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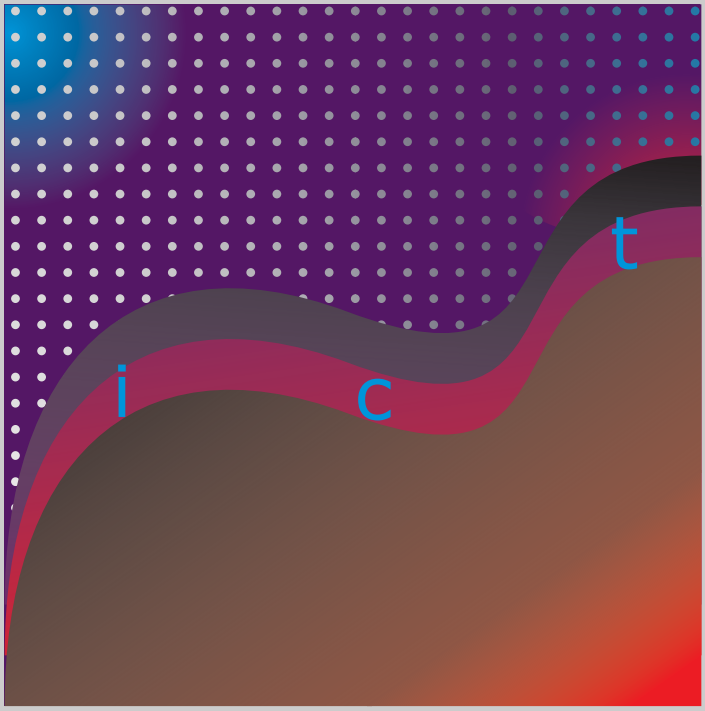
E-COMMERCE AND DEVELOPMENT REPORT 2001

PART ONE

Prepared by the UNCTAD secretariat



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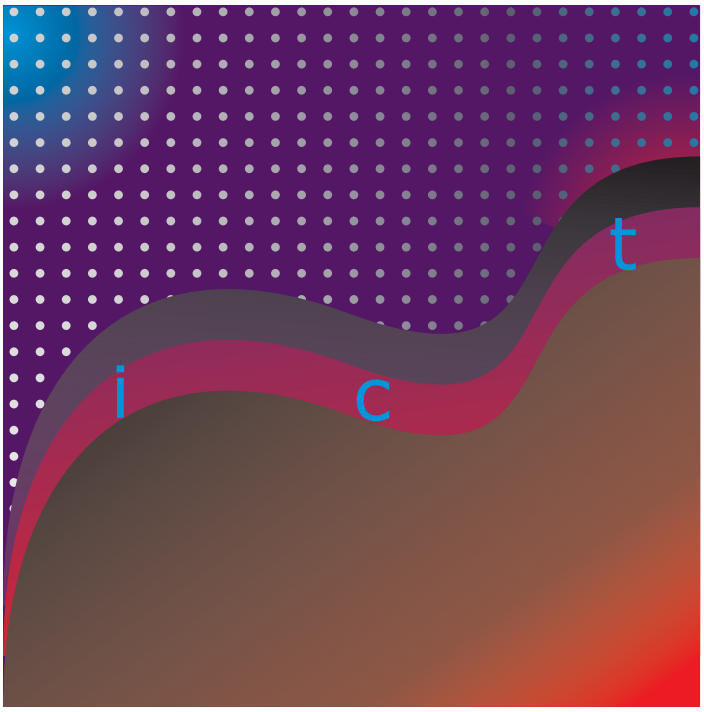
Part One

Facts and Figures about Electronic Commerce



Chapter 1
MEASURING ELECTRONIC COMMERCE

A. Estimating or measuring electronic commerce?

There is little doubt that electronic commerce has penetrated many people's — and particularly businesses' — lives in one way or another during the past few years. But how many businesses really use the Internet? How do they use it? And how are they planning to use it? When it comes to a precise evaluation of the importance of electronic commerce, including its dimensions, growth rate and role in economic growth and development, uncertainty prevails. This is largely because data on e-commerce are not readily available or differ widely, depending on the definition and methodology used by the entity collecting them.

So far, figures are mainly provided by a large number of private sector companies, dedicated to continuously monitoring e-commerce around the world. They regularly publish reports on the latest developments in e-commerce, including short- to medium-term growth estimates. However, some of them have a great interest in providing data that serve their main clientele — e-businesses or financial sector analysts. Furthermore, most of the collecting agencies use different definitions and indicators for electronic commerce and have different methodologies for estimating it.[1] Hence, their data vary widely and are not always representative of a whole community or country. Table 1 shows that even estimates of Internet users vary up to 100 per cent between the different sources. Forecasts could even differ by a factor of ten.

While some of these estimates may be useful for analysing specific e-commerce markets, more precise and comparable data on electronic commerce and its role in the overall economy are crucial for a number of reasons. Without reliable data, policy makers and business people are unable to take decisions that reflect the changes brought about by e-commerce. For example, electronic commerce is said to affect the productivity, profits, procurement and distribution systems of businesses. The use of electronic websites presumably expands the potential market for, and the sales income generated by, businesses' goods and services by increasing the range of potential new customers and business hours. Electronic commerce is also expected to significantly reduce transaction costs associated with the purchase and sale of goods and services, and operating costs of firms by *inter alia* reducing the costs involved in holding stock through the use of better stock control/inventory systems. Furthermore, there could be indirect effects: for example, a business may improve the timeliness and quality of a service and so attract new customers or retain existing ones for a longer period of time. More accurate data on e-commerce would allow policy makers and researchers to analyse the impact of

Table 1
Estimates of e-commerce, 2000

Source	Global B2B e-commerce *($ billions)*	US consumers on-line shopping revenue *($ billions)*	Internet users in Asia *(millions)*	Internet users in Brazil *(millions)*
eMarketer	226	37.0	48.7	3.9
Forrester Research	604	38.8	..	..
IDC Research	213	..	40.0	4.2
Gartner Group	403	29.3	..	..
Morgan Stanley	200	..	82.0	5.6
Jupiter Research	..	23.1	65.1	8.4

Source: eMarketer, 2001, www.eMarketer.com

e-commerce on labour markets and income distribution, and market structures and functioning, including changes in the distribution of goods and services and changes in international and domestic competition. Both policy makers and business people would be able to take well-informed decisions about the best public policy measures and private investments in e-commerce-related sectors.

Current statistics on electronic commerce, however, do not capture these changes. Therefore, the national statistical offices in a number of countries (including some developing countries) have recently turned their attention to measuring electronic commerce. Official statistical offices have the advantage of guaranteeing the confidentiality of data collected, having a more neutral position when it comes to collecting and interpreting that data and being able to use their existing methodologies and infrastructure for data collection, processing and analysis.

Experience so far has been limited. One of the major difficulties facing government policy makers and others who have addressed the issue of measurement has been the lack of comprehensive indicators about electronic commerce. This has been exacerbated by the lack of clear guidelines and consensus on what is meant by electronic commerce. Thus, there has been a considerable effort at the international level, including by the Organisation for Economic Co-operation and Development (OECD), the Asia-Pacific Economic Co-operation (APEC) and the European Union (EU), and their respective member States, to work towards an international agreement on the definitions to be adopted. There seems to be a growing convergence towards internationally accepted guidelines and methodologies for measuring electronic commerce. Hence, the time has come for Governments to consider starting their own statistical compilation programmes.

Although the development of electronic commerce and electronic commerce indicators has been up to now concentrated in the more developed economies, some developing countries have started to become actively involved. They have realized the potential social and economic benefits that could result from e-commerce, as well as the importance of having readily available data which would highlight the role of e-commerce in their economies. Other countries have shown great interest in the subject but need further information and guidelines on how to embark on such a task. This chapter will therefore address the need for data and statistical indicators on electronic commerce and present concrete examples, including a model survey, of how to go about measuring electronic commerce, which could be of particular interest to the developing countries.

The remainder of this chapter is organized as follows. Since the first step towards measuring e-commerce is to agree on a common terminology, the second section briefly introduces some of the concepts and definitions that have been used in the work done so far on measuring e-commerce. The third section presents a number of initiatives that have been taken at the national and international levels for defining e-commerce indicators. The fourth section presents various methodologies that have been chosen by statistical offices in their e-commerce surveys, and discusses the advantages and disadvantages from the perspective of a developing country. On that basis, a model business survey is presented in the fifth section, which could be used by developing countries for surveying e-commerce. The sixth section discusses some of the key requirements for starting a statistical compilation programme on e-commerce. The last section provides concrete examples of how countries that have completed e-commerce surveys have made use of the results and proposes a number of activities which national statistical agencies could take up to further develop their work on measuring electronic commerce.

B. What do we want to measure? Towards a working definition of e-commerce

One reason for the considerable discrepancies among e-commerce estimates is the number of different terms used interchangeably and with no common understanding of their scope or relationship. For example, do we want to measure the number of Internet users, online purchasing, advertising, ordering and procurement, or total e-commerce activities? Are we interested in e-commerce-related infrastructure, electronic business processes or transactions? In order to obtain internationally comparable statistics, we need to establish a clear and consistent terminology. Hence, before embarking on the task of measuring e-commerce, it is useful to look at a few concepts and definitions that have been suggested by various entities involved in defining and measuring electronic commerce.

1. Identifying user needs

Each country or economy will first want to reflect on what kind of e-commerce data it wants to measure, depending on the stage of development it has reached in the area of e-commerce. Some countries, particularly developing countries, may be at an early stage, while others may already be very active users of e-commerce and the Internet.

A good model for identifying these needs of e-commerce data users has been proposed by Canada and is generally considered a good starting point for statistical work on e-commerce (chart 1).

The model recognizes that a distinction needs to be drawn between various situations, such as where a country might wish to know about:

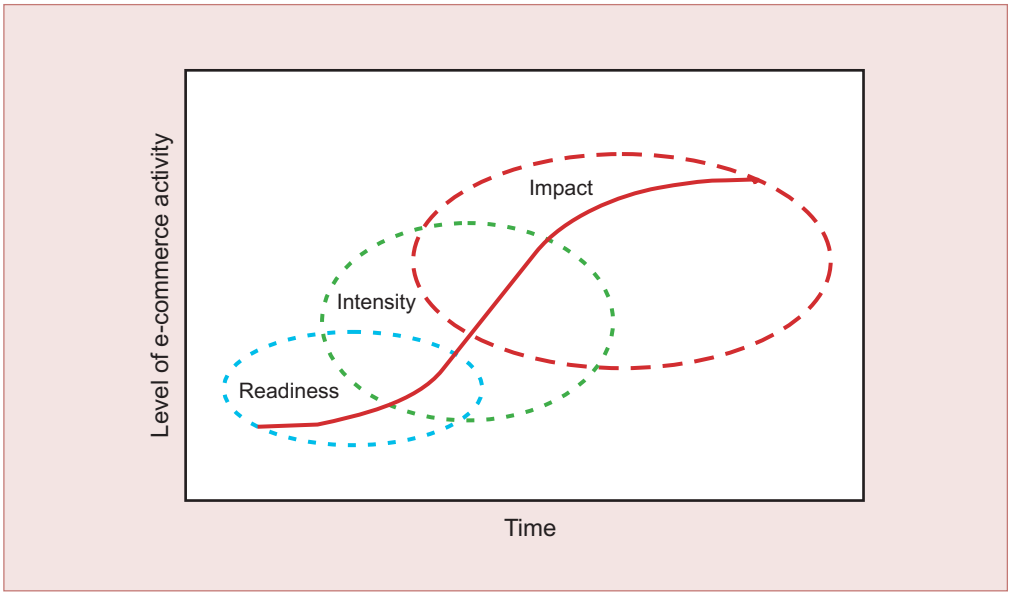
- the *readiness* of its people, businesses, infrastructure and its economy generally to undertake electronic commerce activities — this is likely to be of interest to countries in the early stages of electronic commerce maturity or activity;
- the *intensity* with which information and communication technologies are utilized within a country and the extent to which electronic commerce activities are undertaken — this is likely to be of interest to countries where electronic commerce is becoming much more prevalent; and
- the *impact* of electronic commerce on national economies and business activities being carried out in the country — this is likely to be of interest to countries where electronic commerce activities are very well developed.

As depicted in the diagrammatic representation in chart 1, there is considerable overlapping of the various stages of maturity of e-commerce, and hence a unique classification of the issues and indicators into the three stages is not possible. Some issues, and the corresponding indicators, could be relevant to more than one of the stages of development. The model itself is a simplification of the situation that exists in a country. In reality, of course, different parts of a country may be at different stages of maturity. For example, the business community may have passed from the "readiness" stage of maturity to the "intensity" stage, while the Government or household sectors may have a much lower rate of Internet access and thus be at an early stage within the overall process. Even within the business sector, it is possible to have regional or industrial differences in the stage of maturity. Thus the model adopted should merely be regarded to be illustrative — suitable for helping in the derivation of relevant indicators.

