ONC), founded in 2007 to operate the VENUS and NEPTUNE observatories. Several companies are spin-offs of International Submarine Engineering (ISE), one of BC's largest OT firms that has benefited from federal procurement and developed one of the world's first commercial Remotely Operated Vehicle (ROV). Their ROVs have laid cable under Arctic ice and been used in the search for Franklin's ships.

In **Quebec**, Technopole Maritime du Québec is a not-for-profit organization representing the sector with about 40 members (20 of the total 40 marine technology companies in Quebec) that employ approximately 2,500 people. The cluster has been designated one of 37 priority sectors in the Government of Quebec's Action concertée de coopération régionale de développement (ACCORD) strategy. The Government of Quebec has also announced its new Maritime Strategy (2015-2030), with a budget envelope of $1.5B for 2015-2020, to make Quebec a gateway to the large markets of North America. The strategy includes the creation of the Franco-Quebec Marine Institute, to be located in the heart of the cluster.

Ontario is home to some of the larger OT firms in the country who supply complete systems to naval defence clients as Tier 1 systems integrators. With a focus on naval defence, a significant growth opportunity is supplying components and complete systems (radar, sonar, navigation, marine electronics, etc.) under the NSPS. The Industrial and Technology Benefits policy will help SMEs gain access to the supply chain of these multinational integrators as was the case with Lockheed Martin when they invested in Maritime Way Scientific of Ottawa to fund the company's continued R & D in their acoustic modelling system and tactical decision aid technologies.

Since the 1950s, the **PNR** (Prairie and Northern Region) has been a leader in Arctic R&D, which built a legacy of capability that exists today in companies like Canatec, global leaders in the detection and management of sea ice (see Box 1). The University of Manitoba is a global leader in sea ice research, primarily due to the work of Dr. David Barber, Director of the Centre for Earth Observation Science, who has been working in the Arctic since 1981, and led the proposal to establish the Churchill Marine Observatory (CMO). In July, the Government of Canada and the Province of Manitoba announced a $22M investment in the CMO which will open in July 2017. Establishment of the Canadian High Arctic Research Station at Cambridge Bay in 2017 will act as a driver for Canadian companies looking to develop underwater situational awareness observing system technologies including systems that can operate in an ice environment.

Challenges

The sector is not without its challenges. OT companies, especially SMEs with niche products, may struggle to break into the supply chains of larger marine companies. Another challenge is the lack of a national voice to maximize opportunities to collaborate, as currently no single association has been able to represent the interests of the diverse sector. Lack of capital has also been identified by some sector SMEs. Finally, the fragmentation of the sector makes it difficult to collect quality data at the national level. Regional data varies from strong to minimal, and further research is needed to better understand the scope and importance of the OT sector.

Conclusion

International growth and increased domestic demand, for example due to Canada's investment in the NSPS, will provide opportunities for OT firms to develop home-grown solutions for Canada's shipbuilding and industrial marine sector. Innovation, Science and Economic Development Canada (ISED) is actively involved in fostering the development and use of these products on Canadian ships through programs like the Strategic Aerospace and Defence Initiative. Through our programs and policies, Innovation, Science and Economic Development Canada has the lead to ensure that the NSPS procurements are leveraged to create jobs and economic growth in Canada. The NSPS Value Proposition is also helping to contribute to a vibrant and growing marine sector.

As the sector evolves, it can lever its many strengths to take advantage of opportunities in fields such as ocean observation for scientific and commercial purposes as well as exploring the ocean floor for natural resources, the development of green OT equipment and offshore oil and gas inputs, environmental impact assessments and coastal management practices, among others.

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Canadian Corporate Cash: *Factors Impacting its Increase*

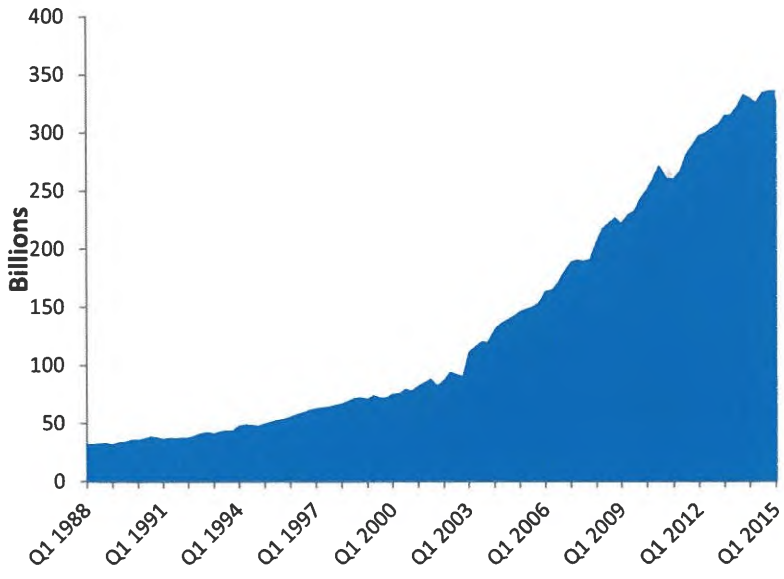
Highlights

- Since the early 2000s there has been a strong trend increase in cash holdings of Canada's businesses, to the point that they are now holding record amounts of cash.
- This has led to media stories about "dead cash" or "dead money" with the concern that businesses are sitting idle on cash instead of returning it to the economy in the form of productive investments.
- However, analysis shows that there are other factors at play impacting business cash holdings, including technological change, shifts in industrial composition, and shifts and responses to changes in risk and uncertainty.

Background and global context

In Canada, as in other countries, there has been a strong trend increase of businesses' cash holdings over the last decade. Canada's businesses are now holding record amounts of cash (Figure 1). Media stories have referred to this build up in cash as "dead cash" or "dead money". Concerns are that it is sitting idle on business balance sheets instead of being put to productive use. In turn, the increase in cash holdings has been linked to speculations about increased "short-termism" on the part of businesses and increased scarcity of profitable investment opportunities for businesses.

Figure 1: Cash and Deposits
(Non-financial Industries)



Source: Statistics Canada.

Canadian corporate cash holdings in a global context

The rise in non-financial firms' cash holdings, as well as the rise of their share of current assets, is not unique to Canada. Non-financial corporations in major advanced economies, including Australia, Germany, Japan, the United Kingdom (UK), and the US have also seen trend increases in cash holdings.

Research at the Bank of England[1] suggests that there are three common structural trends for the long-term rise in cash holdings amongst Canadian, UK, and US firms. First, firms increasingly prefer cash to inventories as a buffer for dealing with shocks. Second, the volatility of firms' cash flows has increased over time. Finally, companies have been holding more intangible capital on their balance sheets, which cannot be pledged as collateral when borrowing, thus encouraging them to rely on cash rather than external finance.

Box 1: Media Outcry

In late August of 2012, then Bank of Canada Governor Mark Carney exhorted Canadian firms to put money to work or to return it to investors instead of sitting on huge piles of "dead money".

Since then, a number of researchers have challenged Mr. Carney's perceptions, contributing to additional media coverage on the topic. A key focal point for media covering this topic is whether the increase in cash holdings is a cyclical or structural change.

