

**Network to Study Productivity in Canada from a
Firm-Level Perspective**

**Digital Economy and Technology Adoption:
A Research Commentary**

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The digital economy and technological innovations have been the transformational force for most nations over the last decade. Countries that lead in productivity and economic growth, e.g., the U.S., benefit tremendously from their firms' successful exploitation of different elements of the digital economy in tandem with policy support. For example, until recently, Internet retailers in the U.S. were not required to collect taxes from a consumer unless the retailer had a nexus in the consumer's state. This has arguably facilitated the growth of ecommerce and made it an important part of the overall economy. Today, businesses and individuals are interacting in new and complex ways in the digital economy, with rapid technological advances contributing to exponential growth in data, generating compelling research questions. The ability to analyze and understand different facets of the current economy – to generate insights about these new and intriguing phenomena and to effectively leverage these developments to maximize economic growth – pose important challenges for modern organizations and policy makers. As expected, existing research has been instrumental in understanding and addressing some of these challenges associated with the digital economy. New research is continually making meaningful contributions to firms' strategies and informing economic policy; albeit, there is room to do much more. With the ever changing nature of technology, these opportunities will never cease. At the risk of oversimplifying a growing and diverse literature, this commentary provides a brief glimpse of the existing works and highlights some interesting outstanding issues that warrant attention from the research community and that can now be studied with data made available from Statistics Canada.

It is well recognized that Canada has been lagging in the digital economy and in productivity compared to other developed nations, especially the U.S. Unfortunately, a similarly dismal picture exists in terms of research utilizing data from Canadian sources. As a result, an understanding of issues related to the Canadian digital economy is significantly lacking. While the lack of data has been the primary barrier for research studies, the reality is that Canadians have been profoundly impacted by the digital revolution. Canada's proximity to the U.S., the increasing presence of U.S. companies in the Canadian market, a resurgence of advanced technology based manufacturing in the U.S., and rapid technological advancements in other competing nations are just some examples of how the insulation of Canadian businesses is dissipating. Canadian firms cannot hide from the digital economy in the long run, rather they need to embrace it. So, research informed by Canadian data will not only provide a much needed and better understanding of the digital economy, but will also likely make significant contributions to theoretical knowledge building.

In the following sections, I discuss some of the important aspects of the digital economy and how the unprecedented access to administrative and survey data from Statistics Canada opens tremendous opportunities to answer many research questions, such as the relationships between competition and firm productivity, efficiency, innovation, and technological growth.

Digital Economy and Competitive Advantage

A fundamental contribution of the digital economy is that it has mitigated traditional geographic barriers – the reach of a firm now is much more extended (similarly, a consumer has much more options). While the Internet has certainly shifted some local traditional demand online, it has also created new demand. In particular, the Internet has increased the demand for niche products

– many of which consumers were previously unaware (Brynjolfsson et al. 2003; Brynjolfsson et al. 2009). In this regard, technological innovations, e.g., recommendation systems and advanced search, are making it much easier for consumers to find items from anywhere in the world (De et al. 2010). Similarly, businesses can now source products/materials from diverse geographic locations and complement local capabilities more cost effectively. Effectively, the Internet has opened up many new opportunities not only for Internet markets but also for traditional markets.

Naturally, with the proliferation of the Internet, different dimensions of within-channel competition and cross-channel competition have become a focus of businesses and policy makers. While the Internet generally increased price competition, price dispersion still exists and traditional factors such as trust and brand name still matter (Chevalier and Goolsbee 2003). Generally, the competition between traditional retailers and Internet retailers exists for popular products, whereas niche products sold by Internet retailers are immune from such cross-channel competition (Brynjolfsson et al. 2009). In consumer product markets, dual-channel retailers can command an advantage over pure Internet retailers due to their ability to engender trust and provide services through local stores for online purchases. Interestingly, a market structure with dual-channel retailers and a pure Internet retailer does not always improve consumer and social welfare (Nault and Rahman 2013).

Thus, gaining, understanding, and leveraging competitive advantage in digital retailing, and generally in the digital economy, is not straightforward. Obviously, the low entry costs make it easier for new entrants; however, with increased social media usage and online word-of-mouth, it is critical for firms to strive to provide world-class services. The room for inefficiency and imperfection is shrinking rapidly. Businesses, especially Canadian firms which have not been subject to intense pressure from Internet markets due to lagged growth of ecommerce in Canada,

would not be able to hide from ecommerce in the long run; rather they need to embrace the digital economy and leverage it.