2. The ICT sector, e-commerce and the use of ICT goods and services

There has been confusion among many people about the different uses of the terms "information and communications technology (ICT) sector", "electronic commerce", and about the use of ICT goods and services more generally. It is therefore useful to distinguish these terms first.

Chart 1
Maturity of e-commerce markets and need for indicators: the S-curve



Source: Industry Canada, presented at the OECD Workshop on Defining and Measuring E-commerce (April 1999).

The ICT sector has been one area that has attracted considerable attention in recent years, particularly among the national statistical agencies. Many countries have now started compiling statistics about the ICT sector as part of their standard industrial statistics survey programmes.

In brief, the ICT sector provides a supply perspective with respect to producers of ICT goods and services. It provides standard details about the size and structure of the industry, employment, number of businesses, value added, etc. As the ICT sector contains businesses that provide both goods and services, it is not separately identified in most industrial classifications that draw boundaries between the goods and services sectors. One useful standard definition of the ICT sector has been developed by the OECD (OECD, 2000d), which brings together a number of industries identified within the International Standard Industrial Classification. Accordingly, the sector comprises the manufacturers of information technology and telecommunications goods, the providers of information technology and telecommunications services, and the wholesalers of these goods and services.

On the other hand, the use of ICT goods and services and electronic commerce is a demand perspective for ICT goods and services, i.e. how are ICT technologies used throughout the economy and, in the case of electronic commerce, what impact do they have on the sale or purchase of goods or services. In this respect, electronic commerce can be seen merely as a subset of all aspects of the use of ICT goods and services, across all sectors of the economy.

3. An internationally agreed working definition of e-commerce

Many organizations and individuals have provided various definitions of electronic commerce, which, when implemented statistically, have led to the compilation of incompatible statistics on the phenomenon.[2] These differences have significantly hampered the ability of researchers and policy makers to fully understand all the ramifications of electronic commerce. It is therefore necessary to form an internationally agreed set of definitions, which could be applied for developing statistical indicators. The following will briefly introduce the work of the OECD,[3] which has been taking a leading role in the international debate in this area (OECD, 2000b, d, e).

The efforts by the OECD to work out a definition of e-commerce have resulted in the acceptance of a need for three dimensions to be spelt out as part of the definition process. These dimensions relate to the:

(i) *Networks* over which the relevant activities are carried out;

(ii) *Processes* that ought to be included within the general domain of electronic commerce; and

(iii) *Actors* involved in the transactions.

Networks

With respect to the networks over which e-commerce activities are carried out, OECD member countries have agreed on the following two definitions to be used:[4]

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 organizations, 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 offline.

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 organizations, conducted over the Internet. The goods and services are ordered over the Internet, but the payment and the ultimate delivery of the good or service may be conducted on- or offline.

Both definitions deal only with "transactions" between two or more parties and they involve the agreement of the parties to buy or sell goods or services, i.e. they conform to the often accepted view of a "commercial" transaction. All other business processes that take place electronically have been excluded. In both definitions, the transaction is "conducted" — and not just "completed" — over the network. This means that electronic orders are included within the definition, irrespective of whether the payment is made over the network or not.[5]

The broader definition includes proprietary networks used, for example, for electronic data interchange (EDI). This more inclusive definition is important for capturing electronic transactions in those countries where electronic commerce has been a regular feature of business activities for many years, for example in the United States, where there are well-established proprietary networks. It is less relevant to smaller and less developed economies where the major network involved is the Internet. For these cases, the narrower (Internet) definition, which is deliberately a subset of the broad definition, is more relevant. The majority of OECD member countries have expressed a preference for measuring Internet commerce. As developing countries are unlikely to have significant business activity occurring over proprietary networks, it could reasonably be expected that those countries would also favour the narrow definition.

Business processes

The second aspect of the definition relates to the activities or business processes being included, or excluded, from the electronic commerce domain. While many countries want to restrict the definition to the purchasing and selling aspect incorporated in the above definitions, many others want to include other types of business processes, such as marketing and advertising. Undoubtedly, the latter ones are going to be very important in the future, as businesses come up with more and more integrated electronic processing systems for a greater range of business functions and the productivity benefits of electronic commerce thus become much clearer. This has led to the conclusion that there ought to be one specific definition relating to purchasing and selling activities as shown above in the broad and narrow definitions, as well as another definition which lists a greater number of business processes.[6] Developing countries will also favour a definition that includes business activities that go beyond purchasing and selling, given the restrictions that some of those countries face in conducting online payments.

E-commerce actors

The third aspect of the definition relates to the actors involved in the electronic commerce process. Electronic commerce is often described as being one of three varieties — business-to-business (B2B), business-to-consumer (B2C) or business-to-government (B2G). Each of these has a set of statistical indicators about e-commerce that might be useful and hence be included. Much of the interest and the literature has focused on B2B and B2C electronic commerce and most of the statistical indicators have also been in respect of these two forms. It is generally agreed that about 80 per cent of the total value of electronic commerce in the world today is accounted for by B2B e-commerce. B2B electronic commerce also provides the greatest potential benefits in terms of productivity gains. On the other hand, B2C e-commerce has the potential to substantially affect the way in which people live and interact with each other and is therefore a key aspect for statistical measurement. Only a small number of countries have so far undertaken much work with respect to the measurement of B2G e-commerce.

C. What are the priority indicators for e-commerce?

Now that a set of definitions for measuring e-commerce has been provided, the next step is to develop a list of e-commerce indicators. Thus, it is worthwhile to look at what Governments have done so far in their respective programmes. How do their indicators differ from each other and can they be used by other countries? This section briefly presents three different initiatives on defining indicators, prompted by work programmes at the regional or multilateral levels. First, the OECD work mentioned earlier will be discussed. Secondly, the Asia-Pacific Economic Cooperation (APEC) has established an e-commerce readiness initiative which has been tested in a number of countries. And thirdly, Eurostat has just finalized the development of an electronic commerce pilot survey aimed at collecting statistics on electronic commerce and the use of ICTs in Europe.

1. OECD work on e-commerce indicators

The OECD (2000e) has established a set of priority electronic commerce indicators for both the business and the household sectors. They are shown in boxes 1 and 2.

The (initial) list includes both readiness and intensity indicators. It was decided to omit indicators designed to measure the impact of electronic commerce, as there were none available for most countries. There is statistical work going on in some countries to try

Box 1
A priority set of indicators for the business sector

1. Number and proportion of businesses with computers.
2. Employment (level and share) of businesses with computers.
3. Number and proportion of businesses with access to the Internet.
4. Employment (level and share) of businesses with the Internet.
5. Number and proportion of businesses undertaking specific processes on the Internet.
6. Number and proportion of businesses with websites.
7. Number and proportion of businesses which recognize specific barriers to e-commerce.
8. Number and proportion of businesses which plan to use the Internet.
9. Number and proportion of businesses which receive orders over the Internet.
10. Number and proportion of businesses which receive orders over computer-mediated networks.
11. Value of orders of goods and services received over the Internet.
12. Value of orders of goods and services received over computer-mediated networks.
13. Proportion of orders of goods and services received over the Internet.
14. Proportion of orders of goods and services received over computer-mediated networks.

Box 2
A priority set of indicators for the household sector

1. Number and proportion of households with computers.
2. Number and proportion of households with access to the Internet.
3. Number and proportion of householders undertaking specific activities.
4. Number and proportion of households which recognize specific barriers.
5. Number and proportion of individuals placing orders (for own use) over the Internet (irrespective of location where purchase was made).
6. Value of orders (for own use) placed by individuals over the Internet.

to develop these, but at this stage no agreed methodologies or indicators are available. In the short term, at least, impact indicators are most likely to be developed using case study methodologies. It was also decided to exclude indicators of government electronic commerce as there has been very little collection activity in member countries. Only in the Nordic group of countries, Canada and Australia are specific statistical collections conducted which provide such indicators.

2. The APEC E-Commerce Readiness Assessment Guide

APEC was one of the first regional forums to put e-commerce high on the agenda, including the task of measuring e-commerce. In their Blueprint for Action for electronic commerce, confirmed by the APEC Ministerial Meeting in 1998, APEC ministers recognized:

> "the enormous potential of electronic commerce to expand business opportunities, reduce costs, increase efficiency, improve the quality of life and facilitate the greater participation of small business in commerce." (APEC, 2000)

The ministers also recognized that the different stages of development of their member countries would lead to different challenges for each country in the development of e-commerce. Thus it was important for each Government to tailor its policies to the conditions in its country. This has led to the development of an APEC E-Commerce Readiness Assessment Guide designed to help Governments develop their own focused plans for development by measuring their level of e-commerce "readiness".[7] The guide is also aimed at helping APEC economies identify and overcome impediments to the deployment of electronic commerce.

The guide is composed of six broad categories of indicators of readiness (see box 3). Each of the categories is based on a detailed set of questions about those categories.

Box 3
The six categories of the APEC E-Commerce Readiness Assessment Guide

1. Basic infrastructure and technology
2. Access to necessary services
3. Current level and type of use of the Internet
4. Promotion and facilitation activities
5. Skills and human resources
6. Positioning for the digital economy.

Box 4
Data items included in Eurostat pilot survey

- Use of computers
- Use and planned use of the Internet
- Presence on a website
- Type of Internet connection
- Barriers to using the Internet
- Use of e-commerce for purchases
- Barriers to using e-commerce for purchases
- Plans to use e-commerce for purchases in 2001
- Length of time using e-commerce for purchases
- Processes undertaken with e-commerce purchases
- Benefits in using e-commerce purchases
- Use of specialized B2B Internet market places for purchases
- Value of purchases (percentage of purchases) made using Internet and all networks
- Use of e-commerce for sales
- Barriers to using e-commerce for sales
- Plans to use e-commerce for sales in 2001
- Length of time using e-commerce for sales
- Processes undertaken with e-commerce for sales
- Benefits in using e-commerce for sales
- Use of specialized B2B Internet market places for sales
- Value of sales (percentage of sales) made using Internet and all networks
- Proportion of e-commerce sales to households

The project is still in its early stages. Members that have so far completed the Guide include Taiwan Province of China, Hong Kong (China), Japan, Malaysia, Mexico, Peru, Thailand and the United States.

3. Eurostat pilot survey on e-commerce

In June 2000, Eurostat presented to its member States a proposal to establish a pilot survey of e-commerce by the business sector. The proposal called for the compilation of a range of ICT use data in the second quarter of 2001, with final results to be compiled and published at the end of 2001. Most of the member States have agreed to participate in the survey.

In general, the pilot survey is designed to produce statistics by industry and by size of business. Businesses with fewer than 10 employees do not have to be included in the survey.

Eurostat is trying its best to keep the pilot survey within the definitional framework laid down by OECD and to ensure that it remains consistent with the draft model survey being prepared by the Nordic group (see below). Most of the data items being collected in the pilot survey refer to intensity indicators, and are shown in box 4 (Eurostat, 2000).

D. How do we measure e-commerce?

So far, we have looked at the user framework, the e-commerce definitions and the priority indicators that have been identified for collecting e-commerce data. All of these provide the basis for an internationally comparable statistical measurement. This section moves to the empirical part of measuring e-commerce, i.e. the actual data collection. The methodologies most commonly adopted by the national statistical agencies are outlined below, together with an assessment of their suitability for the measurement of these indicators. These will be useful for developing countries that are about to embark on the task of compiling statistical indicators on e-commerce.

1. Businesses, households or Governments?

As noted earlier, there is interest in having indicators on the business sector, the household sector and the government sector. The obvious way of obtaining information about the business sector is to survey that sector; such surveys generally provide information on B2B e-commerce transactions and the actors involved in those transactions. B2C e-commerce can, however, be measured from both business sector and household sector surveys as both sectors are participants in the transactions. Similarly, government sector transactions can be measured by government surveys and business or household surveys, depending on which other sector is involved in the transaction. This chapter will limit itself to business surveys, given the fact that this is the sector where traditional surveys are well established and most e-commerce activity takes place. The following considers, first of all, the development of new surveys on e-commerce, and then the addition of e-commerce questions to existing surveys. Next it presents some alternative ways of measuring e-commerce for countries where business surveys are difficult to implement.[8]

2. New surveys on e-commerce

Many countries have adopted the approach of developing new surveys to compile indicators of electronic commerce. These have generally been broad-based, aimed at measuring the use of ICT by businesses across a broad range of industries. The surveys are usually undertaken at the level of enterprises or firms, because a number of the issues relevant to the measurement of ICT and electronic commerce are more appropriately answered by such units, rather than by establishments or statistical units at some other level. This could create difficulties as far as comparability with other statistics is concerned, given that much of the other economic information collected by national statistical agencies relates to establishments.