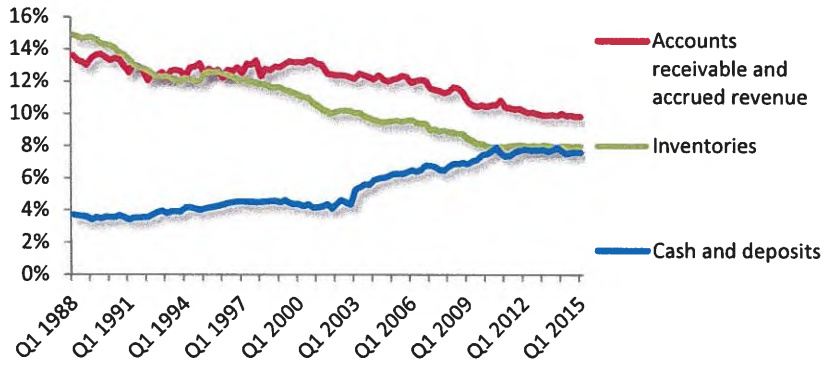
Therefore, a number of factors seem to have contributed to the increase in cash holdings. This article examines the contribution of some of these factors to the increase in cash holdings in Canada.

Technological change

At the same time as aggregate corporate holdings of cash have been increasing, holdings of other short-term assets have been declining.

As a share of total assets, cash and deposits increased from about 4% in the late 1980s to about 8% in recent quarters (Figure 2). Simultaneously, inventories fell from nearly 15% to 8%, while accounts receivable fell from about 14% to about 10%.

Figure 2: Asset Types as a Share of Total Assets
(Non-financial Industries)



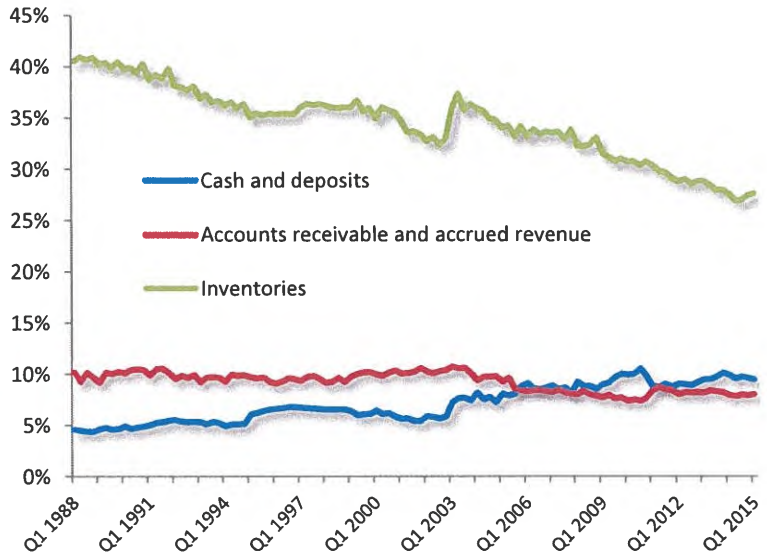
Source: Statistics Canada.

[1] Farrant and Rutkowska (2015).

Technological advances in both inventory management and accounts receivable have contributed to the decline in holdings of these asset types. Innovations in inventory management systems have enabled managers to monitor sales and inventory levels in real time and more tightly link supply adjustments to demand conditions. As well, management of accounts receivable—payments due for goods and services that have been sold—have benefitted from automated invoicing and electronic billing systems. These innovations have facilitated collection activity, allowing businesses to better manage their receivables, reducing the amount of outstanding and overdue funds.

Declines in inventories and accounts receivable and the subsequent rise in cash as a share of assets are more pronounced in some industries. Retailers, for example, have felt the dramatic impacts of improved control over inventories. Although retailers in Canada held more than 40% of assets in the form of inventories in the late 1980s (Figure 3), this figure was less than 30% in early 2015. Accounts receivable have also been trending downward for roughly a decade, going from about 10% to 8%. Over this same period, cash and deposits have increased from about 6% to nearly 10%.

Figure 3: Asset Types as a Share of Total Assets
(Retail Trade Industry)

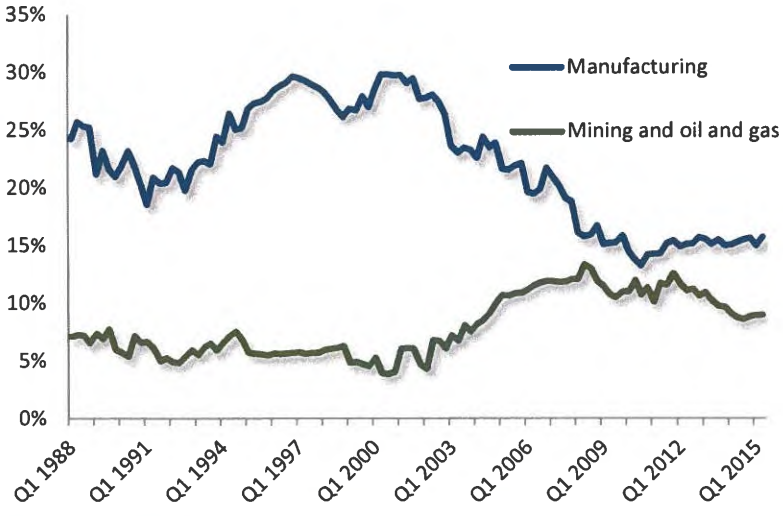


Source: Statistics Canada.

Changing industrial composition

Changes in Canada's industrial composition have also contributed to increased cash holdings. There has been a shift in Canada towards industries that use more internal financing, such as the mining and oil and gas sector, which accounted for roughly 11% of total cash holdings in 2012, up from about 4% in 2001 (Figure 4). At the same time, the manufacturing sector's share decreased from nearly 30% in 2001 to 15% in 2012.

Figure 4: Share of Total Cash and Deposits by Selected Industries
(Non-financial Industries)



Source: Statistics Canada.

Uncertainty and risk

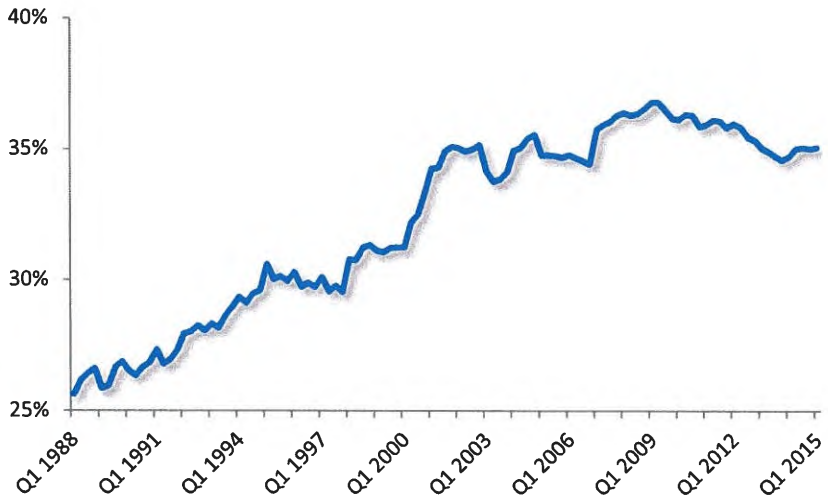
In the wake of the recession, Canada's businesses shored up their balance sheets, so that current assets would more safely exceed current liabilities. In this context, the increased accumulation of liquid financial assets, cash, and cash-like instruments likely reflects, in part, prudent balance sheet management and caution with respect to investment commitments owing to market uncertainty.

