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E-COMMERCE MEASUREMENTS AND ANALYSIS

Keynote paper

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I. INTRODUCTION

1. In a very short time span, e-commerce has emerged to claim a major share of the business and economic headlines. It has the potential to radically alter existing economic and social structures and arrangements. Not surprisingly, it has become a major preoccupation of policy makers and business over the last few years.

2. E-commerce means many different things to many people. Since its inception, defining e-commerce has been the source of much debate. To some, e-commerce is just commerce using computers while to others it is the more encompassing definition of business activities carried out over computer-mediated channels. In many cases, e-commerce definitions and measurements were created for marketing purposes rather than for rigorous analysis and policymaking or other practical measuring purposes.

3. E-commerce represents more than a technology – it is a pervasive phenomenon built around the applications of ICTs and it has the potential to affect every aspect of the value

chain for products and services. Issues related to e-commerce pose numerous challenges to businesses and policy makers as the formulation of responses requires new frameworks.

4. The definitional debate as well as the pervasiveness and breadth of e-commerce, certainly called for greater preciseness in definitions. Fortunately, the international statistical community responded, as is noted under “International Context” and “E-commerce Basics”, below.

II. THE CANADIAN CONTEXT

5. Through a combination of good luck and good planning, Canada’s forays into electronic commerce measurement started relatively early and, from the outset, they reflected the collaborative inputs of both statistical and policy interests.

6. In 1998, the Government of Canada established a program of Connecting Canadians. This broad program comprised policies and activities to facilitate universal access of businesses, households, communities and public sector bodies to the Internet to support on-line delivery of goods and services whether through public or private sectors.

7. The Canadian government’s electronic commerce strategy involved the creation of certain “framework conditions” that would provide an environment conducive to performing commercial transactions over the Internet. Among these “framework conditions” was the creation of technology neutral taxation, the development of policies on cryptography and public key infrastructure, the development of guidelines to protect consumers, and legislation to protect personal information.

8. While these initiatives were positive and beneficial, Statistics Canada and policymakers were mindful of the need for measures that would permit monitoring of progress made in connecting Canadians and assessment of impacts on businesses and individuals. They jointly proposed that the government establish a special “fund” (in the form of an annual budget allocation) for the development of a measurement program to shed light on issues of direct and current policy interest to federal departments. To ensure that priorities would be driven by policy needs, rather than simply interesting statistical questions. Thus, it was proposed, the data “gaps” would be identified by an interdepartmental group, but with a veto option on any project by the Chief Statistician of Canada.

9. The government approved the creation of this “fund” and one of the projects funded through this initiative was the development of an annual program of socio-economic indicators of connectedness, of which electronic commerce was a part. This resulted in a collaborative partnership between the policy department and the statistical office, a condition which has been a key to the success of the electronic commerce program, ensuring that the creation of new datasets would be used to support policy analysis. The Connecting Canadians program also set ambitious targets for achievements which further underscored the need for consistent measurements. The resulting data and analysis programs are described below.

10. At the same time that the Canadian government was focussing on connectivity and e-commerce measurement programs, there was an increasing preoccupation with the topic internationally and an important, lead role was played by the OECD. Canada has derived significant benefit from this internationally forum while also playing an active role through the participation of Canadian statisticians and policy makers in the process of building international consensus.

III. THE INTERNATIONAL CONTEXT

11. The 1998 OECD Ministerial Meeting on Electronic Commerce held in Ottawa, identified numerous gaps in comparable, official statistics. The OECD Working Party on Indicators for the Information Society (WPIIS) was mandated to develop working definitions of electronic commerce that were policy relevant and feasible, along with guidelines for their use. The WPIIS initially produced definitions of electronic commerce in 2000 and, subsequently, it revised them slightly and added guidelines for their application as well as model surveys on the use of ICTs and electronic commerce. The definitions, guidelines and several modules of a model survey have been released by the OECD. Work continues on other model survey components.

12. Since 1998, the work of the OECD has been very instrumental in advancing the understanding of e-commerce. Not only has the work on concepts and definitions and practical survey applications assisted the e-commerce measurement in both member and non-member countries but OECD analytical outputs have also contributed to the field.

13. In addition to the Canadian measures, e-commerce and household Internet use surveys are now carried out in a many OECD countries. International comparability has enriched the value of these enquiries.

