

Retail and Wholesale Trade E-Commerce: What the Numbers Really Mean*

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A review of quantitative research on electronic commerce (e-commerce) and its impact reveals major gaps in our knowledge about current changes. The recent introduction of some online applications and the rapid pace of change are not the only explanations. The great store placed in the myth that perfect markets will be achieved through digital networks and the emphasis on online ordering explain many of the obstacles to proper understanding and measurement of the e-commerce phenomenon.

Three important facts need to be stressed. First of all, the Internet did not beget e-commerce. E-commerce developed from other technologies and several forms of e-commerce will continue to rely on other networks than the Internet. Secondly, many electronic systems are not designed to handle all of the operations involved in a commercial transaction. Digital networks are just one of the channels through which transactions can be conducted in conjunction with other channels. Depending on the operations that networks are built to handle, different types of e-commerce are being developed with contrasting effects. And, thirdly, in many cases, digital networks are used more for differentiating services and targeting specific groups of consumers, rather than for creating more transparent markets.

Agencies in charge of monitoring e-commerce need to develop more sophisticated evaluations of how electronic applications are being used and the rationale of the systems being set up. Such evaluations would provide information on how e-commerce is being introduced in the various components of the economy.

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The names and dates in parentheses refer to the bibliography at the end of the article.

Decision-makers' enthusiastic talk about the sheer size and potential of the *new economy* in general, and e-commerce in particular, is in striking contrast to the dearth of reliable data about concrete results. Except for the first release of official statistics on e-commerce retail sales in the United States in 2000 (U.S. Census Bureau of the Department of Commerce, 2000), private-sector consulting and marketing firms produced the vast majority of the e-commerce data that are now being circulated and even finding their way into official reports. Such firms as International Data Corporation (IDC), the Gartner Group, KPMG, Forrester Research, Jupiter Communication and Accenture have produced these data using methodologies that are not always very transparent. The nub of the problem lies in the fact that most of the available data are forecasts¹, not evaluations, and the data from different sources are not compatible².

The OECD (2000b) cites one of the most blatant examples: estimates for 1995-1997 vary from USD 70 billion to USD 24 billion, depending on the firm providing them (see Table 1). The same firms' estimates made between 1995 and 1998 call for e-commerce to account for an average of 5% of retail sales in 2001 and 2002. These figures are totally incompatible with the Department of Commerce's own figures, which put the share of e-commerce in 2000 retail sales at about 0.7%, even though the American retail trade is by far the most "digital" in the world.

Regardless of the method we use to approach e-commerce data, we see that all of the discus-

sion, investment strategies and government policies related to e-commerce are based on very questionable numbers. Even the bodies that produce the numbers defend them only half-heartedly. They admit that their definitions of e-commerce and categories of e-commerce, as well as their estimation and sampling techniques, differ and that they are prone to problems and biased. The key argument in defence of producing such numbers is that the real issue is to capture the trend, which shows strong growth in this case. We could counter that the different bodies' estimated growth rates are wildly divergent. For example, evaluations of the growth of e-commerce in Britain show estimated annual growth rates that vary by a factor of 2 between Optimedia's estimate of 67% and NOP's estimate of 116%. This means that estimates will diverge by a factor of 14, ten years down the road (CRIC,

¹ Many estimates have been revised downwards or turned out to be false. For example, the U.S. Department of Commerce noted that estimates published in 1999 of 1998 online retail sales volume put the figure at between USD 7 billion and USD 15 billion. This is to be compared to the figure of USD 4 billion to USD 14 billion estimated in 2000 for 1999 online retail sales volume, and to the figure of USD 5.3 billion measured by the Department of Commerce itself. Going by these figures, we see that the expected explosion of sales volume did not occur and estimated online sales volume was trimmed in consequence.