The currently prevailing low interest rate environment, coupled with uncertainty over global and regional growth prospects, amplifies the precautionary factors facing firms when making decisions regarding liquid assets. When borrowed funding is cheap and abundant, risk and uncertainty over returns make capital investment expensive in the financial economics sense. Therefore, firms will face an incentive to structure towards more liquid assets.

Global expansions

Finally, around the same time that businesses began holding more cash and less inventories on their balance sheets, businesses also increased their share of investment assets (Figure 5). Acquisitions and foreign expansions are, to some extent, substitutes for internal expansion. The increase in total investment assets, and particularly the portfolio holdings component, is consistent with Canadian businesses adapting their strategies to improve their return on assets in response to globalization and technological change.

Figure 5: Investment Assets as a Share of Total Assets
(Non-financial Industries)



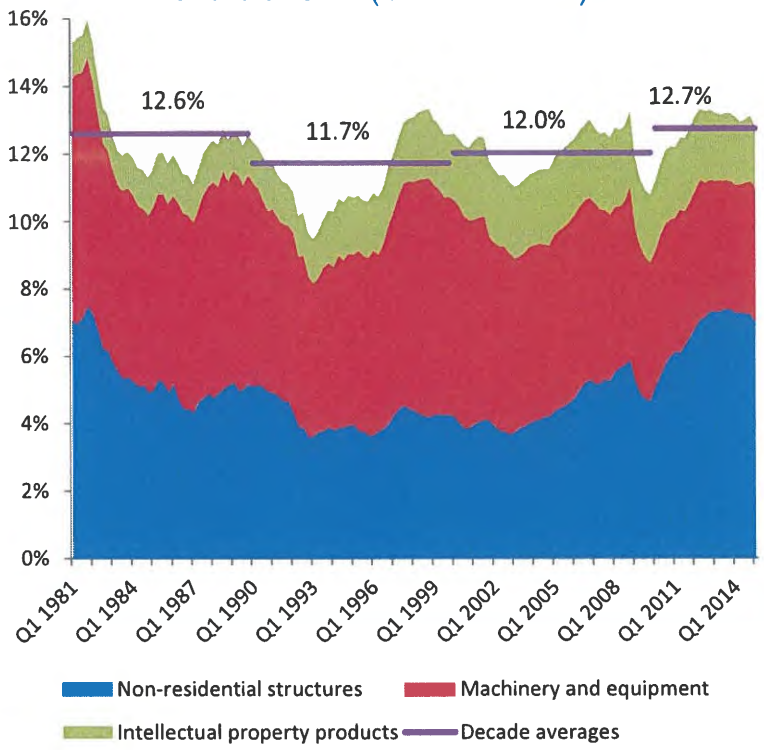
Source: Statistics Canada.

Industries using more internal financing likely need more readily available liquid assets on their balance sheets for day-to-day operations. In addition to potentially requiring more liquid assets for day-to-day operations, energy and mining companies may require more cash because their businesses depend on large infrastructure investments.

Canadian business investment

Much of the concern about potential "dead cash" pertains to businesses sitting idle on cash rather than returning it to the economy as productive investments. However, this is not reflected in business investment (Figure 6). For the past few years, the rate of business investment (as a share of GDP) has been above its average since 1981, largely as a result of investment in structures.

Figure 6: Investment in Non-residential Structures, Machinery and Equipment, and Intellectual Property
Share of GDP (Current Prices)



Source: Statistics Canada.

Conclusion

Overall, concerns about "dead cash" seem to be overstated. The accumulation of cash by Canadian non-financial corporations can be explained, at least in part, by a combination of technological, composition and risk factors, such as an expression of caution on the part of firms and responses to longer-run structural change. As well, despite the increase in cash holdings, business investment as a percent of GDP remains above its historical average.

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The North American Automotive Supply Chain

Highlights

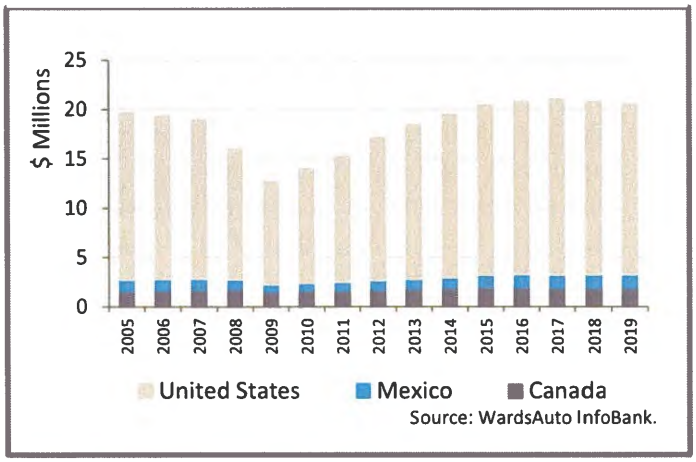
- Canadian automotive suppliers are a key component of Canada's automotive ecosystem, generating $8 billion, almost 50 percent of total automotive manufacturing GDP in 2014.
- Although the North American automotive industry has solidly rebounded from the 2008-09 financial crisis, the industry is entering a period of transformative change, mainly from new regulations and consumer demand, new technology-based manufacturing platforms and regional competition.
- Canada's automotive supply sector, with its reputation for high quality products, is well-placed to adapt and innovate in high value-added components such as software and entertainment, vehicle electrification and lightweighting.

Background on Canada's automotive industry

The automotive market contributes significantly to Canada's economy, especially as the North American automotive industry has rebounded from the 2008-09 financial crisis, with sales and production rising to pre-recessionary levels (Figure 1). This market is expected to remain one of the world's most lucrative.

North America's main automotive producing regions are the Great Lakes, the Southeastern United States (US), and Mexico, with the Great Lakes cluster having the highest concentration of automotive assembly plants and parts manufacturers. Within this cluster, Ontario is the largest vehicle producing jurisdiction in North America, with 11 vehicle assembly lines in 8 assembly plants, 3 engine plants, a network of research and development (R&D) facilities and over 730 suppliers.

Figure 1: North American Light Vehicle Sales



In 2014, Canadian automotive manufacturing generated $18 billion in gross domestic product (GDP), making up 10 percent of total manufacturing GDP. Automotive products (both vehicles and parts) also represented the second largest export behind oil – over $68 billion. Table 1 provides key metrics for the Canadian automotive industry.