Since ICTs are used in a wide range of industries, the surveys are generally undertaken across as wide a range of industries as the business register available in that country can sustain. In most countries the agriculture sector has been excluded and in other countries industries such as construction, transport, education and health are also excluded because of difficulties with coverage within them, or because the industries are largely government-operated. Often there is also a cut-off based on the size of the firm because of problems either with the availability of a suitable business register covering all businesses or with government restrictions associated with the collection of data from very small businesses.

Good examples of these types of survey are found in Australia, Canada, the Netherlands, Portugal, Singapore and the Nordic group of countries.[9] The Nordic group survey provides an interesting contrast to the other surveys as part of it has been consciously designed as a "model survey".

The questions in the Nordic model survey are very similar to those contained in the other country surveys mentioned above. All are essentially surveys on the use of ICTs and incorporate questions based on the narrow definition of electronic commerce described earlier. The questionnaires are structured to ascertain the current and planned use of computers, websites and the Internet within a firm, assess the extent to which purchases and sales are conducted over the Internet, and then consider the barriers to the use of ICT and electronic commerce.

The Nordic survey has been used as the basis for the development of a model survey suitable for application more widely than just in the Nordic countries. The proposed survey has been prepared by Statistics Denmark in conjunction with the statistical agencies in many other countries and was endorsed by the OECD Working Party on Indicators for the Information Society in April 2001. So far, the model survey represents the best practice in this field and hence is described below in a separate section (see annex for the complete questionnaire). This may help countries, especially in the developing world, which are about to launch such a survey, to prepare their own e-commerce surveys.

3. The addition of questions to existing surveys

The practice of adding electronic commerce questions to existing surveys has been adopted in many countries and is an extremely cost-effective way of obtaining extra information. Hence, it may be a useful alternative for countries whose statistical offices have limited resources and statistical infrastructure. A few examples of questions being added to existing questionnaires, as well as alternatives used by countries to survey e-commerce, are given below. The data items collected in each of the examples are summarized in table 2.

Annual surveys

The most common examples of adding questions to existing collection vehicles are in respect of regular economic surveys of businesses in specific industries. An example of the use of this survey approach is in the 2000 Manufacturing, Wholesale, Retail and Service Industries surveys conducted by the United States Bureau of the Census (USBOC) (Mesenbourg, 2000). Here, a few additional questions were added to the Wholesale, Retail and Service Industries surveys and a supplementary computer use survey was added to the Manufacturing survey. The supple-

Table 2
E-commerce survey indicators

Type of survey	Data items collected
USBOC Manufacturing Survey	Type of networks used
	Proportion of employees with access to the Internet
	Use of ERP software
	Placing orders on-line
	Accepting orders on-line
	Type of information provided on-line
	Use of specific business processes
ABS Agricultural Survey	Use of computers on the farm
	Access to the Internet
	Type of use of the Internet
	Barriers to the use of Internet
ISTAT SME Survey	Type of use of the Internet
	Purchases and sales over the Internet
ABS ISP Survey	Numbers and type of Internet subscribers
	Volume of data sent to subscribers
	Time spent on-line by subscribers
	Number of websites hosted (total and with secure transaction capabilities)
	Number of subscribers, by amount billed
	Technical support and related services provided
	Point of presence
KNSO Cyber Shopping Mall Survey	Sales by type
	Sales by product category
	Operating costs by type
	Price competition
	Type of purchaser
	Support systems for e-commerce
	Plans to facilitate e-commerce
KNSO Corporations Survey	Ratio of e-commerce sales to total sales
	E-commerce sales by product
	Ratio of e-commerce purchases to total purchases
	E-commerce purchases by product
	Stumbling blocks to e-commerce
	Future plans to promote e-commerce

Sources: Ambler, 2000; Atrostic, Gates and Jarmin, 2000; Haltiwanger and Jarmin, 1999; Koo, 2000; OECD, 2000a.

mentary questions added to the USBOC annual Manufacturing survey sought details on the questions shown in table 2.

Another example of the approach is in the annual agricultural survey conducted by the Australian Bureau of Statistics (ABS), where questions on computer and Internet use by farming establishments have been asked in recent years. The Italian National Statistical Institute (ISTAT) has inserted a module on ICT use in its annual survey of small and medium-sized enterprises (i.e. enterprises with fewer than 100 employees).

The benefits and drawbacks of adding questions to existing surveys *vis-à-vis* conducting new surveys are set out in boxes 5 and 6.

Monthly surveys

The above surveys are examples of annual collections that generally provide information only about a year after the reference period for the survey. For some purposes, however, there is a need to have more timely information. In the United States, the Bureau of the Census has added to its monthly Retail Sales Survey an additional question about online sales. The monthly survey generally produces results within a few weeks of the end of the period and thus has the advantage of producing statistics that are available on a more timely basis. The survey provides an approximation to B2C electronic commerce and enables the results to be easily compared with the total retail sales in the United States. As this is the only example of this particular approach, it is worth considering the question in more detail. The question asked refers to:

> "the sales of goods and services over the Internet, an extranet, Electronic Data Interchange (EDI) or other online system where payment may or may not be made online" (Ambler, 2000)

Clearly such an approach is very cost-effective and provides a very timely indicator of B2C electronic commerce. The instructions and definitions are consistent with those that are being used for their measure of total retail sales, and hence the resulting statistics are comparable. It should be remembered, however, that only a small share of total retail sales is conducted online (approximately 0.8 per cent in the United States). The sampling errors associated with the measurement of such a small proportion are likely to be greater than desired.

The Korea National Statistical Office (KNSO) has also undertaken an extensive programme of adding questions to existing surveys with a view to increasing the amount of indicators of both B2B and B2C electronic commerce. It has added questions to its monthly and annual establishment surveys in the mining, manufacturing, wholesale, retail and services industry surveys. Each survey identifies whether an establishment has made any e-commerce sales and, if so, the value of such transactions.

Box 5
Benefits of adding questions to existing forms

- Costs are reduced since the only additional cost is the marginal cost of collecting and compiling the additional data items.
- The timeliness of implementation is generally enhanced as collection and computer processing systems are generally already in place.
- It is often possible to obtain additional information from the original survey to help in the analysis of results.

Box 6
Drawbacks of adding questions to existing forms

- The amount of additional information that can be added to a survey is often limited. Too many additional questions may lead to form overload.
- This increases the respondent burden on specific businesses. Respondent burden is an extremely important issue in most countries, particularly for small businesses.
- The design of the original survey vehicle may be inappropriate for the measurement of electronic commerce.
- The industrial scope of the original survey may not include all the industries appropriate for the measurement of electronic commerce.

4. Surveys of Internet service providers (ISP)

An alternative way of providing some measures of electronic commerce readiness is to survey Internet Service Providers (ISPs). While this approach will not provide the priority indicators for international comparability referred to earlier, it will provide some indicators that are useful within a national context. The ABS started such a survey in 2000 and released its first results in March 2001.

Some of the drawbacks of this approach are that it does not provide statistics on the value of sales undertaken within a period, or any of the other priority indicators listed above. However, it does provide an alternative survey type for those countries unable to conduct surveys that might meet those priority requirements. In particular, it could be a useful approach for countries without adequate national statistical business registers (see below). The survey itself is relatively cheap to conduct, as there are few ISPs operating in most countries. It also provides regional statistics, an aspect of electronic commerce and the use of ICT that has a high priority in many countries. In short, for some developing countries it might be a useful starting point for collecting e-commerce indicators.

5. Cyber shopping mall survey

The KNSO has developed a new collection of statistics from cyber shopping malls in order to measure B2C electronic commerce. As from April 2000, the Cyber Shopping Mall survey has been collecting the data items shown in table 2 as well as classificatory data on the shopping mall, including details of whether it is solely an online mall or whether it provides both online and offline services.

The advantage of this kind of survey is that it is relatively easy to implement and that it captures all businesses that have opened Internet-based cyber shopping malls for either B2B or B2C e-commerce. On the other hand, it may be difficult to identify the malls, and the survey can capture only the e-commerce conducted through the malls, thus omitting any other e-commerce.

6. Korea Corporations survey

The KNSO has also initiated a new collection of statistics aimed at measuring trends in B2B e-commerce — the quarterly Corporations survey. This is primarily a survey of private and publicly owned large businesses, based on available lists such as the Korea Stock Exchange. In addition to the general information collected regarding the firm, the survey collects the e-commerce-specific data items shown in table 2.

KNSO has acknowledged that there is considerable work to be done to improve the coverage of e-commerce measured through both the Cyber Shopping Mall survey and the Corporations survey. Nevertheless, it feels that they offer substantial promise in achieving better measures of electronic commerce transactions.

E. A model survey for measuring e-commerce

Governments and statistical offices wishing to start collecting indicators on electronic commerce may consider using a model survey rather than starting to develop new questionnaires. Model surveys that have been previously tested and improved are very useful since they help countries to learn from mistakes made by other countries. The Nordic business survey mentioned above is a good example that could be adopted by other countries, including those from the developing world. The survey has been tested across the countries of the Nordic region. On the basis of their experiences, and with inputs from statistical offices in other countries, Statistics Denmark prepared the model survey, which was endorsed by the OECD in April 2001. It can be implemented across a wider range of countries.[10] The use of this model survey questionnaire will facilitate the comparison of the results internationally and may be a very useful starting point for developing countries as they begin their own statistical programmes to measure electronic commerce.

The following outlines the main features of the survey (Boegh Nielsen et al., 2000). A complete set of the questions being proposed to the OECD is provided in the annex.

The model questionnaire is based on the following principles:

- It is designed to be flexible and modular, facilitating the development of country-specific features;
- It is designed to measure Internet activity at present, but it can be updated quickly as required by changes in technology;

- It is a general survey tool for measuring economic activity; and
- It largely takes a qualitative approach to measuring ICT use and the Internet.

The questionnaire has five main components, or modules: (i) general information about ICT systems; (ii) use of the Internet; (iii) e-commerce via the Internet; (iv) e-commerce via EDI or other computer-mediated networks (other than the Internet); and (v) barriers to the use of the Internet and ICT in general.[11] Table 3 outlines the main topics included under each module. They mainly cover readiness and intensity indicators.

Developing countries interested in using this model survey for developing their own e-commerce surveys should keep in mind that it is based on the experiences of some of the most advanced countries in relation to ICT and e-commerce use. Developing countries may therefore want to use the model as a basis and add or modify questions, which would correspond to the specific situation in their economies. For example, useful additions of indicators in a technologically less advanced country might be:[12]

- Under Module A (use of the Internet): questions on the management of the website (hosted by third parties or not);
- Under Module C (e-commerce via the Internet): questions on online sales through portals; and
- Under Module E (barriers): questions on the use of intermediaries specializing in e-commerce.

F. How do we prepare for e-commerce surveys?

Before starting a programme on collecting statistical indicators for electronic commerce, it is worth considering a few conditions that should be put in place by countries or agencies planning to carry out surveys on e-commerce. Irrespective of whether the strategy adopted relates to conducting new surveys, or merely adding questions to the existing surveys, there are a number of factors to be considered for compiling reliable statistics. This section looks at these conditions and discusses alternatives in case a country cannot meet them, taking into account the situation in developing countries.

Table 3
Modules included in Nordic Survey

Module	Topics included
A. General information about ICT systems	1. Use of PCs, workstations and terminals 2. Use or planned use of specific ICT activities 3. Percentage of employees who have access to PCs, etc. and the Internet (WWW)
B. Use of the Internet	1. Use or planned use of the Internet 2. Type of external connection to the Internet 3. Purpose of use of the Internet 4. Use or planned use of own website
C. E-commerce via Internet	1. Purchases via the Internet 2. Purchases via specialized market places 3. Expected benefits from Internet purchases 4. Sales via the Internet 5. Internet sales by customer group and destination of sales 6. Sales via specialized market places 7. Motivations for Internet sales
D. E-commerce via EDI or other computer-mediated networks (non-Internet)	1. Use or planned use of EDI or other computer-mediated networks 2. Type of use 3. Purchases via EDI or other computer-mediated networks 4. Sales via EDI or other computer-mediated networks
E. Barriers to the use of the Internet and ICT in general	1. Barriers to ICT in general 2. Barriers to the use of the Internet 3. Barriers to Internet sales

1. Check your business register

The first consideration relates to the business register available in a country. Electronic commerce can be undertaken by, and can affect, all types of businesses, small or large, irrespective of the industry to which they belong. Hence, in order to measure the type of business indicators referred to earlier, the first requirement is to have a reliable business register. It should cover all types of businesses, and for the sake of efficiency, it has to be kept up to date with the introduction of new businesses and the deletion of businesses that cease to operate, while allowing for changes in the structure of other businesses.