14. Of particular importance, in the international context, is the need to measure impacts of e-commerce on developing countries. Many developing countries are eager to build and deploy ICT capacity in order to benefit from the perceived benefits for growth and development. There is evidence that establishing an infrastructure for e-commerce will assist businesses in improving competitiveness and will provide tools for both business and individuals to reduce poverty and improve socio-economic well being through economic growth. However, at present, little data exist for these countries on e-commerce activities of businesses or households. It would be misguided to assume that e-commerce activities and impacts will be identical in developing and developed countries. Hence it would be inappropriate to build e-commerce policies for developing countries that are modelled only on the experience of more-developed economies. It is highly desirable to implement e-commerce measurement programs in developing countries, which could in turn help direct policies in the most beneficial ways, as these activities are beginning rather than after they have been established.

IV. E-COMMERCE BASICS

15. Though frequently referenced in numerous other studies on e-commerce, there are nonetheless several important basic aspects of e-commerce measurement that are usefully repeated.

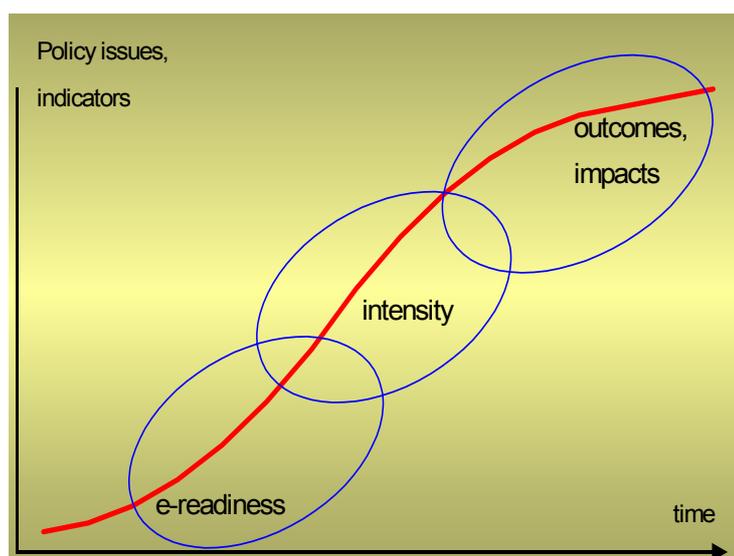
Measurement Framework

16. First, it is important that the e-commerce measurement of a country reflect the state of development of the activity in that country. In 1999, a Canadian government department (Industry Canada) devised a simple yet useful graph which relates a country's ICT readiness, intensity and impacts to evolving information requirements. This S-Curve (figure 1) applies equally to a specific ICT-related activity, such as e-commerce. The chart illustrates the different information needs that exist as ICT-related (or e-commerce-related) activities evolve. It has been adapted by many countries as a framework for the development of statistical work.

17. In the first stage, measures of e-readiness, relating to people, businesses and the ICT infrastructure, are of greatest interest and use. As e-commerce activity becomes established, measures of the extent or intensity of utilisation are desirable. In those countries where e-commerce is very well established, attention can, and should, turn to measuring impacts.

18. One of the important implications of this framework is that certain data programs, though essential at an early phase, will not be required forever. Internet or e-commerce penetration will eventually be universal and there will be no policy-relevance from its continued measurement. For the time being, this remains one of the important core indicators, even for very well developed economies.

Figure 1. Maturity of e-markets: The S-curve



Source: Industry Canada (1999).

Definitions

19. The development of a very wide variety of electronic, economic-oriented activities in a very short period of time resulted in a plethora of different terms being used interchangeably. Terms such as e-commerce, e-business, e-services, electronic data interchange (EDI), and even the Web and the Internet were all applied to similar activities. Reaching agreement on a clear definition of e-commerce, especially one that could be easily applied for measurement purposes across countries, was a significant challenge indeed.

20. The foundation for an e-commerce definition rests on the words “electronic” and “commerce”. However, if e-commerce were to encompass everything implied by these two terms it would be very broad indeed, and very difficult to measure. The experts soon focused on explicit transactions, carried out over computer-mediated channels, rather than the broader notion of commerce or commercial activity. The broader notion of e-business activity (across a wide range of e-business processes that are outlined below) remains of considerable interest to both businesses and policymakers, but a more precise focus was required to permit progress on the e-commerce definition and measurement. A transaction is a finite, measurable event that can be distinguished from myriad other business activities.