Table 1: Canadian Automotive Key Metrics

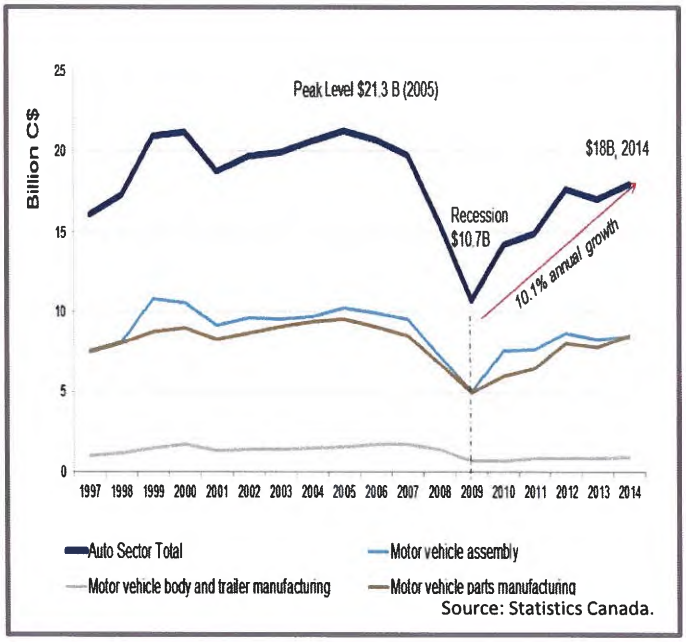
Key Metrics	2014	5-year Annual Average Growth
Sales	C$86 billion	10%
Production	2.4 million	11%
GDP	C$18billion	12%
Employment	121,000	11.3%
Exports	C$68 billion	13%

Source: Statistics Canada.

Canadian automotive suppliers

Automotive suppliers are a key component of Canada's automotive ecosystem, and important to the long-term viability of the automotive sector. In 2014, they generated almost 50 percent of total automotive manufacturing GDP with $8 billion (Figure 2). While the automotive industry overall employs over 121,500 workers directly and another 376,600 in aftermarket and dealerships, Canada has more than 730 automotive parts suppliers directly employing 65,000 Canadians, or 56 percent of all employment in the automotive industry[2].

Figure 2: Canadian Automotive Manufacturing GDP



Source: Statistics Canada.

Canada's automotive supply chain

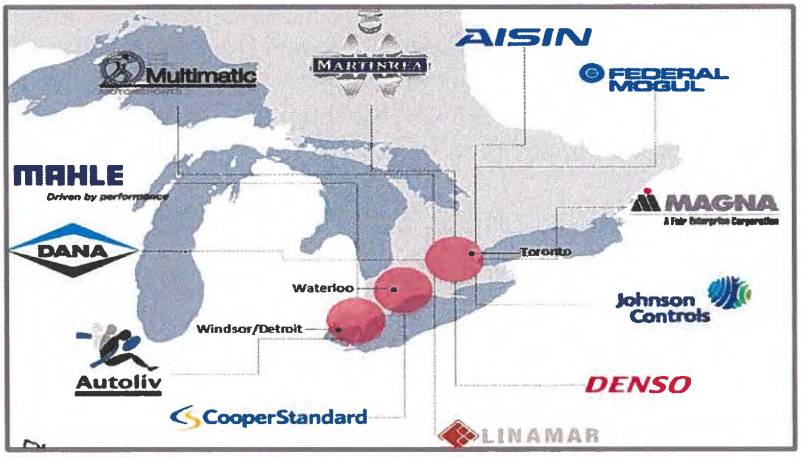
There are many different players in the automotive industry – automotive assemblers; automotive parts suppliers; machine, tool, die and mold makers; raw material suppliers; and dealers and distributors. In understanding the supply chain many describe suppliers as being part of a "tiered" system. Tier 1 suppliers, typically multinational enterprises (MNEs), directly supply finished components and provide system integration services to automotive assemblers and original equipment manufacturers (OEMs). Tier 1 suppliers often have strong engineering and design capabilities and possess manufacturing and research facilities globally. Tier 2 and Tier 3 suppliers mostly supply subcomponents to Tier 1. Compared to Tier 3 suppliers, Tier 2 suppliers typically have stronger engineering capabilities[3]. Raw materials and machine makers feed into the supply chain at any point of the manufacturing process. The typical automotive supply chain is illustrated in Figure 3.

[2] Statistics Canada.
[3] Deloitte, *Canadian Automotive Parts Supplier Industry Profile,* 2010.

Figure 3: Automotive Supply Chain

Canada is home to a number of multinational Tier 1 suppliers. A few of them are Canadian-grown, including Magna, Martinrea, Linamar, ABC and Woodbridge. They provide products directly to OEMs (such as Ford, Fiat Chrysler Automobiles, General Motors, Honda, Toyota and Hino), both in Canada and internationally. Figure 4 shows some of the global suppliers operating in Canada.

Figure 4: Map of Multinational Tier 1 Suppliers in Ontario



Source: Government of Ontario.

The majority of the Canadian supply sector, however, is composed of Canadian-owned Tier 2 and 3 suppliers that are mostly small and medium-sized enterprises (SMEs). Most are found in Ontario (59 percent), followed by Quebec (21 percent) and British Columbia (10 percent)[4]. Over 81 percent employ fewer than 100 employees[5].

[4] Statistics Canada.
[5] Statistics Canada.

Location is important for supplier firms in this sector. For example, half of Ford's Oakville assembly plant suppliers and those of General Motors' Oshawa Complex are located within a 100 km radius of the plant. Japanese assemblers (e.g. Toyota, Honda) often bring their own suppliers when they establish a new plant in a foreign market. This co-location with OEMs can result in benefits such as reductions in logistical costs and risks, fostering efficient collaboration in engineering and design, and improving responsiveness in meeting customer preferences. OEMs place particular importance on the close proximity of firms supplying products that are expensive to transport over long distances and that take considerable space in trucking containers to manage costs and efficiencies in the production line. They push suppliers to locate nearby to enable reductions in their operation costs by holding fewer inventories at the plant, and to make just-in-time logistics more feasible.

The value proposition of Canadian automotive suppliers

Many of Canada's automotive suppliers have a reputation for producing high quality products across the full spectrum of the automotive supply chain. The range of competencies and products offered by our parts supply sector is extensive (Figure 5). The large base of machine, tool and die suppliers in Ontario offers a competitive advantage over other automotive jurisdictions such as Mexico or the US, both of which lack a sufficient base of such companies.

Figure 5: Canadian Automotive Competencies

The 2012 Survey of Innovation and Business Strategy (SIBS) shows that when asked about innovation, 52% of automotive suppliers indicated they have introduced new process innovation (compared to 42% of the total manufacturing respondents) and 46% indicated the same for product innovation (compared to 41% of total manufacturing respondents).

Transformative change in the automotive industry and the challenge for Canadian suppliers

The automotive industry is entering a period of transformative change. Unprecedented levels of innovation influenced by regulations and consumer expectations, as well as increased competition within NAFTA for OEM investments are heavily affecting the industry, including suppliers.

Responding to regulation

Government emission and safety regulations coupled with rising environmental customer preferences is increasing production complexity and inducing a significant amount of innovation by OEMs and their suppliers. The US Environmental Protection Agency estimates, for example, that these companies will spend $200 billion to nearly double the fuel efficiency of passenger

vehicles alone by 2025[6]. Alternative and lighter materials such as plastics and aluminum have become more prevalent and OEMs are continuously looking at new ways to reduce weight and emissions. Automotive analysts expect that components that improve fuel economy, mainly in powertrain, will generate significant growth through 2020.