For efficiency in sampling, it is also important for a business register to contain as many classification variables as possible for the surveys to be undertaken. Generally this means that it is imperative to have an indicator for the size of a business and an indicator for its main activity.

Many developed countries have a reasonably good quality business register, with mechanisms in place for covering all sectors of the economy and all sizes of business (except perhaps for very small businesses). In the case of developing countries, the chances of having good-quality business registers are much smaller, a fact which affects their ability to mount statistical collections quickly and efficiently. For example, business registers that are not updated regularly miss a significant number of smaller firms, where the annual turnover is much higher compared with larger firms. In 1999, Singapore conducted a survey of electronic commerce of only the top 1,000 businesses in Singapore, and the top 1,000 firms providing information technology services (Wong and Lam, 1999). Such an approximation is likely to have to be made if no complete business register is available. If no register is available at all, countries will have to resort to other sources, such as Chambers of Commerce or Manufacturers, or telephone book listings.

2. Identify your user needs

Another prerequisite for conducting an electronic commerce survey is to develop a questionnaire based on a detailed model of the user needs from such a survey, i.e. the kind of data desired (see section B). This questionnaire-designing stage is extremely important as mistakes made in the design of a questionnaire will significantly affect the quality of the data collected. Hence, after an initial design has been made, it is important to undertake sufficient field tests to ensure that the survey works effectively. The development of model surveys is a crucial step in overcoming problems in this respect as it helps to transfer lessons learned in one country to another. By the same token, it is important to note that a question that might work very effectively in one language or country may not work quite so well in another because of language or cultural differences. In addition, the terminology used in the field of electronic commerce needs to be checked. There are significant differences in the understanding of the term, not only between countries, but also between different groups of people within the same country.[13] Thus the importance of field-testing the questionnaire must be recognized at the outset.

As noted earlier, it is likely that developing countries will have different requirements, or user needs, for indicators of electronic commerce. As shown by the S-curve discussed earlier (chart 1), developing countries, in the short term, are likely to be more interested in compiling indicators of e-commerce readiness, while developed countries appear to be more interested in indicators which measure the intensity of use. Therefore, the indicators contained in the APEC E-Commerce Readiness Assessment Guide might be more suitable for some developing countries at present than some of the indicators relating to intensity and impact of e-commerce.

3. Design your collection strategy

An important step in the development of an overall statistical process is to work out a collection strategy. National statistical agencies often have compulsory powers of collection — at least for some types of collection; policy departments in the same countries mostly do not have the same powers. General experience from around the world has been that voluntary surveys do not work very effectively, since in many cases the response rates were only 20–30 per cent. Voluntary surveys conducted by national statistical agencies often perform a little better than that, but still struggle to reach a 50 per cent response rate.[14]

It is difficult to quantify the impact of low response rates on the quality of the statistics compiled from the survey. If the non-response is purely a random happening, the low response rates will merely imply a greater degree of sampling error than desired. However, it is more likely that non-respondents will be different from respondents (as they did not answer

in the first place), which means that the omission of such businesses from the survey results will bias the answers, often by an extent and in a direction that cannot be easily estimated. Thus it is important to recognize the importance of achieving a good response rate.

Developing countries are less likely to have appropriate collection systems in place to facilitate the compilation of electronic commerce indicators and their national statistical agencies are less likely to have compulsory powers of collection. For them, one option to enhance a good response rate would be to have an appropriate cover letter attached to the survey form, signed by someone who may be important to the receiver of the form, stating why it is important to participate.

4. Prepare an attractive survey form

A key consideration in achieving a good response rate is the quality of the questionnaire design and the subject matter of the survey. If the subject matter appears to be important to the reader, and the reader can answer the question without reference to a great deal of bookwork, the survey questionnaire has a much greater chance of being completed. If, on the other hand, the survey form appears to be irrelevant to the business in question, or if it was sent to a person in the organization who is unable to answer the questions, it is unlikely that it will be completed. The survey taker needs to understand these issues, otherwise the questionnaires are unlikely to be completed. Even in the case of compulsory surveys (where response rates of 90 per cent or higher are often achieved), form fillers may well take an easy option in the completion of the form and omit answering questions they do not understand or think are not relevant for their business. In the case of electronic commerce surveys, many countries have adopted questionnaire designs which feature a greater use of tick-box answers than is normally the case. This is undoubtedly one of the reasons for the good response rates (for a voluntary survey) achieved by Statistics Denmark in its most recent survey.

Another aspect affecting form completion that needs to be recognized is the overall respondent burden on an individual businessperson. Generally this is related to the overall length of the questionnaire. Respondent burden on individual businesses, particularly large businesses, is less likely to be a problem in developing countries as those countries have less developed statistical systems and hence the number of questionnaire forms being sent to these large businesses will be smaller. Thus there may be less reluctance in developing countries to complete forms about electronic commerce.

G. Conclusion and outlook for the future

1. How useful are e-commerce indicators?

While it is still early in the development of electronic commerce indicators, the experience to date has been very positive. In many countries, the collected indicators have highlighted a number of barriers to the wide implementation of electronic commerce, providing Governments with keys to future policy development. Some indicators have demonstrated digital divide issues, highlighting areas of the population and business community that have been disadvantaged. They have also pointed to areas of concern such as age and training, and to security, a key aspect when related to the actual conduct of commercial transactions, especially for small and medium-sized enterprises and private householders. So far, indicators have mainly been used in the areas of readiness and intensity. The third general area of use — measuring the impacts of electronic commerce — has not yet been subject to statistical measurement to any substantial degree.

With respect to readiness and intensity indicators, a prime example comes from Canada, where the Government made a commitment in 1997 to make Canada the most "connected" nation in the world by the year 2000.[15] To be able to test progress in this regard, it has been necessary to form an overall indicator for Canada and compare and contrast it with similar ones from other countries. The Conference Board of Canada and Industry Canada have now established such an indicator and it provides a very useful tool to measure the effectiveness of government action in attaining the overall policy objective.

The Nordic countries have for some years been concerned about the impact of ICT use on their countries. The Government of Denmark has recently set itself an objective similar to that of the Canadian Government and will undoubtedly want to undertake a similar indicator exercise. The Danish Government is using e-commerce indicators (such as the number of enterprises with PCs, the share of the workforce with access to PCs, the number of enterprises with

access to the Internet, the number of enterprises with web pages, the number of enterprises with e-commerce transactions and total e-commerce) as indicators for benchmarking the Danish information society with competitors internationally. Also, information on e-commerce barriers, such as the lack of qualified people, has been used for more specific policy purposes. Information about the share of the workforce with PCs has been used to estimate the amount of investment needed for providing everyone with a PC at work.

The European Commission, in its eEurope action plan, has used data on ICT penetration in enterprises as a main indicator on the development towards the information society with regard to enterprises.

The United Kingdom is implementing a strategy that will bring together a wide range of indicators through an international benchmarking study as well as through implementation of a range of statistical initiatives as part of its overall official statistical programme. The United States has formulated a plan to introduce the measurement of electronic commerce transactions throughout its entire statistical measurement programme and is in the process of implementing this plan. In this way the United States is aiming to be eventually able to tackle the more complex task of measuring the impact of electronic commerce on the overall performance of the economy.

Finally, the APEC leaders, at their last meeting in Brunei (November 2000), agreed in their final declaration to:

> "Use the results of the APEC E-Commerce Readiness Assessments for APEC Economies to further explore collective and individual actions, including by implementing the follow-on 'Readiness Evaluation Action Partnerships' showcasing practical actions to remove roadblocks to participation in electronic trade" (WTO, 2000).

2. Suggestions for policy action

The rapid growth in electronic commerce around the world has prompted many to look for better ways of measuring the phenomenon. As more and more countries and international agencies become involved, it is important to develop plans to ensure that there is no unnecessary duplication of effort and that users have the data necessary for informed decision-making at the earliest possible opportunity. From the above discussion, it appears that there are a number of actions that could be taken by national statistical agencies in both developed and developing countries:

- Assuming leadership for the development of international standards, concepts, definitions and model surveys by associating with the relevant international agencies;
- Collaborating with other national statistical agencies (particularly national statistical agencies in developed countries collaborating with those in developing countries), to improve the quality of statistical indicators that can be made available;
- Participating in seminars and workshops organized by international agencies aimed at improving statistical standards in the measurement of electronic commerce.

Those statistical offices that are about to start their compilation programmes on e-commerce are advised to consider the checklist discussed above, which includes:

- Checking the national business register;
- Identifying user needs for e-commerce data;
- Designing a collection strategy; and
- Preparing an attractive survey form.

Bearing in mind that the priority statistical indicators of electronic commerce in some developing countries are likely to focus on the readiness of those economies for electronic commerce, national statistical agencies in those countries are encouraged to develop, as a first step, readiness indicators of the type already discussed (such as those included in the APEC E-Commerce Readiness Assessment Guide, the OECD proposed set of indicators or the Nordic model survey). Those countries that see themselves at a more mature stage in their e-commerce development are encouraged to include intensity indicators in their e-commerce statistical compilation programmes (see those proposed by the OECD and Eurostat and included in the model survey).

Given their resources and statistical infrastructure, national statistical agencies in the developed countries are in a better position to contribute to the development work and are encouraged to do so. They are, however, strongly encouraged to work with their counterparts in developing countries to assist them in the development of the statistical infrastructure needed for the compilation of electronic commerce indicators and subsequently with the derivation of electronic commerce indicators themselves.

Notes

1 For example, some studies include all business activities carried out over the Internet, while others include only those that result in the purchase of a good or service. Some use personal interviews, and others use e-mail surveys or website surveys. Moreover, the methodologies used for calculating estimates vary widely among the studies. For a discussion on methodologies used by private data collectors, see OECD (2000c).

2 Definitions have been provided by, inter alia, UNCTAD (2000) and WTO (1998). While useful for describing the current status and possible trends of e-commerce, they have not been designed as a basis for compiling internationally comparable data on e-commerce. This is partly because most existing definitions are the product of individual researchers rather than, for example, a working group representing the member States of an international organization.

3 Carried out through its Working Party on Indicators for the Information Society.

4 All OECD member countries have agreed to use these definitions in their statistical work in measuring e-commerce (including Eurostat members, the Nordic countries, the United States, and Canada). However, some will use the narrow definition, and others the broad definition, as explained in the text.

5 One aspect that has not yet been fully resolved relates to electronic commerce conducted using e-mail. Some experts view e-mail transactions as being little different from transactions taking place using fax machines or ordinary (postal) mail and would therefore like these to be excluded from electronic commerce. However, experts from other countries consider it necessary to include e-mail orders within electronic commerce, particularly in the household sector, where the majority of such transactions occur.

6 This definition is more in line with the concept of electronic business, as identified by Statistics Canada (1999).

7 The APEC Guide defines "readiness" as the degree to which the economy of a community is prepared to participate in the digital economy. This is the same concept as the one adopted by OECD.

8 Some statistical indicators on the readiness aspect can also be derived from information supplied by telecommunications carriers, rather than by the businesses themselves.

9 Denmark, Finland, Iceland, Norway and Sweden.

10 The Nordic group will also present its survey to the United Nations Voorburg Group, a group of statisticians, mainly from national statistical agencies, which was formed to facilitate the availability of services sector statistics. The Voorburg Group has had some experience in developing model surveys, having developed a model computer services industry survey in the early 1990s.

11 An additional (non-core) module X on background information about the enterprise is included where the information requested is not available from national business registers.

12 These indicators are taken from ISTAT (2000).

13 In Slovenia, surveys on the information society have been carried out since 1996. Vehovar (1999) points out that the translation of the English term "electronic commerce" into Slovene comes closer to "electronic business" rather than "electronic trade". Hence, a definition clearly specifying the activities involved is critical.

14 In this regard, it is interesting to note that Statistics Denmark (2001) achieved a response rate of 67 per cent in its most recent ICT Use in Business survey.