The key elements of the digital economy – e.g., rapid information flow, ubiquity, technological revolutions – are likely to facilitate competitive edge for technology savvy firms and may support more “winner takes all” type scenarios. The firm level data available at Statistics Canada actually offers an opportunity to shed more light on the effect of the digital economy on competitive advantage. In particular, we can use firm level survey and administrative data (e.g., Capital and Investment Program [CIP], Corporate Tax Statistical Universe File [T2SUF]) to measure market share growth of different firms and their relation to technological investments and/or utilizations. Are the firms that embrace the digital economy generating higher profits, revenue, growth, etc.? Is there an abnormal rate of return for such firms? If so, can this be attributed to the utilization of the digital economy? Also, using the time series data, we may gain insight on the demise of inefficient firms. What is the role of the digital economy in expediting or slowing the demise of such firms?

Digital Economy and Value Creation

In the past two decades, many studies have documented the returns of IT investments and usage on firms’ process improvement, reducing costs, increasing revenue and productivity, etc. (e.g., Brynjolfsson and Hitt 1996). In terms of ecommerce technologies such as recommendation systems, search, zoom, and alternative photos, recent studies have shown beneficial effects of such technologies along with when they may lead to unintended consequences (De et al. 2010; De et al. 2013). In other words, the importance of IT is now well-established along with the fact that unless IT is carefully and strategically used, it may not lead to desired outcomes.

Given the integrated nature of firms in the current economy, naturally there has also been focus on better understanding the IT spillover effects (e.g., Bloom et al. 2013; Cheng and Nault 2007). In general, these studies, many of which use industry level data from the U.S., emphasize the importance of value co-creation. Even at the industry level, there is clear evidence of IT spillover effects: IT's benefit travel with intermediate inputs. A firm level study provides evidence that technology spillovers lead to great social returns and large firms generate more of such returns (Bloom et al. 2013). Clearly, there is much to learn about value co-creation and spillover from nuanced data at the firm level.

The time-series data available from Statistics Canada (e.g., T2-LEAP-Export and Import Registry Database) enables researchers to explore how technology spillovers evolve over time and how they affect change in social returns. Are there certain firms that are better at value co-creation? If so, what are the key characteristics of these firms and what is the nature of their relationship with supply-chain partners? This gives us an opportunity to combine knowledge about individual firms with knowledge about spillover effects. By analyzing the transactions across businesses entities, we can now identify factors that lead to better spillover utilizations.

The digital economy does not affect all industries in a homogeneous manner; so, spillover effects and technology utilization are likely to vary across industries. Moreover, industry level studies point to the moderating effect of IT intensity and competitiveness on spillover effects (Han et al. 2011). Consequently, it is also important to compare and contrast value co-creation processes and effectiveness across industries, based on the firm's target market (for example, export orientation vs. domestic market orientation or produce finished products vs. intermediate inputs).

Digital Economy, B2B Relationships, and Structures

Although less visible than business-to-consumer (B2C) ecommerce developments, business-to-business (B2B) transactions account for a significant part of ecommerce. Compared to the number of empirical studies focusing on B2C relationships, the understanding of the impact of the digital economy on B2B relationships is still relatively nascent. This is partly because of the scarcity of data on such relationships.

The reality is that the digital economy has had a profound impact on B2B transactions, including how relationships between businesses are formed and nurtured. Now, we have a much better integrated supply-chain, which enjoys great information flow between stakeholders. Such information flow, on the one hand, lowers the coordination costs and information asymmetry within a firm, thus better facilitating vertical integration. On the other hand, improved information flow also favors markets by greatly lowering transaction costs. Due to lower transaction costs, firms may now easily transact with other business entities. Until now, it has been quite difficult to provide empirical insights regarding this market vs. hierarchy argument raised by Malone et al. (1987).

The firm level data available from Statistics Canada allows researchers to analyze business transactions over time and provide a better understanding of the evolution of the market vs. hierarchy in the digital economy. Does the use of hierarchy or market differ across firms depending on the industry, target markets, etc.?