Canada has companies capable of developing disruptive technologies to traditional engine and powertrain components. For example, British Columbia's expertise in fuel cells is supported by a cluster of companies and research facilities that includes Ballard Power Systems, the Automotive Fuel Cell Corporation, and Mercedes-Benz Fuel Cell. In Quebec, where there are rich sources of hydroelectric power, there are a number of companies focusing on vehicle and transport electrification which aim to replace traditional fuel powertrains. Quebec also has a large base of suppliers specializing in alternative materials for lightweighting, particularly in aluminum forming and welding and plastic injection molding. Those suppliers that leverage their expertise in alternative fuels, advanced materials, lightweighting and alternative powertrains will be more competitive and relevant.

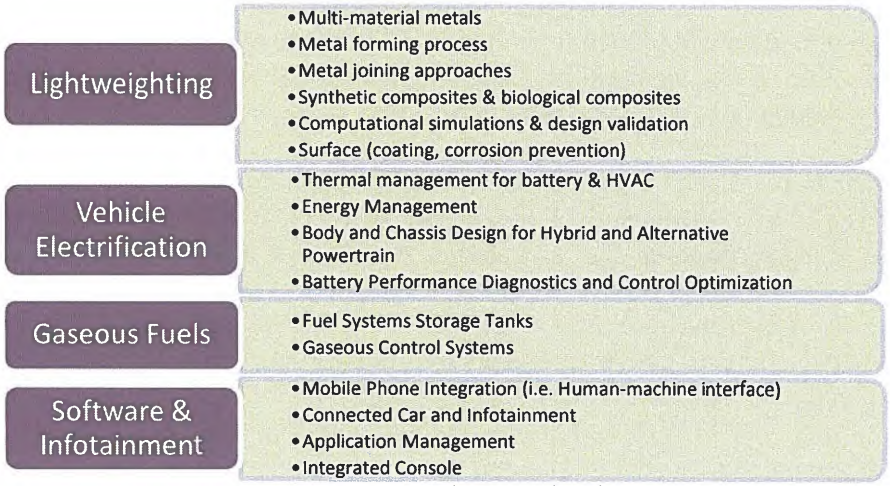
Responding to consumer demand

New consumer offerings and expectations for infotainment, connectivity, and autonomous driving features to enhance driving experiences and safety are also leading to more complex vehicle design and attracting non-traditional automotive companies into the sector. Information technology solutions are increasingly becoming a key component of the vehicle. Vehicles are being equipped with infotainment features, traffic information services, assisted driving technologies, and active safety applications (such as cars that can avoid collisions, or automatically speed up or slow down during traffic congestion and parallel-park automatically).

Canada has a wide range of assemblers and suppliers operating in these emerging technology areas of automotive products with specific strengths. Many new applications for the automotive industry come from companies operating in other industries that are bringing innovative ideas to next generation vehicle models. Companies servicing the information communication technologies sector, for example, are not only enhancing the infotainment offerings within a vehicle, they are also contributing to a new wave of connected and autonomous vehicles. In particular, companies in Canada's Kitchener-Waterloo information technology cluster, such as Blackberry and QNX (in Ottawa) are providing Internet of Things software solutions for the connected car as it relates to data intelligence, remote diagnostics, software updates, asset tracking and custom user applications. Figure 6 is a shortlist of strengths of Canadian automotive companies.

[6] Source: Detroit News, *Automakers Pleased With Proposed EPA Sulfur Regulation,* 2013. http://automotivedigest.com/2013/04/automakers-pleased-with-proposed-epa-sulfur-regulation/

Figure 6: Shortlist of Opportunities for Canada

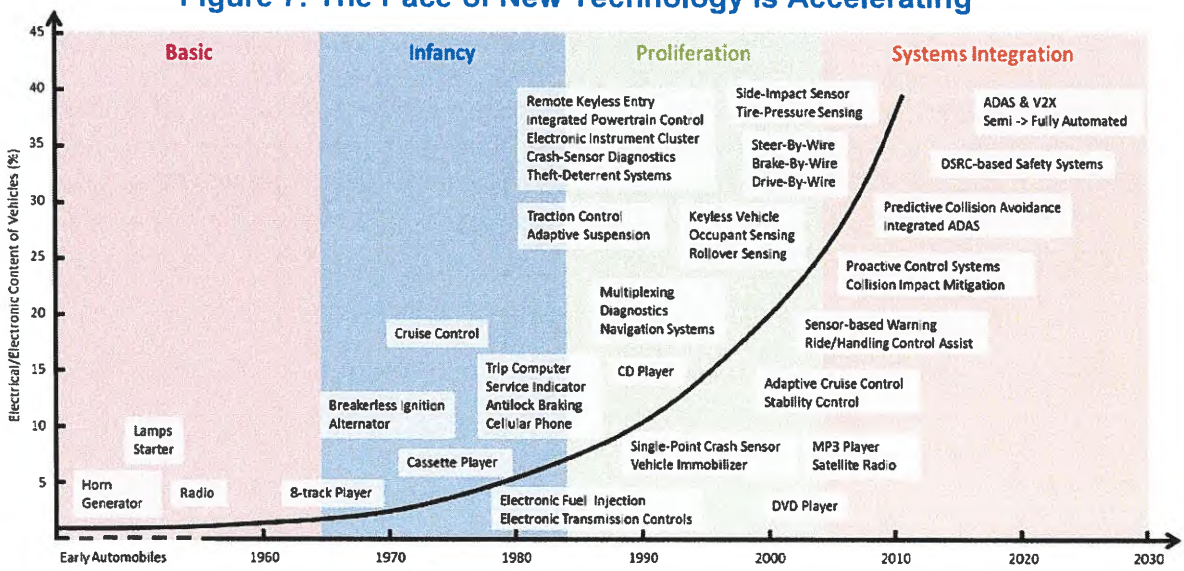


Source: Boston Consulting Group (2013) special study for Industry Canada.

Platforms

In addition to the transformative technologies changing the content of a vehicle, the manufacturing platforms that assemblers use in producing their products are also changing. In the past, assemblers would use a single platform to build a single vehicle model, but with new manufacturing technologies, a variety of vehicle models are now being built on common platforms. With fewer vehicle engineering architectures and model variations, the demand for specific parts to fit one type of vehicle model is reduced. Assemblers are gradually consolidating their supply base to achieve economies of scale and enhance supply chain management as these common platforms, otherwise known as modular platforms, offer greater flexibility. Suppliers will have to be flexible in adapting to OEMs' technology platforms and new business models or risk losing market share in this globally competitive environment. Figure 7 illustrates the pace at which new technology content in vehicles has accelerated.

Figure 7: The Pace of New Technology is Accelerating



Source: Center of Automotive Research adapted from Hellestrand 2005 and Fedewa 2013.

Regional competition and pressure to co-locate

Finally, another change in the industry that is affecting Canadian suppliers is competition from the Southern US and Mexico for OEM investment to anchor its automotive eco-system. In the past decade, the majority of North American automotive assembly investments have been located in the Southern US and Mexico. Eight of ten recent investments made in North America were located in Mexico, due in part to pressure for companies to follow the competition. As OEMs move south, they in turn exert pressure on suppliers to establish a manufacturing base in close proximity to them in order to enhance flexibility, responsiveness and lower inventory and logistical costs. In fact, this pressure to co-locate is not limited to North America, as the ability to manufacture nearby the OEMs' global plants is increasingly becoming a necessity for suppliers to be considered for a project. Furthermore, OEMs ask suppliers to supply the same parts globally at consistent quality and price levels. As production continues to increase in other emerging markets, beyond Mexico, there will be a pull for suppliers to expand globally. Nevertheless, while Mexico and the Southern US have experienced impressive investment, the Great Lakes region, which includes Ontario as a key and the largest part, remains the heart of the industry in North America. Canadian automotive suppliers will be able to leverage being situated in this cluster of manufacturing, design and research and development.