² The French E-Commerce Task Force emphasised that evaluations of B2B (business-to-business) online sales volume in 1998 ranged from USD 3 billion to USD 15 billion (Lorentz, 1998). The report on the impact of IT by the French General Planning Commission cited discrepancies to the order of one to ten between rival estimates (Dang N'Guyen, 1999). The accuracy of estimates has hardly improved at all over the last two years. In its 2000 report on the digital economy, the U.S. Department of Commerce reported that private-sector estimates of B2C (business-to-consumer) sales volume varied widely (see note 1). The same holds true for estimates of B2B sales volume, which ranged from USD 634 billion to USD 2,300 billion for 2003 (U.S. Department of Commerce, 2000).

Table 1
The Main E-Commerce Estimates in the United States

In USD millions

Source	1995-1997	2000-2002
IDC	1,000	117,000
INPUT	70	165,000
VeriFone	350	65,000
ActivMedia	24,400	1,522,000
Data Analysis	2,800	217,900
Yankee	850	144,000
E-land	450	10,000
EITO	475	262,000
AEA/AU	200	45,000
Hambrecht & Quest	1,170	23,200
Forrester	8,000	327,000
Morgan Stanley	600	375,000
Mean	725	154,500

Source: OECD, 2000b.

1999). Therefore, the different firms do not even agree that we are at the same point on the S-shaped diffusion curve (since we are dealing with network technology, see Curien, 2000) and it is only reasonable to have very serious doubts about their ability to account even for trends.

A Phenomenon that Takes Many Forms and Changes Rapidly

The inaccuracy of estimates is easy to explain. It stems mainly from three overlapping phenomena. First of all, we are dealing with phenomena where quantities and qualities are both changing very rapidly (see Table 2). According to the International Telecommunications Union, the number of Internet users in the European Union/United States/Japan area increased from 70 million to 174 million between 1997 and 1999 (Eurostat, 2001)³. According to the U.S. Department of Commerce (1999), Internet traffic volume doubles every 100 days. The number of secure servers, which are especially useful for e-commerce, increased by 95% in the OECD countries between April 1999 and April 2000 (OECD, 2000a).

This exponential growth comes with a rapid diversification of use. The growing numbers of Internet sites are further testimony to diversification. The number of sites swelled from 26,000 in 1993 to 5 million in 1999 (U.S. Department of Commerce, 1999). Even though there is some overlap, the range of services on offer is much broader today than it was a few years ago. The change is obvious in the case of online retailing. Lucking-Reiley and Spulber (2000) reviewed

all of the marketplace. More than 75% of the 50 or so marketplaces are less than three years old. In the B2C (business-to-consumer) field, the public at large is aware of or has heard from the media about the explosive growth of online services. These include more or less sophisticated distance-selling techniques in all business areas or more innovative sites offering new functions, ranging from auctions and group purchasing to networked games.

Given these circumstances, it is difficult to come up with stable classifications and put together statistical series, or even to agree on “standardised” measurement methods. E-commerce is not the only area where this problem is encountered. The same problem comes up for all forms of information and communication technology (ICT) and all its uses, as was emphasised in a French General Planning Commission report (Brousseau and Rallet, 1999). Even inside firms, it is hard to evaluate the real costs and the real impact of investment in ICT. Staff training, maintenance and organisational costs are often omitted. The impact in terms of jobs, productivity and competitiveness is very complex, because the technologies involved change so quickly and affect all business areas. ICT use is governed by more than one decision-making circuit and its effectiveness is very dependent on supporting measures. This means that, even at the firm level, it is difficult to come up with reliable figures.

Secondly, we are dealing with very sensitive information and strategic concerns distort the

³ The estimated number of Internet users around the world in 1993 was approximately 3 million (U.S. Department of Commerce, 1999).