It is also important to understand how the digital economy has affected relationships among supply-chain partners. One possibility is that better information flow, empowered by improved process integration and physical flows (Rai and Seth 2006) leads to higher transaction volume

with fewer partners, i.e., relationships become deeper. Another possibility is that better information flow, coupled with lower transaction costs, leads to partnerships with many entities, i.e., it broadens access to relationships. While deeper relationships with fewer partners would result in a higher concentration, broad-relationships with more partners would result in a lower concentration. Obviously, it would be interesting to explore the structure of supply-chains to understand the role and effect of different levels of concentrations within supply-chains. Again, this is now possible using the data available from Statistics Canada. It may also be possible to measure the contribution of different forms of supply-chains to productivity and growth.

Digital Economy and Innovation

Innovation is one of the key elements of any economy, but it is even more important in the digital economy. In the current economy, the payoff from innovations can be quite significant and rapid because of vanishing geographic barriers and increasing reach. Moreover, in some ways, innovation is relatively more critical to firm survival now because of wide exposure to competition. In other words, low entry barriers and the ability to reach consumers anywhere in the world act as incentives to innovate and reap great rents as well as increase the importance of innovation as a competitive strategy. In contrast, the threat of being imitated is also much higher in the digital economy, which may act as a disincentive for innovation.

While innovation, entry, and firm performance has been of interest to the academic community for a long period of time, empirical studies that provide insights about different aspects of these issues is lacking. Previous studies have demonstrated the relationship between technical progresses in an industry and entry and exit (Samaniego 2010), showed U-shaped relationship between competition and innovation in an analytical framework (Tishler and Milstein 2009), and

provided evidence that market leaders are more likely to adopt e-business technology (McElheran 2012). The data available from Statistics Canada enables researchers to add to the body of nascent empirical literature on innovation, entry, and exits.

In particular, using Statistics Canada time series administrative and survey data on Research & Development (R&D) expenditures, transactions, and entries (e.g., T2SUF, Survey of Innovation and Business Strategies [SIBS]), we can empirically measure the role of competition in affecting the efficiency and growth of existing players. This impact of competition on existing firms might be different based on technological intensity of the industry or based on target markets. In addition, the impact of competition may vary across different types of innovations (e.g., product innovations, process innovations, and technology innovations).

An important aspect of strategic utilization of innovations is their complementarity with existing processes and assets. The heterogeneity of firms – in terms of capability, management practices, and existing technologies– determines how much value a firm can derive from innovations. Therefore, it would be interesting to identify the key factors that determine how firms derive benefits from innovations. It might also be possible to measure interaction and spillover between different types of innovations. Innovations are also strategically used to deter entries. Using the data from Statistics Canada, we can also measure the role and evolution of innovations in determining market concentrations overtime.

Digital Economy and SMEs

Small and Medium Enterprises (SMEs) are an important part of the overall economy. So, it is critical to have SMEs onboard with the development of the digital economy so that they don't lag behind. A big challenge in encouraging SMEs to adopt and utilize the digital economy is that

most are skeptical of the necessity and benefits of the digital economy and are often missing capabilities that would allow them to leverage it. Also, SMEs are missing insights about the best ways to exploit different aspects of the digital economy.

In this regard, it would be a good start to explore the Statistics Canada data (e.g., Survey of Electronic Commerce and Technology [SECT], SME Data Warehouse) and provide insights about when and how SMEs are utilizing the digital economy. Moreover, this data opens ways to measure values reaped by SMEs from technology investments. Another related aspect is being able to empirically study the evolution of industry structure (large firms vs. SMEs, their market shares, etc.). Technological changes and/or technology intensity may moderate these structures. Finally, it would be important to relate the evolution of industry structures with overall economic productivity, growth, GDP, and so on.

Concluding Remarks

A key challenge of providing empirical answers to important research and policy questions is the limited availability of rich and relevant data. Consequently, the administrative and survey data available from Statistics Canada should greatly alleviate this constraint and lead to studies concerning different facets of the digital economy. In the age of “big data” initiatives, where organizations are greatly leveraging and competing on insights generated from available data, this data initiative from Statistics Canada is quite timely in creating compelling research opportunities for the academic community. The ideas outlined in this commentary should just serve as a beginning: as more researchers start to explore the available data and combine it with other data sources, opportunities to advance knowledge on the interplay between the digital economy, technological innovations, and economic developments will only grow.

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