15 In this regard, "connectedness" can be considered to relate to both readiness and intensity.

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Annex

Nordic Model Questionnaire[1]

Indicators

Module A: General information about ICT systems

A1.	**Does the enterprise use personal computers, workstations or terminals?** (Filter question)	Yes	No →	Go to question E3	
A2	**Does the enterprise use or plan to use ICT in the following areas?**[2] (Multiple choise)	Year t-1 or earlier	Year t	Year t+1	Do not know/ not relevant now
	E-mail (including e-mails reached by any means)				
	Internet (access to www)				
	Intranet[3]				
	Extranet[4]				
	Computer-mediated networks other than Internet (e.g. EDI, Minitel, Interactive telephone systems)				
	WAP (The enterprise as supplier of WAP services)				
A3.	**The share of the total no. of employees using in normal work routine:**				
	Personal computer, workstation or terminal	___%			
	Personal computer connected to the Internet/www	___%			

Module B: Use of Internet

(asking enterprises with ICT)

B1.	**Does the enterprise use or plan to use Internet?** (Filter question)	Year t-1	Year t or earlier	Year t+1 →Go to B3	Do not know/ not relevant now →Go to D1
B2.	**Type of external connection to the Internet in year t?** (Multiple choise)				
	Modem (analog)				
	ISDN				
	xDSL (ADSL, SDSL etc.)				
	Other fixed connection < 2Mbps (Frame relay or other broadband network service)				
	Other fixed connection >= 2Mbps (Frame relay or other broadband network service)				
	Do not know				
B3.	**For what purposes does the enterprise use or plan to use Internet?**				
B3-1.	**General activities** (Multiple choise)	Year t-1 or earlier	Year t	Year t+1	Do not know/ not relevant now
	Information search				
	Monitoring the market (e.g. prices)				
	Communication with public authorities				
	Banking and financial services				
	Information about employment opportunities (recruitment and search)				
B3-2.	**Activities related to purchasing goods and services** (Multiple choise)	Year t-1 or earlier	Year t	Year t+1	Do not know/ not relevant now
	Information search on homepages				
	Receiving purchased digital products				
	Receiving free digital products				
	Obtaining after sales services				

1 As proposed to the OECD in April 2001.
2 The ICT-indicators such as Internet and EDI should not be asked if they are used as filter-questions in other modules.
3 An internal company communications network using the same protocol as the Internet allowing communications within an organization.
4 A secure extension of an intranet that allows external users to access some parts of an organization's Intranet.

Annex (contd.)

Indicators

B4. Does the enterprise have or plan to have a Web site? (Filter question)	Year t-1	Year t	Year t+1	Do not know/ not relevant now →Go to C1
B4-1. Activities related to selling goods and services (Multiple choise)	Year t-1 or earlier	Year t	Year t+1	Do not know/ not relevant now
Marketing the enterprise's products				
Inquiry/contact facility				
Customized page for repeat clients (e.g. customized presentation of product preferences)				
Facilitating access to product catalogs, price lists etc.				
Delivering sold digital products				
Capability to provide secure transactions (e.g. firewalls or secure servers)				
Integration with back end systems				
Providing after sales support				

Module C: E-commerce via Internet[5]

(asking enterprises with Internet access)

C1. Purchases via Internet				
Has the enterprise purchased products via the Internet in year t? (Filter question)	Yes	No →	Do not know →	Go to C4
What percentage of the total purchases (in monetary terms) do the Internet purchases represent?[6]	__%	Do not know		
Has the enterprise paid on-line[7] for products purchased on the Internet?	Yes	No	Do not know/ not relevant now	
C2. Has the enterprise purchased products via specialized Internet market places[8] in year t?	Yes	No	Do not know/ not relevant now	
C3. Expected benefits from Internet purchases (Multiple choice)	No importance	Some importance	Much importance	Do not know/ not relevant now
To reduce costs				
Increased access to, and awareness of, suppliers				
To speed up business processes				
C4. Sales via Internet				
Has the enterprise received orders via the Internet in year t? (Filter question)	Yes	No →	Do not know →	Go to D1
What percentage of the total turnover (in monetary terms) do the Internet sales represent?[9]	__%	Do not know		
Has the enterprise received on-line[10] payments for Internet sales in year t?	Yes	No	Do not know/ not relevant now	
C5. Breakdown of Internet sales				
Please break down the Internet sales in year t into the following customer groups/destination of sales (estimate in percentage):				
1) Other enterprises 2) Households 3) Others (1+2+3= 100 %)	__%	__%	__%	Do not know
1) Homemarket (domestic sales) 2) Exports (non domestic sales) (1+2=100 %)	__%	__/%	Do not know	

5 Depending on decision concerning definition of e-commerce. This module includes EDI over the Internet.

6 The proposal is to ask about percentage of total purchases and sales instead of accurate money values. The reason is the experiences from the Nordic surveys where respondents have preferred this option. In case, a country wants to ask directly for money values this can be done as well. As total amounts of purchases and sales are asked in module X, the percentages can be converted into money values or vice versa.

7 On-line is defined as an integrated ordering-payment transaction.

8 More than one enterprise is represented at the website. The market sells either certain goods/services or is adressed towards limited costumer groups.

9 See note 6.

10 See note 7.

Annex (contd.)

Indicators

C6.	**Has the enterprise sold products to other enterprises via a presence on specialized Internet market places[11] in year t?**	Yes	No	Do not know/ not relevant now	
C7.	**Motivations for Internet sales** (Multiple choise)	No importance	Some importance	Much importance	Do not know/ not relevant now
	Company image considerations				
	To reduce business costs				
	To speed up business processes				
	To improve quality of services				
	To reach new customers				
	To expand the market geographically				
	To launch new products				
	To keep pace with competitors				

Module D: E-commerce via EDI or other computer-mediated network (other than Internet)[12]

(asking enterprises with ICT)

D1.	**Does the enterprise use or plan to use EDI or other computer-mediated networks?** (Filter question)	Year t-1 or earlier	Year t	Year t+1	Do not know/ not relevant now → Go to E1
D2.	**Is EDI or other computer-mediated networks used in relation to:**	Year t-1 or earlier	Year t	Year t+1	Do not know/ not relevant now
	Customers				
	Suppliers				
	Other cooperating partners				
	Banks/Financial institutions				
	Public organisations/institutions				

D3. Purchases via EDI or other computer-mediated networks

If the enterprise orders products via EDI, what percentage of the total purchases (in monetary terms) does this represent in year t?[13] __% Do not know

D4. Sales via EDI or other computer-mediated networks

If the enterprise receives orders via EDI, what percentage of the total turnover (in monetary terms) does this represent in year t?[14] __% Do not know

Module E: Barriers on the use of Internet and ICT in general

(Asking enterprises with ICT, general barriers also asking enterprises without ICT)

What significance does the following barriers have for the present and future use of ICT?

E1.	**Barriers on Internet sales**	No importance	Some importance	Much importance	Do not know/ not relevant now
	The products of the enterprise not applicable for Internet sales				
	Customers not ready to use Internet commerce				
	Security problems concerning payments				
	Uncertainty concerning contracts, terms of delivery and guarantees				
	Cost of developing and maintaining an e-commerce system				
	Logistical problems				
	Considerations for existing channels of sales				

11 See note 8.
12 Depending on decision concerning definition of e-commerce. EDI over the Internet is included in module C.
13 See note 6.
14 See note 6.

Annex (concluded)

Indicators

E2. Barriers on use of Internet	No importance	Some importance	Much importance	Do not know/ not relevant now
Security concerns (e.g. hacking, viruses)				
Technology too complicated				
Expenses of development and maintenance of websites too high				
Lost working time because of irrelevant surfing				
Data communication expenses too high				
Data communication is too slow or unstable				
Lack of perceived benefits				

E3. Barriers on the use of ICT in general	No importance	Some importance	Much importance	Do not know/ not relevant now
ICT expenditure too high				
New versions of existing software introduced too often				
Supply of ICT-technology not matching the ICT needs of the enterprise				
The level of ICT skills is too low among the employed personnel				
Difficult to recruit qualified ICT personnel				
Existing personnel reluctant to use ICT				
Lack of an updated ICT strategy				
Lack of perceived benefits				

Module X: Background information[15]

X1. Name and address of the enterprise

X2. Activity of the enterprise

X3. No. of employees end of year t

X4. Total purchases of goods and services in year t (national currency)

X5. Total sales in year t (national currency)

15 The information asked in this module might be available – or a number of them – from the Statistical Business Register and/or statistical registers and thus not included in the questionnaire.

Chapter 2

ELECTRONIC COMMERCE AND DEVELOPING COUNTRIES: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

A. Introduction

The United States, currently the leading country in electronic commerce (e-commerce), showed impressive GDP and productivity growth rates during the 1990s. In particular between 1995 and 2000, productivity growth accelerated significantly, reaching an annual rate of 2.5 per cent, significantly higher than the rate of the previous two decades.[1] Much of this growth is explained by the increased use of information technology, and in particular e-commerce. It is expected that European countries will catch up quickly with the United States in their use of e-commerce, and that developing countries, with a certain degree of preparation, could follow suit and converge in productivity with the developed countries. This could significantly boost their economic growth rates. On the other hand, if countries lag behind in their technological development, what will be the impact on macroeconomic growth and development?

This chapter addresses this question and analyses the overall impact of e-commerce on the global economy by simulating two scenarios: one in which developing countries fall behind technologically (characterized by less productivity growth than developed countries), and a second in which they catch up with the developed countries. It is assumed that e-commerce has a direct impact on cost savings in service sectors, particularly in wholesale and retail trade, financial and business services, and transport services. These cost savings are simulated through a productivity growth scenario, using a computable general equilibrium model. This allows for analysis of the impact of e-commerce on macroeconomic variables such as GDP, welfare, wages and terms of trade.

The chapter is organized in six sections. The second section provides a short discussion of how cost savings may result from business-to-consumer (B2C) and business-to-business (B2B) e-commerce. The third section presents briefly some recent studies on the overall impact of e-commerce on developed countries' economies. The fourth section turns to the modeling exercise. It first describes the methodology used, and then shows the results of two experiments: (a) one in which developed countries experience a 1 per cent productivity growth (developing countries fall behind); and, (b) one in which developing countries converge in productivity in services sectors and experience a 1 per cent productivity growth (developing countries catch up). Finally, the last section presents some conclusions.

B. E-commerce and cost savings

It is widely recognized that e-commerce reduces transaction costs, increases efficiency, and generates important changes in the management and production processes of businesses. For example, by linking industries and consumers through the Internet, B2C e-commerce has the potential to significantly reduce transaction costs. It also increases access to information for consumers, thus reducing search costs and allowing consumers to find the lowest price for a product or service. B2C e-commerce also reduces market entry barriers for producers, given that the cost of setting up and maintaining a web site is much lower than the installation of a "brick-and-mortar" firm. A larger number of suppliers will increase competition and reduce monopolistic profits of firms.

In the B2B sector, e-commerce contributes most to reducing costs by linking industries and suppliers electronically along the supply chain. It reduces procurement costs because it makes it possible to find the lowest supplier prices. It increases efficiency because greater competition among suppliers will reduce monopolistic profits and the number of intermediaries. It also reduces the cost of providing financial services or other services that can be made available

electronically through the Internet. Moreover, a better flow of information reduces inventory stocks.

Garicano and Kaplan (2000) classify transaction costs as coordination and motivation costs, and argue that B2B e-commerce has the potential to affect both types of transaction costs. Coordination costs are related to the determination of prices and the details of a transaction, to the mutual knowledge of potential buyers and suppliers, and to bringing them together to conduct a transaction. B2B e-commerce reduces this type of costs by improving the efficiency of business processes, for example when a transaction that is normally conducted by phone or fax is made by Internet, or when business processes are redesigned. Coordination costs are also reduced when B2B e-commerce improves access to direct information, for example by reducing search costs in finding suppliers and allowing them to reach more potential buyers at lower cost. B2B e-commerce also reduces coordination costs by providing better information on the availability, characteristics and prices of products, buyers and sellers.

Motivation costs are related to the costs of informational incompleteness and imperfect commitment. Costs of informational incompleteness occur when buyers and suppliers do not have all relevant information to find out whether the terms of an agreement are fulfilled, for example whether the product provided by the supplier satisfies all the technical requirements of a productive process. B2B e-commerce reduces these costs through the standardization of products. Costs of imperfect commitments are produced when buyers and suppliers do not have the ability to bind themselves. E-commerce contributes to reducing these costs by standardizing processes and allowing for electronic tracing of products.

It is expected that most cost reductions related to B2B e-commerce will be in procurement costs. According to Goldman Sachs analysts[2], it is estimated that in the United States the percentage saving in the cost of inputs that results from migrating from traditional procurement systems[3] to B2B e-commerce varies from 2 per cent for coal to 39 per cent for electronic components. These cost savings are the result of the combined effect of reductions in transaction costs and greater competition among suppliers. Table 4 shows the savings in cost of inputs by industry.

Table 4
Estimated B2B cost savings by industry

Industry	Cost savings *(%)*
Aerospace machinery	11
Chemicals	10
Coal	2
Communications/bandwidth	5-15
Computing	11-20
Electronic components	29-39
Food ingredients	3-5
Forest products	15-25
Freight transport	15-20
Healthcare	5
Life science	12-19
Machinery (metals)	22
Media & advertising	10-15
Maintenance repair and operating supplies	10
Oil & gas	5-15
Paper	6
Steel	17

Source: Goldman Sachs Investment Research (1999), p.8.