Role of government support in the automotive sector

The future of the supply sector in Canada, to a large extent, hinges on its capacity to adapt quickly to a highly competitive and ever-changing environment through product and process innovations, as well as to changes in traditional business models by automotive assemblers. The ability to innovate and commercialize is particularly important in the automotive sector due to increased competition among suppliers for OEM business. Suppliers who are able to transform new ideas into innovative commercially-ready products will have a better opportunity to succeed. Such transformations are key to their growth. In a study completed by the Center of Automotive Research (CAR) in which they surveyed suppliers, it notes that OEMs are increasingly spinning off their in-house parts operations. Due in part to this and their interest to share in the risk of innovation, OEMs are turning to parts suppliers for innovative and improved products and processes.

However, many Canadian Tier 2 and 3 traditional small automotive suppliers face the most difficulty in adapting. They often lack the financing needed to support innovative activities (such as R&D, prototype development, technology demonstration projects) and capital requirements to meet growing demands as compared to larger Canadian multi-national counterparts and multi-national foreign suppliers with operations in Canada. This increases their risk of losing market share and competitive advantages to their international competitors. Recently, Innovation, Science and Economic Development Canada (ISED) introduced the Automotive Supplier Innovation Program that provides non-repayable contributions in support of technology demonstration and prototyping activities of Canadian-based suppliers. This program complements financing support offered by Export Development Canada and the Business Development Bank of Canada to suppliers and the Automotive Innovation Fund (AIF) designed to support large-scale, strategic investments in the automotive industry. While the AIF is suited

for larger suppliers and automotive OEMs, it has also contributed to projects in Canada which have increased business opportunities for Canadian suppliers.

Many other federal departments and agencies play a role in supporting the industry. These organizations include the National Research Council Canada, the Natural Sciences and Engineering Research Council, Global Affairs Canada, the Trade Commissioner Service, the Federal Economic Development Agency for Southern Ontario, Transport Canada, Environment and Climate Change Canada and Natural Resources Canada.

Conclusion

The automotive supply sector is a key component of the manufacturing sector in Canada. It supports the domestic and international automotive industry with its technologies and competencies, such as connected and autonomous vehicle technologies. The industry is entering a period of transformative changes and we need to ensure that Canadian firms – large and SMEs – are well equipped to face these changes through continuous innovation that results in high value-added new technologies and new processes relevant for the industry. ISED and other federal departments as well as provincial governments can and are already supporting these firms by providing financial support for technology demonstration and prototypes or to help export Canadian products. ISED – through the Industry Sector – will continue to monitor the Canadian automotive supply industry and ensure that it stays competitive.

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Competition in the Canadian Telecom Sector*

Highlights

- Measuring competition in the telecommunications (telecom) sector is difficult as traditional measures do not account for the fact that the significant investment requirement upfront means that only a small number of firms can enter the sector.
- *Tobin's Q*, a measure of competition based on market shares, could provide valuable insights into competition in the Canadian telecom sector.
- Using Tobin's Q, our estimates suggest the Canadian telecom sector may not be subject to competition as intense as that found in the US telecom sector.

Introduction

Competition in the Canadian telecommunications (telecom) sector has been an important public policy issue since the Telecom Policy Review Panel in 2006. This report raised concerns over Canadian telecommunications suffering from a lack of competition, with evidence of Canada performing poorly both internationally and relative to the US in terms of mobile penetration, network rollout and prices. In response, several policies were implemented to encourage entry and competition in the sector, particularly in the wireless segment. Examples include: set-asides in the 2008 AWS Auction; tower sharing and roaming regulations; and, the elimination of foreign investment restrictions for providers with less than 10% of the national market share.

As a result of these policy interventions, new entrants have entered the wireless market and prices have gone down. However, it remains unclear what impact these developments are having on competition in the Canadian telecom sector. The incumbents' profitability remains high, while the smaller players are seemingly struggling to challenge the incumbents' competitive position.

This article examines the state of competition in the Canadian telecom sector since 2005 by using a complementary measure called Tobin's Q, which is based on expectations of the firms' long-run profits (see Box 1).

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* This is a summary of a forthcoming ISED research paper by Hankook Kim and Ryan Kelly (2016).

Difficulties measuring competition in the telecom sector

Measuring competition in the telecom sector is difficult. The significant investment required upfront – the main feature of the sector – means that only a small number of firms can successfully enter the sector. As such, they will all enjoy high levels of profitability in the short run. However, the large upfront investments mean the long-run profitability is expected to be close to zero (no economic profits above normal profits). These aspects of the telecom sector render traditional measures of competition inapplicable, e.g., measures based on market shares, short-run profitability, and the number of firms.

The difficulties of measuring competition are particularly problematic in today's environment of fast-paced technological development. Firms' investment costs are constantly increasing as a result of changing telecom technologies requiring service providers to make ongoing investments to meet user demand. This complicates the measurement of the value, timing, life-cycle, cost of capital, and risk of these investments, making it difficult to determine if a firm is earning supra-competitive profits from simple short term accounting profit measures.

Box 1: Measuring Competition using Tobin's Q

Tobin's Q is an alternative measure of competition calculated as the ratio between the market value of a firm and the replacement value of its assets:

$$Tobin's\ Q = \frac{MV}{BVTA}$$

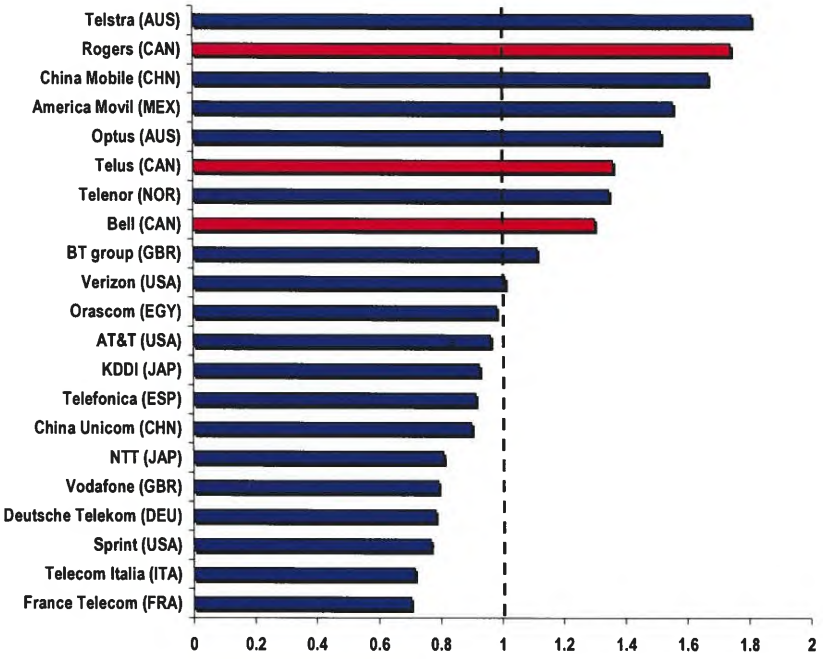
Where *MV* is the market value defined as the sum of market value of equity (including common and preferred shares) and market value of debt, and *BVTA* is the book value of total assets.