21. In 2000, the OECD members endorsed definitions of e-commerce based on a considerable amount of work, and thorough discussion, by member countries. The development of concepts was based on the need for feasible programs that countries could implement with questions that respondents could answer. Canada participated actively in the discussions leading to the eventual definitions, along with many other member countries. In order to better understand Canadian needs and respondent realities, Canada undertook a study of possible e-commerce definitions along with some pilot interviews in a few key sectors.

22. The result of the OECD work was two, nested definitions of electronic commerce transactions, one broad and one narrow. These are set out below, along with the OECD guidelines for their interpretation.

23. A fundamental tenet of the OECD definition is that it is the method by which an order is placed (or received) that establishes whether a transaction is “e-commerce”. Payment for an e-commerce transaction, and delivery of any good or service purchased, may be conducted on or off-line.

E-commerce transactions	OECD definitions	Guidelines for the interpretation of the definitions (WPIIS proposal April 2001)
BROAD definition	An electronic transaction is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over computer-mediated networks . The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.	Include: orders received or placed on any online application used in automated transactions such as Internet applications, EDI, Minitel or interactive telephone systems.
NARROW definition	An Internet transaction is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over the Internet . The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.	Include: orders received or placed on any Internet application used in automated transactions such as Web pages, Extranets and other applications that run over the Internet, such as EDI over the Internet, Minitel over the Internet, or over any other Web enabled application regardless of how the Web is accessed (e.g. through a mobile or a TV set, etc.). Exclude: orders received or placed by telephone, facsimile or conventional e-mail.

24. Members have responded well to the OECD encouragement to use these definitions in their national survey programs so international comparability has been furthered from the outset. This is a far easier process than any attempt to build harmonization after data programs are well established. Further development of the definitions and guidelines will no doubt continue as countries gain experience in their application.

The OECD Model Questionnaire

25. In addition to its pioneering international collaborative work on e-commerce definitions, the OECD's Working Party on Indicators for the Information Society (WPIIS) has been actively engaged in model questionnaire development to guide countries in the development of appropriate measurement tools for ICT-related activities. Initially, the focus of the work was on e-commerce, reflecting the priorities and interests of member countries. The model questionnaires are modular so that countries may choose the relevant questions for their state of e-commerce development. Model questionnaires have been developed for both enterprises and households. Work is ongoing on additional modules for government use of ICTs and for measurement of broader aspects of e-business.

26. The model questionnaires serve as guidelines, rather than rigid prescriptions, as it is realised that different wordings and explanations of questions will be required in different environments. The completed and ongoing work on model questionnaires is well described in "A Framework Document for Information Society Measurements and Analysis" by the OECD's WPIIS, (2003).

E-Business Processes

27. While the focus of much of the international work on concepts, definitions and model questionnaires has been on e-commerce, it is recognised that e-commerce is but one important facet of a much broader set of e-business processes. Like e-commerce, the other e-business processes are already having profound transformative effects on economies and societies. They are affecting the structure of firms as well as the entire supply and customer chains, from product design to after-sale service.

28. Initially work on measurement issues focussed on e-commerce, in part because of immediate policy interest. It was also necessary to isolate discrete aspects of e-business if any progress was to be made on the development of measures. Now, given the progress on e-commerce concepts and measurements, attention is turning to other elements of e-business processes. These pose even more substantial challenges to measurement experts. E-business processes are activities that will be much more difficult to measure than the discrete "transaction" measured as e-commerce. Furthermore, not only is the list of processes for potential measurement very long, but the need to guard against overburdening respondents is very real.

29. E-business processes can take place over any computer-mediated networks, not just the Internet. These processes operate both within and between firms and there is a desire to distinguish inter- and intra-firm processes in order to understand the changing nature of firm boundaries and relationships.

30. Some e-business processes of potential interest to countries have already been identified (OECD 2003) and some definitions have already been struck:

- Customer acquisition and retention;
- E-commerce;
- Finance, budget and account management;
- Human resource management;
- Product design and development;
- Order fulfilment and order tracking;
- Logistics (inbound and outbound) and inventory control;
- Product service and support.

31. The work on e-commerce definitions and measurements will serve as a model for progress on this extensive list of potential information requirements.