C. E-commerce and productivity growth

Despite the growing evidence of the importance of e-commerce at the microeconomic level, doubts have been raised about its impact on macroeconomic growth. During the past few years, a debate has evolved as to whether information technology can explain the acceleration in productivity growth. At the root of this debate was the fact that the United States, the leading country in information technology and e-commerce, has experienced impressive GDP growth since 1995. This output expansion has been characterized by an acceleration in productivity growth, very low unemployment rates, low inflation rates, and a reduction of fiscal deficits. This debate was linked to the "productivity paradox"[4], which states that productivity statistics do not seem to provide any evidence of the impact of computer and information technologies. There are three main positions among economists to explain the productivity paradox: (i) there is a mismeasurement problem; (ii) there is nothing paradoxical[5]; and (iii) the observation of positive macroeconomic effects requires decades rather than years, as the economy is in a process of transition.

Robert Gordon believes that all of the United States productivity growth originated from the computer-manufacturing industry and that technological progress acceleration in all other industries is zero, arguing that: "For the economy as a whole, extra capital plus growth in computing technical progress constitute the whole of the increase in labor productivity: the contribution from technological progress outside computing is zero".[6]

Nordhaus (2001) evaluated Gordon's hypothesis and rejected it. Using a new approach to measuring industrial productivity, he showed that during the period 1996-1998, productivity growth in both the new economy[7] and non-new economy sectors grew faster than in the 1977-1995 period. He concluded that productivity growth is widespread and not concentrated in a few sectors of the new economy.

Similarly, the *Annual Report* of the United States Council of Economic Advisers[8] shows evidence of productivity growth in both computer and non-computer sectors. The report considers that changes in productivity have cyclical and structural components. A structural acceleration in productivity may originate from four sources: (i) capital deepening; (ii) improvements in labor quality; (iii) technological progress in computer-producing industries; and (iv) technological progress in other industries.

Table 5 shows statistical estimates of labour productivity and its components, where labour productivity is calculated as the average of income-and-product side measures of output per hour worked. These figures indicate that in the private non-farm business sector, there was a structural acceleration in productivity for the 1995-2000 period, compared to the 1973-1995 period, due to the productivity growth in both computer and non-computer sectors. The contribution coming from the productivity growth of the non-computer sector is calculated as a residual and accounts for 1 per cent of the acceleration in productivity. This last figure represents, therefore, the impact on productivity growth of technological progress and management and production system improvements outside the computer sector, such as those related to e-commerce, computer and web-based learning.

These results are consistent with the idea that the use of information technology contributes most to the expansion of productivity, but not the production of information technology products. Atkinson and Court (1998) argue that "… the animating force for productivity and wage growth in the New Economy will be the pervasive use of digital electronic technologies to increase efficiency and productivity".

Table 6 shows the productivity growth in various services industries, as measured by the value added per full-time equivalent employee. These figures show that there has been an acceleration in productivity growth since 1995 in sectors such as wholesale and retail trade, financial and business services. Although there are some data problems in certain sectors, these figures seem to give some support to the hypothesis that the use of information technology, coupled with

Table 5
Accounting for the productivity acceleration in the 1990s
(Private non-farm business sector; average annual rates)

Item	1973 to 1995	1995 to 2000	Change (percentage points)
Labour productivity growth rate (per cent)	1.39	3.01	1.63
Percentage point contributions			
Business cycle effect	0.00	0.04	0.04
Structural labour productivity	1.39	2.97	1.58
Capital services	0.70	1.09	0.38
Labour quality	0.27	0.27	0.00
Computer sector TFP	0.18	0.36	0.18
TFP excluding computer sector	0.22	1.22	1.00

Source: United States (2001), p. 28.

Note: TFP denotes total factor productivity.

improvements in business practices, has, in fact, increased productivity growth.

Some studies have tried to evaluate the impact of e-commerce on developed countries using macro-econometric or computable general equilibrium (CGE) models. Their results indicate that e-commerce could have a significant positive impact on GDP growth and other macroeconomic variables.

Brooks and Wahjai (2000) used the MULTIMOD[9] model to estimate the macroeconomic impact of B2B e-commerce on some developed countries (United States, Japan, Germany, United Kingdom and France). They first calculated savings from procurement in selected industrial sectors, and used input-output accounts to calculate price reductions of inputs for other industries. They then used the MULTIMOD model to estimate the total effect on the economy. The results indicate that in the five economies, B2B e-commerce will raise GDP by about 5 per cent, with over half of this increase expected within the next 10 years.

A study by the Australian Government[10] used a mixed methodology to estimate the impact of e-commerce on the Australian economy. It combines qualitative information provided by business leaders from selected industry sectors with quantitative analysis provided by the Monash model.[11] The study estimated that e-commerce would increase GDP by about 2.7 per cent (direct and indirect effects) by the year 2007. It would also increase imports and exports, improve terms of trade, and increase real wages. The increase in trade would result in a trade deficit.

In short, there is now a growing trend among economists to agree that B2C and B2B e-commerce can have a positive impact on productivity and growth in developed countries.

D. The impact of e-commerce on the global economy: a CGE analysis

As a contribution to this debate, this section presents the results of a quantitative analysis of the impact of e-commerce on the global economy. It discusses two scenarios: one in which developing regions fall behind technologically, and a second in which they catch up with developed regions.

The analysis is centered on cost savings, assuming that e-commerce can reduce the costs of services. As services are important inputs to other production sectors, their cost reduction will spread across the economy. In a partial equilibrium framework, a cost reduction will push the supply curve out to the right, thereby achieving a new equilibrium where output will increase and prices will decline. In this analysis, special attention is given to the effects of cost reductions in transport services, wholesale and retail trade,

Table 6
Labour productivity growth by private industry - services
(Average annual percent change)

Item	1973 to 1995	1995 to 2000	Change (percentage points)
Transportation	2.48	1.72	-0.76
Trucking and warehousing	2.09	-0.73	-2.82
Transportation by air	4.52	4.52	0.00
Other transportation	1.51	2.14	0.63
Communications	5.07	2.66	-2.41
Electric, gas, and sanitary services	2.51	2.42	-0.09
Wholesale trade	2.84	7.84	4.99
Retail trade	0.68	4.93	4.25
Finance	3.18	6.76	3.58
Insurance	-0.28	0.44	0.72
Real estate	1.38	2.87	1.49
Personal services	-1.47	1.09	2.55
Business services	-.16	1.69	1.85
Health services	-2.31	-1.06	1.26
Other services	-0.72	-0.71	0.01

Source: United States (2001), p. 32.

as well as business and financial services. Except for transport services, these are sectors where the use of information technology and improvements in business practices through e-commerce have contributed most to the productivity increase in the United States. Although, at present, there is no evidence of productivity growth in transport services (see table 6), this sector is included because it is expected that the transformation of the traditional transport chain and other features of e-commerce will produce significant gains in productivity.[12]

For the purposes of the analysis, countries were aggregated into six regions: developed countries, Eastern Europe, Asia, Latin America, Africa and the rest of the world. Commodities were aggregated into 13 sectors: primary/food, manufacturing, trade, air transport, maritime transport, other transport, communications, financial services, insurance, business services, recreational services, government and other services. Factors of production were divided into five factors: capital, land, unskilled labour, skilled labour and natural resources.

To analyse the impact of cost savings in services on the global economy, due to e-commerce, a general equilibrium framework is used.[13] Specifically the GTAP[14] model is used to run the simulations. The multisector specification provided by the GTAP model makes it possible to consider the transmission of technological change effects across sectors of a region, while the multiregion specification enables us to analyse the transmission across regions.[15]

It must be pointed out that the simulations below should be considered as an exploratory exercise that is used to understand the nature and direction of the impact of e-commerce, but not for forecasting purposes.[16]

1. Falling behind technologically: productivity growth in developed countries only

The first experiment simulates a cost reduction in services, due to e-commerce, in developed countries only. The aim of this experiment is to examine the impact of e-commerce on developing regions when they do not keep up with developed regions technologically. This cost reduction is simulated through an increase in productivity of 1 per cent in the services sectors of the developed countries.[17] It should be mentioned that an increase in productivity[18] of 1 per cent is equivalent to a downward shift of the unit cost function by 1 per cent, *ceteris paribus*. The experiment consists of seven separate simulations: a 1 per cent increase in productivity in (1) trade services, (2) air transport, (3) maritime transport, (4) other transport, (5) financial services, (6) business services, and (7) all precedent services.

It is important to point out that the 1 per cent technological shock does not correspond to the rate of technological progress of the services sector of developed countries. It is merely a working hypothesis. It can be considered as the rate at which services sector productivity grows in the developed countries relative to other regions.

Given the structure of the GTAP model, a productivity growth in services of developed countries will expand the output of services and increase the price of production factors[19] (income effect) in a first step; then it will reduce the price of services[20] in a second step (price effect). In an open economy and in a partial equilibrium framework, terms of trade will deteriorate or not depending on whether the services are exportable or not.[21] In a general equilibrium framework the impact on other markets is taken into consideration. If the income effect is larger than the price effect, it is possible that the price of other sectors increases in relative terms, bringing about an increase of the terms of trade of developed countries.[22] In this case, depending on the composition of exports and imports of developing countries, it is possible that developing countries lose welfare[23] through a deterioration of their terms of trade. This explains part of the results of the experiment, which are presented below.

Table 7 shows the results of the first experiment by different services sectors. Output of trade services mainly includes retail and wholesale trade.[24] Output of retail and wholesale trade is measured by the total value of commercial margins. As these margins are important elements of transaction costs, a reduction in the cost of trade services could capture a portion of the effect of B2C and B2B e-commerce. Column 1 of table 7 shows the results of the productivity growth in trade services. For developed countries, it can be observed that the effect of this shock in terms of GDP, wages and welfare is significant. A 1 per cent increase in productivity in this sector results in a GDP increase of 0.22 per cent, a wage increase of 0.03 per cent and 0.05 per cent for unskilled and skilled labour respectively, welfare gains of $47.9 billions (in 1997 dollars) and an increase in the terms

of trade of 0.01 per cent. On the other hand, the impact on the developing countries' economies is largely negative, with a fall in welfare ($614 million), wages (0.12 per cent), and terms of trade (0.02 per cent).

If we consider transport services for goods, output is measured by the total value of transport margins. E-commerce generates improvements in the supply chain that produce productivity gains and cost reductions in the transport sector. Table 7, columns 2–4, shows the results of the simulation where productivity increases in transport services of developed countries only. For example, an increase of productivity of 1 per cent in maritime transport services will result in a GDP rise of 0.02 per cent, welfare gains of $2.9 billion and a deterioration of 0.01 per cent in the terms of trade in developed countries. For developing countries, cost reductions in maritime transport services in developed countries will improve their terms of trade, thus improving the competitiveness of exports from developing regions. The analysis indicates that developing countries will increase imports of maritime transport services from

Table 7
A 1% increase in productivity in developed countries only (experiment 1)

	Trade services (1)	Air transport (2)	Maritime transport (3)	Other transport (4)	Financial services (5)	Business services (6)	Services (1) to (6)
Welfare (millions of US$ of 1997)							
Developed	47 942	3 365	2 896	17 238	12 071	35 081	117 869
Eastern Europe	-55	-13	21	11	-8	-53	-93
Asia	-121	130	528	261	-8	1	802
Latin America	-197	-5	83	-19	-52	-123	-301
Africa	-45	-4	69	-40	-12	5	-23
Rest of the world	-196	-38	96	-8	-56	-124	-309
GDP – Quantity Index (% change)							
Developed	0.22	0.02	0.02	0.08	0.06	0.16	0.54
Wages – Unskilled labour (% change)							
Developed	0.03	0.01	0.00	0.01	0.02	0.08	0.15
Eastern Europe	-0.12	-0.03	-0.01	-0.08	-0.05	-0.14	-0.42
Asia	-0.13	-0.02	0.01	-0.07	-0.04	-0.13	-0.36
Latin America	-0.13	-0.03	-0.02	-0.08	-0.05	-0.14	-0.44
Africa	-0.11	-0.02	0.00	-0.09	-0.04	-0.13	-0.39
Rest of the World	-0.14	-0.04	-0.02	-0.10	-0.06	-0.16	-0.50
Wages – Skilled labour (% change)							
Developed	0.05	0.01	0.00	0.03	0.00	0.06	0.14
Eastern Europe	-0.12	-0.03	-0.01	- 0.07	-0.06	-0.18	-0.45
Asia	-0.12	-0.02	0.01	-0.06	-0.04	-0.15	-0.37
Latin America	-0.13	-0.03	-0.02	-0.08	-0.05	-0.15	-0.46
Africa	-0.11	-0.03	0.00	-0.10	-0.05	-0.16	-0.44
Rest of the world	-0.13	-0.04	-0.01	-0.09	-0.06	-0.19	-0.52
Terms of trade							
Developed	0.01	0.00	-0.01	0.00	0.00	0.00	-0.01
Eastern Europe	-0.02	0.00	0.01	0.00	0.00	-0.02	-0.03
Asia	-0.01	0.01	0.03	0.01	0.00	0.00	0.04
Latin America	-0.03	0.00	0.02	0.00	-0.01	-0.01	-0.02
Africa	-0.02	0.01	0.04	-0.01	0.00	0.01	0.03
Rest of the world	-0.03	0.00	0.02	0.00	0.00	-0.01	-0.03

developed countries and reduce their output and that the freed resources will be allocated to more productive activities. In short, improvements in terms of trade and a better allocation of resources in developing countries will increase their welfare by $797 million.