If, for example, *Tobin's Q* > 1 (that is, if the market valuation of the firm exceeds the replacement value of its assets), the market could be expecting the firm to accrue economic profits in the long-run. The greater the *Q-value* exceeds 1, the higher the expected long-run economic profit.

This approach indirectly incorporates several complicating factors that can bias profitability comparisons through investor expectations. By focusing on market value instead of short-run profitability, it is possible to provide a long-run perspective on firm profitability that allows for direct comparisons with other firms.

Given that this measure uses market values, individual segments of a firm (e.g. wireless) are not assessable. Therefore, we focus on overall competition in the telecom sector.

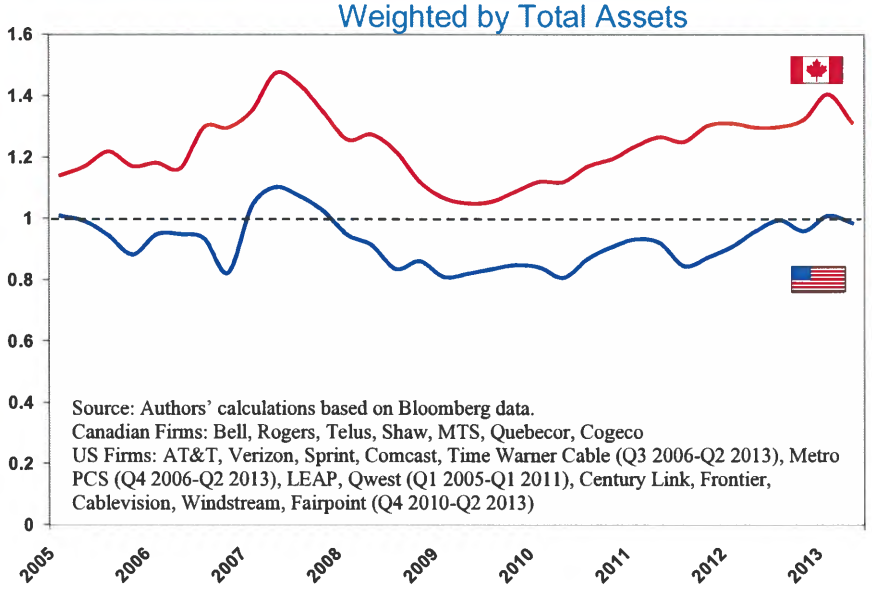
Figure 1: *Tobin's Q* – International Comparison, 2012



Source: Authors' calculations based on Bloomberg data.

What does Tobin's Q tell us about competition in the Canadian telecom sector?

Figure 2: Tobin's Q – Canada & US Telecommunications
Weighted by Total Assets



Canadian telecom firms have a high Tobin's Q compared to others

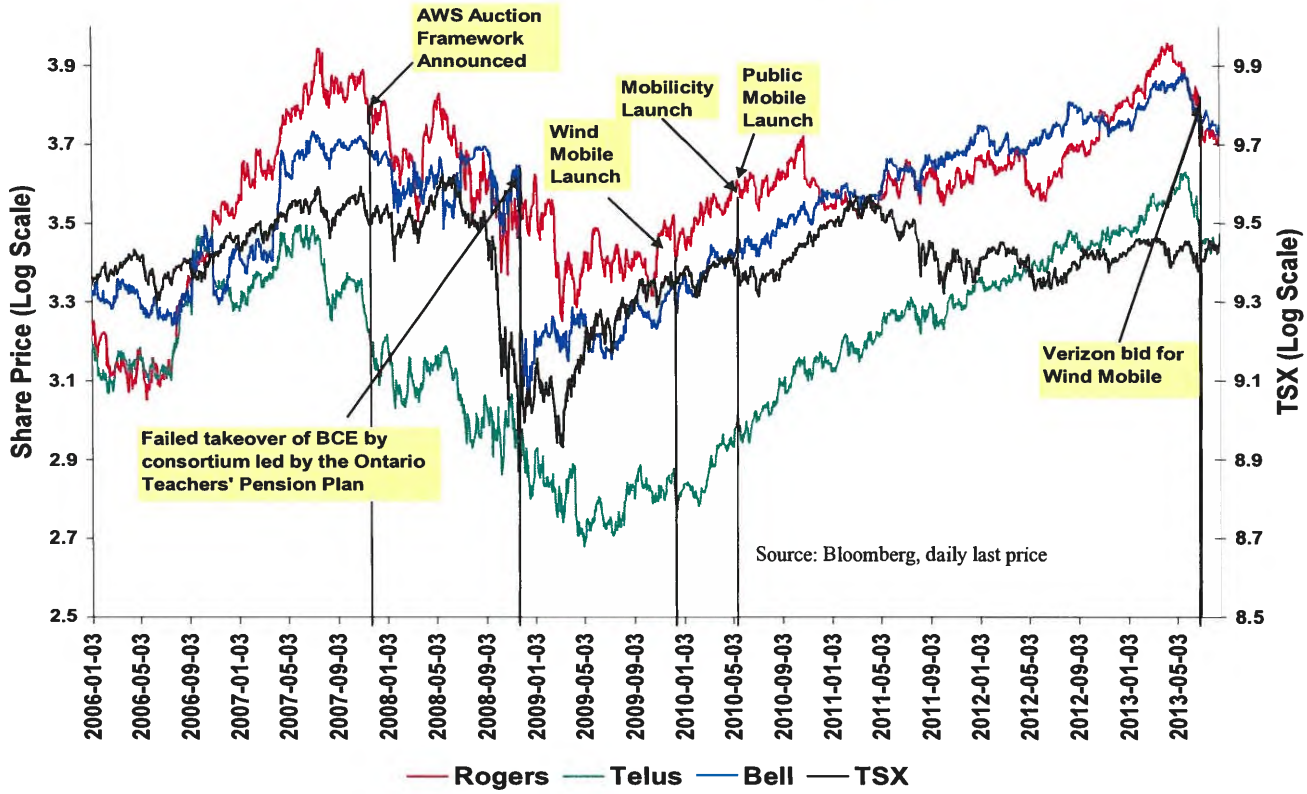
The *Tobin's Qs* for Canada's national incumbents and a sample of the largest publicly traded telecom firms around the world are shown in Figure 1. The results show the expected long-run profitability of Canadian firms to be higher than most other comparable telecom firms in other countries. Rogers has a high *Q-value* even relative to the other Canadian incumbents, which could be related to its cable TV assets – an industry often characterized as facing minimal competition within a region. While this result would suggest that Canadian firms face less competition when compared to most major telecom firms abroad, some caution is required when making these comparisons. The benchmarking spans several foreign jurisdictions with various market structures and, as a result, could be influenced by factors such as differences in primary product offerings, and differences in accounting practices.

Canada – US comparison: The Canadian telecom market could be less competitive relative to the US.