The Canadian Data Programs

32. While the specific focus of e-commerce measurement is on Internet transactions or electronic transactions through computer-mediated networks, the broader, and essential, measurement framework requires information on infrastructure, readiness, intensity and impacts in order to fully illuminate e-commerce policy analysis and planning. Furthermore, e-business goes well beyond the sale of goods and services over the Internet to include such things as the use of the Internet to communicate with suppliers and customers, conduct

marketing, develop products and provide after-sale service and support. Similarly, data on e-commerce transactions over the Internet is not sufficient to measure the full impact of e-commerce on businesses and consumers. Data on Internet use to facilitate commercial transactions, such as research or window shopping, are also important.

33. The Canadian statistical program encompasses many of these additional measures that are also relevant to understanding e-commerce. While this paper focuses on those specific data programs that measure e-commerce transactions, the other programs that cover important aspects of infrastructure and use are also briefly summarised.

34. Statistics Canada has been measuring and analysing internet use among households for several years and readings of business use of selected ICTs have also been taken for some time, though in the early days they were part of a broad range of advanced technologies and mainly focussed on the manufacturing sector.

35. The ongoing and regular program of e-commerce measurement really began in 1999 as a result of the Socio-Economic Indicators of 'Connectedness' Project, mentioned above. The objective of this project was to improve knowledge of the economic activities conducted electronically by:

- Improving data on the production and the use of ICTs by the business, household and public sectors;
- Developing new and improved surveys and uses of administrative data, and;
- Analysing and disseminating the findings.

36. Several statistical activities were established or redesigned under the umbrella of the Connectedness Project. In addition several established collection activities, though not part of the Connectedness Project, have been explored for possible contributions to e-commerce measurement². To date, Statistics Canada has largely refrained from attempting e-commerce measurement through industry specific surveys for various methodological and response-burden reasons.

37. Statistics Canada's activities divide into two broad categories: infrastructure data, which focus on specific, core information and communication technology industries; and; e-commerce application data, which covers economy-wide activities. In addition to the data collection initiatives, a third component of the program, Co-ordination and Analysis, ensures ongoing relevance. This activity comprises the synthesis and dissemination of outputs, analytical papers and articles and research into new areas of statistical work. Responsibility for analysis is shared with partners in government policy departments, notably Industry Canada, which helps to ensure ongoing statistical program relevance. A summary of the data collection activities follows.

Core Infrastructure Data

Telecommunication and Cable Surveys

38. The well-established telecommunications surveys have been modernized and extended to address many of the key questions on e-commerce readiness in Canada. They measure important characteristics of the Internet backbone including potential accessibility to the Internet and the access speed. The trend to wireless Internet use is also tracked through these vehicles. Cable and other program distribution surveys have also changed to reflect new technology and policy interests. Measures of high-speed Internet access and digital television penetration help to monitor progress towards the government goal of universal access to broadband Internet.

Surveys of Software Development, Computer Services, and Internet Service Providers, Portals and Related Services

39. Existing surveys have been redesigned and new surveys added to provide measures of e-commerce readiness and intensity. While the immediate need is to understand the enabling and facilitating role of these industries in e-commerce, the opportunity will be seized to understand the role that e-commerce plays in the regular buying and selling activities of the computer services industry. In other words, this industry will be viewed just like any other producer services industry, seeking to understand how much of their output is sold via e-commerce and how much of their expenses incurred on inputs are transacted through e-commerce.

40. The software development and computer services survey produces information on electronic sales and purchases by firms in the industry. This allows a comparison of how the aggregate industry figures compare with those from the cross-economy survey. The Internet service providers survey collects information on electronic commerce products provided, the distribution of business and personal subscribers and the capacity of access, whether it is narrowband or broadband.

Electronic Commerce Application Data

Survey of Electronic Commerce and Technology (SECT)

41. Since 1999, Statistics Canada has conducted regular surveys to measure ICT use by business, including the existence of web-sites, the use of computers and the Internet and the use of the Internet for commerce.

42. The first survey focused on the use of ICTs and electronic commerce across almost all public and private sector enterprises. At its inception, a very detailed questionnaire covering the uses of various ICTs and electronic commerce (sales and purchases) was designed. Until that time, no comprehensive estimates existed on the use of ICTs by Canadian businesses. Clearly, closing this gap was a prerequisite to measuring e-commerce. The survey was administered at the establishment level, with the intent to use appropriate methodology and

produce estimates at the enterprise level. The establishment is not the proper level in an organization to collect much of the information sought (i.e. sales over the Internet).