The financial services sector includes financial services and auxiliary activities. Output of this sector is measured by the sum of implicit and explicit charges. E-commerce can have an important impact on the productivity of this sector, by reducing costs of "brick-and-mortar" establishments. Table 7, column 5, shows the results of the productivity growth in financial services in developed countries only. For developed countries, a 1 per cent increase in productivity entails a GDP rise of 0.06 per cent and welfare gains of $12.1 billions. Developing countries, on the other hand, will experience welfare losses ($136 million) and wage reductions (0.05 per cent), but no changes in their terms of trade.

The business services sector includes business activities, real estate, and renting. As business activities include professional "knowledge" services, e-commerce can reduce margins through, for example, electronic service delivery. Table 7, column 6, shows the results of the simulation on the business services sector. For developed countries, a 1 per cent increase in productivity results in a GDP rise of 0.16 per cent and welfare gains of $35 billions. In the developing world, a fall in wages and welfare will be experienced in Eastern Europe, Latin America and the rest of the world. Asia and Africa will reduce wages but their welfare and terms of trade will not be affected.[25]

To summarize, results from the analysis suggest that when developing regions fall behind technologically (i.e when they experience less productivity growth compared to the developed countries), in general the macroeconomic gap between developed and developing countries could increase. Only the Asian region experienced a positive impact, and largely in the transport (in particular maritime transport) sector. Hence, e-commerce could constitute an additional factor increasing the gap between the developed and many developing countries.

It is to be recalled that the numerical results of this analysis have to be considered with caution and interpreted not in quantitative and absolute terms, but in qualitative and relative terms. This analysis is intended not to forecast but to identify tendencies of the overall impact of e-commerce on developing countries, simulated through productivity growth in a number of services sectors. It should also be noted that the analysis refers only to increases in productivity in the services sectors, and does not take into account the impact of a reduction of inventory stocks and the increase of competitiveness in intermediate services.[26]

2. Catching up: productivity growth in selected developing regions only

It is expected that in the next few years the productivity gap between the European countries and the United States will close rapidly as European productivity growth increases faster than that of the United States. This process is known as convergence in productivity. Convergence in productivity takes place when the countries that lag behind the technological frontier grow more rapidly in productivity than the leading countries.

The same could be true for developing countries, with a reasonable degree of readiness. The impact of e-commerce on developing countries could be even stronger than that on developed countries because the scope for reducing inefficiencies and increasing productivity is much larger in the developing countries.

The second experiment therefore simulates a cost reduction in services, due to e-commerce, in a single developing region only. In other words, it simulates, for example, a 1 per cent growth in Asia (Africa, Latin America, etc.), while productivity in all other regions remains unchanged. The aim of this experiment is to examine the impact of a cost reduction on a single developing region when it converges in productivity for the services sectors, that is when the rate of productivity of these sectors grows faster relative to other regions. The experiment consists of 28 separate simulations. For each developing region and region in transition[27], a 1 per cent increase in productivity is simulated in (1) trade services, (2) air transport, (3) maritime transport, (4) other transport, (5) financial services, (6) business services, and (7) total of (1) to (6). The results should then be interpreted as the overall effect, on a developing region, of one additional percentage point of productivity growth in services sectors relative to other regions. The rate at which these services grow in productivity determines the time needed to close the gap between the leading countries and developing countries.

The results of technological progress in services in a single developing region are presented in tables 8–11. They indicate that an increase of productivity of 1 per cent in services will reduce prices, increase economic activity, wages and welfare. For example, in the case of the Asian region (table 8), productivity growth in all services combined (column 7) is expected to increase GDP by 0.43 per cent, wages by 0.42 per cent and welfare by $12 billions (1997 dollars). The results also indicate that output and exports of trade services would rise, while value added and imports would decrease. The simulations for individual services sectors (columns 1 to 6) indicate that productivity growth in trade services (which include retail and wholesale trade), followed by other transport and business services, results in the highest welfare gain for Asian countries. Similar positive results were obtained for the other regions (tables 9–11), with somewhat lower welfare gains compared to Asia.

To summarize, by cutting costs, increasing efficiency and reducing time and distance, e-commerce could become an important tool for development. A reasonable degree of e-commerce preparedness[28] of developing countries could give rise to the potential to catch up with leading countries. Thus, the discussion on the convergence of sectoral productivity could be treated as forming part of the discussion on economic convergence of the economic development literature, that is the tendency for poorer countries to grow faster than rich countries, and, consequently, to converge in living standards. Although there are many explanations for the absence of economic convergence, results of a recent study by Sachs and Warner[29] support the idea that appropriate economic and legal frameworks give developing countries the potential to catch up with leading countries.

E. Conclusions

The results of the experiments presented in this chapter indicate that the overall effect of productivity growth in the services sectors (which is assumed to simulate the direct effect of e-commerce) will be positive for a number of macroeconomic variables for regions adopting e-commerce.

They indicate, however, that when developing regions fall behind technologically, the gap between developing and developed countries could increase. Except for transport services, and in particular maritime transport services, the results show that productivity growth in developed countries' services sectors could result in a deterioration of the terms of trade, welfare and wages of many developing countries.

Convergence in productivity in services contributes to raising the external competitiveness of developing countries' exports and reducing international trade and transport margins. The results suggest that, by increasing the productivity of services, e-commerce could offer the possibility for increasing welfare in developing countries.

It has to be noted, once more, that the findings of this chapter should be interpreted carefully. The chapter has tried to identify the nature and direction of the impact of e-commerce on developing countries. Consequently, the results depend on the approach used to simulate the impact of e-commerce (cost savings in services) and on the structure and basic assumptions of the GTAP model framework.

Table 8
A 1% increase in productivity in Asia only

	Trade services (1)	Air transport (2)	Maritime transport (3)	Other transport (4)	Financial services (5)	Business services (6)	Services (1) to (6)
Welfare, $ millions							
Asia	3 601	1 914	1 530	2 389	863	1 706	12 012
World	3 766	1 970	1 626	2 536	866	1 781	12 555
GDP, % change							
Volume	0.13	0.07	0.06	0.09	0.03	0.06	0.43
Prices	-0.05	0.00	0.00	-0.02	0.00	0.02	-0.05
Terms of trade	-0.02	-0.01	-0.01	-0.01	0.00	-0.01	-0.06
Wages, % change							
Unskilled labour	0.09	0.08	0.06	0.07	0.03	0.09	0.42
Skilled labour	0.10	0.09	0.06	0.07	0.02	0.11	0.46
Output, % change							
Primary	0.01	0.00	0.01	0.01	0.01	-0.02	0.02
Manufacturing	0.01	0.01	0.02	0.00	0.03	-0.08	-0.02
Trade services	0.69	0.04	0.02	0.03	0.02	0.02	0.83
Air transport	-0.01	0.59	0.02	0.07	0.00	-0.02	0.64
Maritime transport	0.03	0.00	0.43	0.04	0.03	-0.01	0.51
Other transport	0.03	-0.03	-0.01	0.71	0.01	-0.02	0.69
Financial services	0.00	0.01	-0.01	0.01	0.14	-0.01	0.15
Business services	-0.08	-0.05	-0.05	-0.05	-0.02	1.27	1.02
Value added, % change							
Primary	0.01	0.00	0.01	0.01	0.01	-0.02	0.02
Manufacturing	0.01	0.01	0.02	0.00	0.03	-0.08	-0.02
Trade services	-0.31	0.04	0.02	0.03	0.02	0.02	-0.17
Air transport	-0.01	-0.41	0.02	0.07	0.00	-0.02	-0.35
Maritime transport	0.03	0.00	-0.57	0.04	0.03	-0.01	-0.48
Financial services	0.00	0.01	-0.01	0.01	-0.85	-0.01	-0.84
Business services	-0.08	-0.05	-0.05	-0.05	-0.02	0.27	0.02
Exports, % change							
Primary	-0.17	-0.18	-0.09	-0.12	-0.05	-0.21	-0.82
Manufacturing	-0.05	-0.02	0.01	-0.04	0.02	-0.18	-0.26
Trade services	2.68	-0.02	-0.09	-0.06	-0.01	-0.08	2.40
Air transport	-0.12	2.57	-0.01	0.16	-0.02	-0.14	2.44
Maritime transport	-0.08	-0.05	1.85	0.10	0.02	-0.09	1.74
Other transport	-0.09	-0.17	-0.06	2.70	-0.03	-0.19	2.14
Financial services	-0.25	-0.11	-0.17	-0.17	3.69	-0.10	2.87
Business services	-0.20	-0.16	-0.17	-0.16	-0.04	3.44	2.70
Imports, % change							
Primary	0.10	0.10	0.08	0.09	0.05	0.07	0.49
Manufacturing	0.07	0.04	0.04	0.05	0.02	0.05	0.28
Trade services	-0.78	0.07	0.08	0.08	0.02	0.08	-0.45
Air transport	0.14	-0.95	0.06	0.02	0.04	0.12	-0.56
Maritime transport	0.15	0.08	-1.07	0.00	0.01	0.10	-0.75
Other transport	0.09	-0.02	-0.10	-1.20	0.04	0.1	-1.11
Financial services	0.15	0.07	0.08	0.11	-1.77	0.06	-1.30
Business services	0.08	0.01	-0.15	0.08	0.03	-0.61	-0.57

Table 9
A 1% increase in productivity in Latin America only

	Trade services (1)	Air transport (2)	Maritime transport (3)	Other transport (4)	Financial services (5)	Business services (6)	Services (1) to (6)
Welfare, $ millions							
Latin America	1 920	1 199	860	1 439	949	1 236	7 614
World	1 885	1 174	879	1 454	910	1 195	7 507
GDP, % change							
Volume	0.10	0.06	0.05	0.07	0.05	0.06	0.38
Prices	-0.04	0.00	0.00	-0.02	0.00	0.01	-0.05
Terms of trade	0.01	0.00	-0.01	-0.01	0.01	0.00	0.00
Wages, % change							
Unskilled labour	0.06	0.07	0.05	0.06	0.06	0.10	0.39
Skilled labour	0.07	0.08	0.05	0.07	0.04	0.10	0.42
Output, % change							
Primary	0.00	-0.02	-0.01	-0.01	0.01	-0.01	-0.03
Manufacturing	0.02	-0.01	0.00	-0.01	0.04	0.00	0.04
Trade services	0.59	0.05	0.02	0.04	0.05	0.08	0.84
Air transport	0.00	0.76	0.02	0.06	0.02	0.03	0.89
Maritime transport	0.03	0.01	0.68	0.05	0.06	0.03	0.86
Other transport	0.03	0.00	0.01	0.75	0.03	0.03	0.86
Financial services	0.01	0.01	-0.01	0.01	0.19	0.03	0.25
Business services	-0.03	-0.01	-0.01	-0.01	0.00	0.49	0.44
Value added, % change							
Primary	0.00	-0.02	-0.01	-0.01	0.01	-0.01	-0.03
Manufacturing	0.02	-0.01	0.00	-0.01	0.04	0.00	0.04
Trade services	-0.40	0.05	0.02	0.04	0.05	0.08	-0.16
Air transport	0.00	-0.24	0.02	0.06	0.02	0.03	-0.10
Maritime transport	0.03	0.01	-0.32	0.05	0.06	0.03	-0.14
Other transport	0.03	0.00	0.01	-0.25	0.03	0.03	-0.14
Financial services	0.01	0.01	-0.01	0.01	-0.80	0.03	-0.74
Business services	-0.03	-0.01	-0.01	-0.01	0.00	-0.51	-0.56
Exports, % change							
Primary	-0.08	-0.14	-0.07	-0.11	-0.07	-0.13	-0.61
Manufacturing	-0.08	-0.11	-0.07	-0.11	0.00	-0.13	-0.50
Trade services	3.59	-0.06	-0.13	-0.15	-0.05	0.02	3.20
Air transport	-0.12	3.42	-0.05	0.10	-0.06	-0.07	3.21
Maritime transport	-0.10	-0.10	2.71	0.05	0.07	-0.06	2.56
Other transport	-0.12	-0.17	-0.08	3.21	-0.08	-0.13	2.60
Financial services	-0.19	-0.16	-0.17	-0.20	3.78	-0.13	2.90
Business services	-0.17	-0.18	-0.16	-0.20	-0.14	3.73	2.86
Imports, % change							
Primary	-0.03	0.05	0.04	0.05	0.05	0.06	0.30
Manufacturing	-0.10	0.06	0.05	0.08	0.06	0.09	0.43
Trade services	1.03	0.06	0.08	0.10	0.07	0.05	-0.96
Air transport	-0.12	-1.15	0.06	0.02	0.08	0.10	-0.84
Maritime transport	-0.08	0.05	-1.19	0.01	0.02	0.07	-0.97
Other transport	-0.09	0.03	-0.03	-1.16	0.08	0.10	-0.89
Financial services	-0.23	0.09	0.09	0.12	-1.71	0.10	-1.19
Business services	-0.16	0.09	0.03	0.12	0.10	-1.27	-0.83