Table 2
Changes in E-Commerce Infrastructure 1995-1999

In millions of Units

	France		EU		USA		Japan	
	1995	1999	1995	1999	1995	1999	1995	1999
Number of PCs Per 100 people	7.8 13	13.0 22	56.2 15	93.2 25	86.3 33	141.0 52	15.1 12	36.3 29
Internet Hosts Per 100 peoples	0.15 0.3	0.6 1.0	1.8 0.5	8.5 2.3	6.0 2.3	53.1 19.6	0.26 0.2	2.6 2.1
Internet users Per 100 people	1.0* 1.7*	5.6 9.6	19.3* 5.2*	55.9 14.9	40.0* 15*	110.0 40.5	11.5* 9.3*	18.3 14.5
Mobile telephone Per 100 people	1.0 1.8	21.4 36.3	21.1 5.7	146.5 39.1	33.7 12.9	86.0 31.7	1.7 9.3	56.8 45.0
* 1997 figures								

Source: Eurostat 2000.

behaviour of firms with regard to disclosure and diffusion. We are faced with emerging markets and uses in a context of technological competition. Online service providers and the technology providers serving them are aware of the characteristics of an economy with high returns to adoption and network externalities (David, 1985; Katz and Shapiro, 1985; Arthur, 1989; Cowan, 1990; Varian and Shapiro, 1999). Providers have to convince potential adopters or subscribers that their products and services will become “industry standards” or that they will play a central role in the market. This means that they are inevitably tempted to exaggerate information about their actual or expected market shares. Furthermore, potential adopters are especially sensitive to “forecasts” and beliefs⁴. As was the case in other ICT applications (Brousseau and Rallet, 1999), the uncertainty surrounding the impact of new uses, combined with large real or assumed potential for economies of learning, created a constant fear of being left behind by the competition. This fear leads to copying of competitors’ adoption choices.

The “Myth” of Online Ordering

The third phenomenon that explains divergence between e-commerce evaluations stems from great uncertainty surrounding the definition and possibilities of e-commerce. As Rallet (2000) aptly points out, most of the evaluations are based on the “myth” of online ordering. We could even add that they focus solely on online ordering over the Internet. This stems from a biased perception of what ICT contributes to commercial transactions and a simplistic view of Internet characteristics. In fact, many opinion leaders, technology mavens and ordinary citizens have a more or less explicit vision of the Internet as a global virtual marketplace operating as a quasi-Walrasian market with not intermediaries between supply and demand⁵. On top of this, the virtual nature of the electronic market is assumed to provide extraordinary savings on transaction costs.

On the strength of this myth, a lot of research on e-commerce disregards all forms of commerce that don’t use the Internet, even though they may use other electronic media. Yet, in functional terms, using e-mail to place an order is not very different from using a fax or a telephone. Similarly, viewing a catalogue on a website is not very different from consulting a catalogue via a videotext system, such as the Minitel, or even using a telephone to reserve air-

line tickets, for example. Furthermore, conducting an electronic data interchange (EDI) over the Internet using WebEDI or over another network, does not change the fact that EDI is mainly concerned with *ex post* transaction management, rather than *ex ante* management (see below). In more general terms, the exclusion of commerce that does not use the Internet disregards the diversity of uses. Most e-commerce sites are not anonymous auction markets. Most sites are more concerned with implementing new forms of discrimination and intermediation than they are with creating transparent markets without intermediaries.

It is also on the strength of this myth of a virtual Walrasian market that most statistical work concentrates on online ordering. If all of the operations involved in a transaction are not conducted online, the innovative effect of the Internet is assumed to be less significant. If orders are not placed online, the World Wide Web is no longer the medium for a fully integrated global market, it is merely another medium that conventional operators use for advertising, prospecting for customers, supplying some additional services more cheaply, more dynamic catalogue and price list management, etc.