43. This survey provided important baseline measures of the use of computers, e-mail and the Internet by Canadian business and public enterprises. It captured the extent to which public and private sectors had developed web sites and engaged in electronic commerce, including measures of the value of sales. Certain barriers to the introduction of electronic commerce were also identified.

44. The survey was then redesigned and administered annually at the enterprise level. Content was reduced and topics were limited to those that could be answered by a single individual for the enterprise. For example, while tracking sales over the Internet it excludes the value of purchases, which are generally decentralised throughout an enterprise. Nevertheless, the new survey yielded a richer dataset on electronic commerce. Sales made to households (B2C) are distinguished from sales to business (B2B) and export sales are also measured.

45. SECT uses the OECD's definition of an Internet transaction. Electronic commerce is defined as sales over the Internet, with or without online payment. Included is the value of orders received over the Internet. Sales using electronic data interchange over proprietary networks and transactions conducted on automatic teller machines are excluded. The value of financial instruments transacted on the Internet such as loans and stocks are not considered e-commerce sales, but the service charges received for conducting these transactions over the Internet are included.

Household Internet Use Survey (HIUS)

46. This survey was originally conducted for 1997, to measure the use of the Internet, by location, categorized by various household characteristics (income, type of family, geography and characteristics of the household maintainer). The survey is administered as a supplement to the LFS (a sample of more than 40,000 households).

47. In 1999, the Household Internet Use Survey was re-designed to include an e-commerce module, again in close consultation with Industry Canada. In addition to household connectivity, it provides expenditure estimates for purchases made via the Internet regardless of the means of payment, purchases made and paid for through the Internet, what the purchases were, as well as whether they were made in Canada or elsewhere. The sampling unit is the household, and a designated member of the household is interviewed with respect to the online orders made by all members of the household.

48. The engagement of a household in e-commerce activities is a continuum. An individual typically proceeds through several stages before actually placing an order over the Internet: he/she must use a computer, become an Internet user, explore the goods and services available on the Internet, make a purchase and even make payment electronically. All these stages are measured in the Statistics Canada Household Internet Use Survey (HIUS).

The General Social Survey (GSS)

49. The GSS for 2000, (Cycle 14), was devoted for the first time to the access and use of ICTs among individual Canadians. It involved more than 25,000 interviews of people aged 15 and over to measure the nature and the extent of the use of ICTs, with particular focus on the use of the Internet and its impacts. The survey content contained questions about the location of access and use, including home, work, school and other locations. As well, it collected additional information on training, the impact of technology at work, children's use of the Internet, e-mail as a communications tool, security and privacy concerns, time displacement, volunteerism and civic participation. Socio-demographic variables, including income, education and language were also measured. The survey produced a rich dataset conducive to revealing analysis.

Gaps and Outstanding Issues

50. While Canada has established a sound program of e-commerce measurement, a variety of gaps and challenges remain. Many of the challenges are methodological and reflect the very young state of the conditions we are measuring. As we better understand the state and impacts of e-commerce our desire to measure additional or different aspects of the phenomenon will evolve as well.

51. There are also non-methodological challenges facing us. An important one is funding for on-going e-commerce statistical program. Budget pressures on the public sector generally, and statistical agencies particularly, mean that there is a constant competition for funds and even successful data programs can be in jeopardy.

52. Another challenge is the need to establish greater credibility for the official statistics on e-commerce in the face of opinion polls and proprietary information releases representing other interests. There has been so much enthusiasm and even hype surrounding e-commerce that the reality presented by the objective, official statistics is hard for many casual observers to accept.

53. Timeliness is another significant challenge for e-commerce data programs. While the timeliness record for Statistics Canada's outputs compares very favourably with the record of other traditional data outputs³, the rapid pace of the e-commerce world means that many of the actors demand even greater timeliness.

54. The global nature of e-commerce activities poses particular challenges. Multinational enterprises may have significant e-commerce activity that is missed if it is not within the domain of the Canadian enterprise. Likewise, Canadian households engaging in e-commerce activities through foreign sites may be reluctant to report fully, especially if an e-purchase is also combined with e-delivery.