Table 10
A 1% increase in productivity in Eastern Europe only

	Trade services (1)	Air transport (2)	Maritime transport (3)	Other transport (4)	Financial services (5)	Business services (6)	Services (1) to (6)
Welfare, $ millions							
Eastern Europe	664	89	56	345	122	492	1 770
World	642	79	80	350	101	416	1 671
GDP, % change							
Volume	0.22	0.03	0.03	0.12	0.04	0.15	0.58
Prices	-0.08	0.02	0.00	0.02	0.02	0.06	0.04
Terms of trade	0.01	0.00	-0.02	-0.01	0.01	0.03	0.02
Wages, % change							
Unskilled labour	0.14	0.05	0.03	0.14	0.06	0.21	0.63
Skilled labour	0.19	0.05	0.03	0.16	0.06	0.24	0.72
Output, % change							
Primary	0.04	-0.01	0.00	-0.01	0.00	-0.03	-0.02
Manufacturing	0.01	-0.04	-0.02	-0.11	-0.01	-0.14	-0.30
Trade services	0.62	0.02	0.01	0.07	0.03	0.11	0.85
Air transport	-0.04	1.49	0.00	0.06	-0.02	-0.08	1.41
Maritime transport	0.01	-0.01	1.13	0.14	0.01	-0.04	1.22
Other transport	0.03	-0.01	0.00	1.03	-0.01	-0.03	1.01
Financial services	0.00	-0.02	-0.01	-0.05	0.62	-0.05	0.48
Business services	0.02	-0.01	-0.01	-0.03	-0.01	0.88	0.85
Value added, % change							
Primary	0.04	-0.01	0.00	-0.01	0.00	-0.03	-0.02
Manufacturing	0.01	-0.04	-0.02	-0.11	-0.01	-0.14	-0.30
Trade services	-0.38	0.02	0.01	0.07	0.03	0.11	-0.15
Air transport	-0.04	0.49	0.00	0.06	-0.02	-0.08	0.41
Maritime transport	0.01	-0.01	0.12	0.14	0.01	-0.04	0.22
Other transport	0.03	-0.01	0.00	0.03	-0.01	-0.03	0.01
Financial services	0.00	-0.02	-0.01	-0.05	-0.38	-0.05	-0.51
Business services	0.02	-0.01	-0.01	-0.03	-0.01	-0.12	-0.15
Exports, % change							
Primary	-0.19	-0.11	-0.05	-0.26	-0.10	-0.43	-1.13
Manufacturing	-0.12	-0.09	-0.05	-0.26	-0.06	-0.38	-0.96
Trade services	3.76	-0.08	-0.08	-0.28	-0.12	-0.34	2.84
Air transport	-0.15	3.49	-0.02	0.07	-0.08	-0.28	3.02
Maritime transport	-0.07	-0.03	1.75	0.18	-0.01	-0.11	1.71
Other transport	-0.10	-0.09	-0.04	2.68	-0.09	-0.30	2.04
Financial services	-0.26	-0.11	-0.09	-0.39	4.08	-0.43	2.77
Business services	-0.20	-0.13	-0.09	-0.40	-0.15	3.75	2.75
Imports, % change							
Primary	0.12	0.03	0.02	0.08	0.04	0.14	0.43
Manufacturing	0.14	0.04	0.02	0.11	0.05	0.18	0.54
Trade services	-1.65	0.05	0.04	0.17	0.07	0.24	-1.08
Air transport	0.21	-1.00	0.03	0.08	0.06	0.23	-0.40
Maritime transport	0.13	0.04	-0.96	-0.02	0.03	0.13	-0.65
Other transport	0.12	0.10	0.04	-1.36	0.06	0.18	-0.85
Financial services	0.12	0.03	0.03	0.12	-1.57	0.14	-1.13
Business services	0.11	0.07	0.05	0.16	0.06	-1.11	-0.66

Table 11
A 1% increase in productivity in Africa only

	Trade services (1)	Air transport (2)	Maritime transport (3)	Other transport (4)	Financial services (5)	Business services (6)	Services (1) to (6)
Welfare, $ millions							
Africa	1 214	144	139	1 214	233	383	2 663
World	1 139	141	160	1 139	218	351	2 568
GDP, % change							
Volume	0.21	0.03	0.03	0.21	0.04	0.07	0.48
Prices	-0.02	0.01	0.00	-0.02	0.00	0.04	0.05
Terms of trade	0.04	0.00	-0.01	0.04	0.01	0.01	0.03
Wages, % change							
Unskilled labour	0.19	0.04	0.03	0.19	0.05	0.11	0.53
Skilled labour	0.24	0.06	0.04	0.24	0.04	0.14	0.65
Output, % change							
Primary	0.02	-0.02	0.00	0.02	0.00	-0.06	-0.09
Manufacturing	0.02	-0.03	-0.01	0.02	0.01	-0.06	-0.12
Trade services	0.55	0.01	0.01	0.55	0.03	0.02	0.66
Air transport	-0.08	1.35	-0.01	-0.08	-0.01	-0.05	1.25
Maritime transport	0.05	-0.01	0.76	0.05	0.02	-0.02	0.83
Other transport	0.05	0.00	0.00	0.05	0.02	-0.01	0.82
Financial services	0.02	0.00	0.00	0.02	0.21	0.02	0.26
Business services	-0.02	-0.01	-0.01	-0.02	0.03	1.13	1.09
Value added, % change							
Primary	0.02	-0.02	0.00	0.02	0.00	-0.06	-0.09
Manufacturing	0.02	-0.03	-0.01	0.02	0.01	-0.06	-0.12
Trade services	-0.45	0.01	0.01	-0.45	0.03	0.02	-0.34
Air transport	-0.08	0.34	-0.01	-0.08	-0.01	-0.05	0.25
Maritime transport	0.05	-0.01	-0.23	0.05	0.02	-0.02	-0.17
Other transport	0.05	0.00	0.00	0.05	0.02	-0.01	-0.18
Financial services	0.02	0.00	0.00	0.02	-0.79	0.02	-0.73
Business services	-0.02	-0.01	-0.01	-0.02	0.03	0.13	0.09
Exports, % change							
Primary	-0.22	-0.10	-0.04	-0.22	-0.06	-0.24	-0.85
Manufacturing	-0.26	-0.11	-0.06	-0.26	-0.04	-0.26	-0.96
Trade services	3.33	-0.10	-0.08	3.33	-0.03	-0.26	2.60
Air transport	-0.33	3.46	-0.04	-0.33	-0.04	-0.18	2.90
Maritime transport	-0.19	-0.06	2.18	-0.19	-0.02	-0.15	1.70
Other transport	-0.31	-0.10	-0.06	-0.31	-0.05	-0.21	2.52
Financial services	-0.47	-0.10	-0.09	-0.47	4.06	-0.23	2.83
Business services	-0.35	-0.08	-0.07	-0.35	0.05	3.70	3.00
Imports, % change							
Primary	0.19	0.05	0.03	0.19	0.05	0.12	0.56
Manufacturing	0.27	0.05	0.04	0.27	0.06	0.15	0.71
Trade services	-1.18	0.05	0.04	-1.18	0.00	0.13	-0.85
Air transport	0.23	-1.16	0.03	0.23	0.05	0.12	-0.69
Maritime transport	0.19	0.05	-1.37	0.19	0.04	0.12	-0.91
Other transport	0.20	0.09	0.00	0.20	0.05	0.11	-0.95
Financial services	0.29	0.05	0.05	0.29	-2.00	0.13	-1.32
Business services	0.32	0.06	0.04	0.32	0.02	-0.97	-0.37

Notes

1 Oliner, S. and Sichel, D. (2000).

2 Goldman Sachs Investment Research (1999).

3 Traditional systems are based on paper, telephone, fax, electronic data interchange (EDI) or value added networks (proprietary networks).

4 In 1987, Robert Solow, professor at the Massachusetts Institute of Technology (MIT) and Nobel prize-winner economist, said that "we see the computer age everywhere except in productivity statistics".

5 Economists adopting this position are called "computer revolution sceptics".

6 *The Economist*, 8 June 2000.

7 Nordhaus defines new economy as machinery, electric equipment, telephone and telegraph, and software. These sectors represented 9 per cent of GDP in 1998.

8 United States (2001).

9 MULTIMOD (MULTI-region econometric MOdel) is a dynamic multicountry macro model of the world economy, which has been designed to analyze the impact of shocks across countries as well as the effect of fiscal and monetary policies of developed countries on the global economy. It has been developed since 1988 by the International Monetary Fund.

10 Commonwealth of Australia (2000).

11 The Monash model is a dynamic computable general equilibrium model of the Australian economy, which has been designed for policy analysis and forecasting. It has been developed since 1993 by the Centre of Policy Studies of the Monash University, Australia.

12 UNCTAD (2000).

13 A computable general equilibrium model or CGE model is general because it specifies the behaviour of several economic agents; it is in equilibrium because prices of goods and factors adjust according to the market; and finally, it is computable because it produces numerical results.

14 The standard GTAP model is a multiregion, computable general equilibrium model, with perfect competition and constant returns to scale. The full GTAP version 5 database covers 65 regions, with five production factors and 57 commodities, and is constructed with data for 1997. It has been developed by the Center for Global Trade Analysis, Purdue University, West Lafayette, United States.

15 Although e-commerce in information goods could have an important impact on the overall economy, characteristics of these goods (increasing returns) and data restrictions (aggregation) do not allow taking into account the behaviour of information goods firms by using the current framework.

16 In fact, the analysis is a comparative static one, in which the changes between equilibria given a change in productivity in services sectors are analysed.

17 A better approach could be to simulate a reduction in margins (the difference between producer and consumer prices), but the GTAP model does not have the option to work with these margins. It gives only special treatment to international trade and transport margins (the difference between fob and cif prices).

18 In terms of the CGE notation, a shock of 1 per cent in total factor productivity is programmed by augmenting the technological augmentation parameter, ao, by 1 per cent. This corresponds to a Hicks-neutral technological change, which means that 1 per cent more output will be produced by using the same quantity of factors and intermediate inputs.

19 Wages and remuneration of other production factors are assumed to be a function of productivity.

20 The GTAP model does not have a monetary sector, that is, all results are expressed in real terms. In this case, the reduction of prices refers to relative prices.

21 For example, when the productivity growth is in the import-competing sector, terms of trade will improve.

22 That is, when "other sectors" are mainly export sectors, so that the price of exports of developed countries rises relative to the price of their imports.

23 Changes in economic welfare represent a change in income that can be allocated to aggregate private consumption, aggregate government consumption and savings.

24 It also includes commission trade, hotels and restaurants, repairs of motor vehicles and personal and household goods.

25 Results show that all developing countries will reduce output of business services but Asia and Africa will reduce the most (-1.01 per cent and -0.75 per cent respectively).

26 The impact of a reduction of inventories could be incorporated by simulating a technological change in the production sectors. The impact of the increase in competitiveness could be incorporated by simulating a reduction of the monopolistic profits of enterprises (mark-up).

27 Asia, Latin America and Caribbean, Eastern Europe, and Africa.

28 E-commerce preparedness implies *inter alia* the existence of e-commerce-related infrastructure, human capital, and economic and legal frameworks.

29 Sachs, J. and Warner, A.M. (1995). For the 1970-89 period, the authors examined economic convergence for a set of countries and found that a sufficient condition for it is that countries adopt appropriate market-based economic policies.

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