While it is easy to understand why so many observers are obsessed with the online ordering criterion, this position is untenable if we want to understand the impact of using electronic media to manage commercial transactions. Yet, this is a key issue for macroeconomic and microeconomic research. We need to evaluate the impact of ICT on productivity and market coordination to understand its macroeconomic impact and microeconomic research needs to capture firms’ strategies and analyse the impact of e-commerce on the division of the surplus. It is really not very relevant to make a distinction between commerce on the Internet and commerce that uses other media and to restrict the notion of electronic commerce to transactions where orders are placed online when we are trying *to understand how commerce is using digital technologies rather than electronic commerce per se*, as suggested by A. Rallet (2000).

⁴ In the case of e-commerce, exaggerated demand figures were further inflated by figures presented to investors as the dot-com stock market bubble grew during 1998 and 1999.

⁵ A Walrasian market is one that centralises the supply and demand of all of the agents involved in the economy in order to discover the market-clearing equilibrium prices. If the Internet were to make the cost of finding information insignificant and computers did the same thing for the cost of processing information, then each agent could have full information about all of the opportunities and terms of trade in the economy. This would be the same as knowing the equilibrium price vector.

Beyond the Internet: Other Digital Networks

Rather than letting our approach be dictated by technical criteria, we should look at the problems in terms of uses. The technical characteristics of the network used are not important; what counts is how the network is used. This must be the starting point for any attempt to measure e-commerce. The approach needs to focus on services or applications, rather than on the medium.

The Internet is by no means the sole growth vector for e-commerce. In France, the Minitel videotext system handles substantial traffic related to commercial transactions (OECD, 1998). Digital television cable and satellite networks, as well as cell telephone networks, are also major vectors for growth in B2C commerce (see Box 1). Some 8% of households in the European Union have Internet access, as opposed to 11% in the United States, and 34% of EU households have cable or satellite television, as opposed to 36% of American households. In both the USA and the EU one-third of the population have cell phones and two-thirds have access to teletex (CRIC, 1999).

Dedicated data transmission networks play an important role in B2B commerce. Such networks are long-established links between most large and medium-sized firms and they are the main medium for EDI. According to the Census Department of the French Ministry of Industry (Sessi), only 8% of French manufacturing firms received online orders over the Internet in 1999 (even though some 24% of such firms used the Internet to diffuse information), yet 44% of these firms used EDI: 36% for transactions with partners, 15% for exchanges with tax and employment authorities and 14% for exchanges between their various establishments. In France, business volume conducted via EDI was estimated at FRF 800 billion, as compared to the estimated volume of FRF 7.3 billion for B2B business over the Internet (Observatoire du Commerce et des Échanges Électroniques, 1999).

Even though there is a gradual shift towards the Internet, many of the online information markets still rely on dedicated secure data transmission networks (Brousseau and Quélin, 1991 and 1996).

Internet Innovation

The indisputable innovation that the Internet brings to e-commerce lies mainly in the Internet Protocol technologies (TCP/IP, invented in the early nineteen-seventies) and the World Wide Web (WWW, invented in the early nineteen-nineties).

IP is a communications protocol that provides interoperability for networks operating on different standards. It makes all of the available physical networks in the world into a single network.

Network administration is also decentralised. It is provided by all of the network components that use the IP address information included in each “packet” of information travelling over the network. Decentralisation means that the network cannot be blocked and it enables the network to grow with minimal coordination, which is limited to compliance with the Internet technical standards. The range of functions available can be expanded simply by hooking up more hardware or introducing new software to the Internet. Decentralisation also makes differentiated communications management possible, ranging from mass communication to point-to-point communications and all combinations in between in which information is targeted and adapted to different audiences.

World Wide Web technology provides a standardised system for addressing and displaying information that also works on all networks. This technology can handle data, text, still images and animated images.

We could cite hundreds of other innovations related to the Internet, such as signal compression and encryption techniques that enhance network capacity and security, but IP and the World Wide Web are the two that brought about the greatest transformation.

The Internet has become an inexpensive worldwide multimedia network used for:

- Information exchanges between economic players in different categories, including producers, intermediaries and consumers. These exchanges have the potential to reorganise market transactions,
- Mass worldwide distribution of information products and services,
- Cooperation, especially between individuals involved in creative and innovative processes that require powerful media for informal communication.