Unlike benchmarking *Tobin's Qs* across several foreign jurisdictions, which can be subject to several limitations, the comparison between Canadian and US telecom firms (both face similar technological and geographical environments) is believed to provide a clearer picture on how competition in the Canadian telecom sector fares. The Canada–US comparison also benefits from the fact that almost all major telecom service providers in both countries are publicly traded and similar in their product offerings. As shown in Figure 2, on average, the weighted *Tobin's Q* for Canadian telecom firms was 34% greater than the corresponding US figure during the 2005 Q1–2013 Q2 period. This result suggests the expected long-run profitability of Canadian telecom firms is higher than that of their US counterparts, meaning that Canadian telecom firms may face

a less competitive environment than their US counterparts. This difference between Canadian and US Tobin's Q is consistent throughout the whole sample period, which includes the entry of new players in the wireless segment after 2008, such as Wind Mobile, Quebecor, Mobilicity, and Public Mobile (see Figure 3).

Figure 3: Stock Prices of Canadian Incumbent Telecom Firms



Stock price movements suggest competition from the new entrants did not meet initial expectations, but the entry of a financially secure service provider could boost competition.

Figure 3 examines the Canadian incumbents' stock prices along with indications of significant events. The incumbents' stock prices have declined over a short period of time following the announcement of the 2008 auction framework, up until Wind Mobile's launch in December 2009. The decline has not been sustained. Stock prices have recovered close to their 2007 highs despite the general stock market still being below its 2007 level. This suggests that the expectations of heightened competition from the new wireless entrants have been lowered as they have yet to capture a significant market share from the incumbents.

Following a news report on a possible bid for Wind Mobile by the US firm Verizon, the incumbents' stock prices fell between 4-9%. This has provided a case study to assess the potential effects of a financially secure new player on competition in the wireless segment. While this decline suggests the market views a financially stronger new entrant to be a credible threat to the incumbents' profits, the relatively small drop in the incumbents' valuations raises

questions regarding whether such an entry could increase competition in the Canadian telecom industry to US levels. Based on our computations, Bell and Telus' stock prices would need to depreciate by approximately 30% and Rogers' by 50% to bring their respective *Q-values* to one, thereby roughly equating market expectations for economic profits in Canada with US levels. That being said, the full extent of market reaction to an entry by a financially secure new player in the wireless segment will be known only when or if the entrant officially announces its entry into the Canadian market.

Conclusion

Our preliminary results suggest that investors generally expect Canadian telecom firms to realize higher long-run economic profitability than US telecom firms. Further, an entry by a financially secure provider could increase competition in the Canadian telecom sector, but it remains unclear whether competition from such an entrant would bring the expectations on profitability in the Canadian telecom sector down to the US level.

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Insights Data Table

Monthly Economic Indicators

	Reference period	Month-over-month growth (at monthly rates) Latest month	Prev. month	2 Months before	Q-o-q growth 2015Q2	Year-over-year growth 2014	2013
Mfg sales (current $)	Aug '15	-0.2	1.7	1.7	0.5	5.2	0.3
Mfg sales (constant $)	Aug '15	-0.1	1.0	0.9	0.3	2.7	-0.9
Retail trade (current $)	Aug '15	0.5	0.6	0.4	0.7	4.6	3.2
Retail trade (chained $)	Aug '15	0.7	0.3	-0.1	0.4	3.5	2.9
Real GDP	Jul '15	0.3	0.4	-0.2	-0.2	2.5	2.1
-Services	Jul '15	0.2	0.3	0.0	0.5	2.4	2.0
-Manufacturing	Jul '15	0.6	0.6	-1.0	-0.5	2.9	-0.3
Exports (bop) (current $)	Aug '15	-3.6	2.4	5.8	-0.7	10.4	3.5
Imports (bop) (current $)	Aug '15	0.2	2.4	0.2	0.1	7.7	2.6
All-items CPI	Sep '15	-0.2	0.0	0.2	1.0	1.9	1.0
Core CPI	Sep '15	0.1	0.2	0.2	0.8	1.8	1.2
LFS employment (Δ in 000s)	Sep '15	12.1	12.0	6.6	32.8	121.3	125.7
Unemployment rate (%)	Sep '15	7.1	7.0	6.8	6.8	6.9	7.1
US employment (Δ in 000s) (CPS)	Sep '15	-236.0	196.0	101.0	408.0	2,771.0	1,391.0
US unemployment rate (%)	Sep '15	5.1	5.1	5.3	5.4	6.2	7.4

Financial Indicators

	Reference period	Current value	Monthly average Latest full month	Prev. month	2 Months before	Annual average 2014	2013
Bank rate (%)	Oct 22 '15	0.75	0.75	0.75	1.00	1.25	1.25
Exchange rate	Oct 22 '15	130.9	132.7	131.5	128.7	110.5	103.0

Quarterly Economic Indicators

	Reference period	Quarter-over-quarter growth (at annual rates) Latest quarter	Prev. quarter	2 Quarters before	Year-over-year growth 2014	2013
Real GDP	2015Q2	-0.5	-0.8	2.2	2.4	2.0
Final consumption expenditure	2015Q2	2.0	0.3	1.8	2.0	1.9
Gross fixed capital formation	2015Q2	-6.1	-8.3	1.0	0.2	0.4
-Machinery & equipment	2015Q2	-17.1	-6.2	-2.5	1.0	-1.7
Exports	2015Q2	0.4	-1.4	-1.7	5.4	2.0
Imports	2015Q2	-1.5	-1.4	1.6	1.8	1.3
Final domestic demand	2015Q2	0.0	-1.8	1.6	1.6	1.5
Labour productivity	2015Q2	-2.3	-2.0	1.4	2.7	1.1
Unit labour cost	2015Q2	1.7	5.3	-0.3	1.0	1.3
Industrial capacity utilization (%)	2015Q2	81.3	82.6	83.5	82.8	81.2
Real US GDP	2015Q2	3.9	0.6	2.1	2.4	1.5

Abbreviation Guide	
GDP	*Gross Domestic Product*
BOP	*Balance of Payments*
CPI	*Consumer Price Index*
LFS	*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 Organization*
Sources for the Insights Databoard	
Statistics Canada	www.statcan.gc.ca
Bank of Canada	www.bankofcanada.ca
US Bureau of Economic Analysis	www.bea.gov
US Bureau of Labor Statistics	www.bls.gov

Insights Hot Chart

Country	Population (millions)	GDP per Capita (US$)	2015 Competitiveness Rank (n=140)	2014 Competitiveness Rank (n=144)	2013 Competitiveness Rank (n=148)	Change from 2014	
Switzerland	8.1	87,475	1	1	1	→	0
Singapore	5.5	56,319	2	2	2	→	0
United States	319	54,597	3	3	5	→	0
Germany	81.1	47,590	4	5	4	↑	1
Netherlands	16.9	51,373	5	8	8	↑	3
Japan	127.1	36,332	6	6	9	→	0
Hong Kong SAR	7.3	39,871	7	7	7	→	0
Finland	5.5	49,497	8	4	3	↓	–4
Sweden	9.7	58,491	9	10	6	↑	1
United Kingdom	64.5	45,653	10	9	10	↓	–1
Norway	5.2	97,013	11	11	11	→	0
Denmark	5.6	60,564	12	13	15	↑	1
Canada	35.5	50,398	13	15	14	↑	2
Qatar	2.2	93,965	14	16	13	↑	2
Taiwan, China	23.4	22,598	15	14	12	↓	–1