55. Response burden and the apparent contradiction, at least to some, of ongoing use of old statistical technology (surveys) to measure e-commerce are also outstanding issues. There is a perception, yet to be confirmed, that electronic collection of data over the Internet will be less burdensome to respondents than traditional survey vehicles. While methodological,

privacy and other complications have somewhat slowed the transition to online data collection, the need for continued progress in this area, especially in the field of e-commerce, remains. Furthermore, the desire to avoid direct data collection altogether, for example by automatically monitoring the web presence of firms, is another outstanding challenge.

56. In the case of the Survey of Electronic Commerce and Technology, the economy-wide data collection has been successful and informative but there remain calls from some for greater industry and geographic detail.

57. The Household Internet Use Survey has a couple of inherent limitations. Data are collected only for the household and not the individual. While a household has certain characteristics (location, household income, type of Internet connection), it is not possible to categorize Internet use data by individual characteristics such as age, sex occupation or education. Finally, while Internet consumer research, or window shopping, is identified as an activity through HIUS, it is not possible yet to quantify the impact of such activities in terms of the value of purchases.

Where do we go from here? (Statistics Canada's plans for future)

58. To date we feel the programs have been successful but even successful programs are always challenged to justify their continued existence. Hence, an important aspect of "future plans" is maintenance of the highly illuminating programs that exist. In other words, our first priority is to ensure that the core surveys, SECT and HIUS, continue to produce core indicators. When possible, additional, special content will be added to push the bounds of innovative content.

59. In keeping with international interest we would like to further expand data collection beyond e-commerce to measure more facets of e-business. In part this is not entirely new as some elements of e-business were measured by Statistics Canada even before priority was placed on e-commerce. We will work with the OECD and others to extend existing questionnaire content and re-examine some of the measures of ICT use that have existed at Statistics Canada for some time.

60. Another area of potential interest is the measurement of e-delivery of products and services, whether the initial transaction was through e-commerce or a conventional ("old") sales channel.

61. As the penetration of e-commerce increases, and our measurement ability matures, policymakers are increasingly interested in measures of impact. This, in turn, underscores a need for even greater attention to our analytical program. We will explore the possible use of micro data linkages between SECT and other production surveys. Such work is indispensable in answering performance-related questions at the firm and industry levels, but privacy and confidentiality concerns necessarily means that any initiatives are approached cautiously and are subject to careful scrutiny.

62. Finally, we will continue to work with international partners to improve and expand the indicators essential for understanding and developing electronic commerce.

V. CONCLUSION

63. There are numerous policy issues, broad and specific, associated with e-commerce. It impacts on trade policy and challenges the differences in national regulatory regimes, competition policies as it undermines traditional boundaries, technology policy, regulatory reform and social policies. It has obvious implications for productivity and growth as well as human resource development, particularly the need for continuous up-skilling. Other policy issues relate to fiscal regimes and the concern for tax jurisdiction. Virtually no area is immune from its potential effects, providing an immense challenge to understand the implications of e-commerce on the business world and the society at large.

64. The impact of e-commerce and, more broadly, ICTs is not limited to businesses and people. Governments themselves, and more specifically national statistical agencies, will be transformed. Not only are many new measures required, but there will be increasing pressure to bring the frequency, timeliness and methodologies for measuring of e-commerce into line with the nature of the technologically-transformed world we are measuring.

65. Statistics Canada has developed an annual program to measure electronic commerce, and related enabling technologies in households, businesses and the public sector. The framework underlying these statistics has been developed in close collaboration with the policy department and the OECD. Efforts will continue to improve the data and to broaden the coverage. As it has in the past, Statistics Canada will ensure that continuing collaboration with policy analysts will drive our contribution to the public policy debate and we will continue to work with the OECD and other international bodies to ensure an orderly development of comparable data frameworks, definitions, outputs and indicators.

NOTES

¹ In addition to Canada, other countries that have applied these definitions include, Australia, the US, Japan, Scandinavian countries and Eurostat in data collection across its member states.

² These include industry-specific surveys such as the Annual Retail and Wholesale Trade Survey, the Non-Store Retailing Survey, The Annual Survey of Manufacturers and the Survey of Deposit Accepting Intermediaries.

³ The SECT release is some 3 months after the reference period while HIUS is released within 9 months.

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