Public Networks, Corporate Networks

There are many other media for e-commerce transactions beside the Internet. The general public is likely to use digital television networks

and cell telephone networks for many e-commerce transactions in the future. Cell telephone networks are complementary to the fixed telephone networks carrying the Internet today. They reach more people and different segments

Box 1

E-COMMERCE CATEGORIES

It is common practice to distinguish between business and retail e-commerce applications.

- B2C stands for Business-to-Consumers and refers to sales of goods and services to the general public, some of which are delivered online. Amazon and Dell are the archetypes of such online retailers. However, a large proportion of Minitel services also follow the same pattern. B2C services are mostly provided by commercial intermediaries, who may be new retailers, like Amazon, or conventional retailers, like Carrefour (Brousseau, 1999).

However, there are a few sites where manufacturers sell their products directly to customers. There are not many such sites, since manufacturers and service providers do not always have the necessary expertise to sell their products and manage their customer relationships. Furthermore, they do not necessarily wish to compete with the retail outlets that handle most of their sales.

- B2B stands for Business-to-Business and refers to transactions between businesses. This category of e-commerce is either based on bilateral agreements between commercial partners that decide to share information via electronic media, or else on services provided by specialised firms. As a general rule, these services are aimed at a particular sector or industry, in view of the specific coordination requirements in each industrial segment, in each country or each economic area. These service providers are mostly offshoots of firms in the sectors where they do business. They are either subsidiaries of the major firms in the sector, as is the case with the airline sector; joint-ventures combining different firms, as in the case of car insurance in France, etc.

Sometime specialised providers of “value-added” information are commissioned by industry associations or standardisation bodies to develop customised services. For example, in the United States, GEIS, a General Electric subsidiary developed services to promote trading between oil companies at the end of the nineteen-seventies. B2B services are less familiar to the general public than B2C services are, but they are much older and involve much greater business volume.

Other “classes” of service emerged with the Internet:

- C2C stands for Consumers-to-Consumers and refers to systems aimed at promoting transactions between individuals. There are services that operate in the same way as classified advertisements. The interactive possibilities of the Internet have given rise to

genuine electronic auction markets. E-bay is the prime example of this type of service. C2C now refers to all of the services intermediating between individuals, such as selling used goods, barter systems similar to local trading systems and agencies that bring interested parties together. Such services had already emerged with the Minitel.

Insofar as many of these services do not give rise to commercial activity per se, it would not be appropriate to put them all under the heading of e-commerce. Yet the example of Napster, which a system that enables users of the Napster software to share data stored on all of the users hard disks, shows that such systems can have a significant impact on commercial activities.

- C2B stands for Consumers-to-Business and represents an attempt to turn the rationale governing the relationship between supply and demand around. The basic principle is to use electronic networks to consolidate individual consumers' demands and have suppliers bid for their business. Priceline.com, for example, enables individuals to announce the price that they are willing to pay for an airline ticket. It is then up to the airlines whether or not to accept the prices bid. On another level, several services are aimed at aggregating individual demands so that individual buyers can form groups to obtain wholesale prices from manufacturers.

In what is bound to be a more interesting development, there are now sites where consumers pool their information about service providers in order to reduce the asymmetry of information. One of the most dynamic developments of this type is taking place in the health information services sector in the United States. Some sites are aimed at providing a forum for people suffering from the same diseases. In addition to their psychological aspects, such “virtual communities” now play a major economic role by promoting systems for evaluating the quality of care, services provided by insurance companies, treatment costs, etc. (Nabarette, 20021).

Some of the classification matrixes now have an extra line and column labelled G for Government. This gives G2B, B2G, etc. Governments have made a major effort in recent years to provide a growing supply of information over the Internet for economic agents (G2B and G2C). However, such tools as the Minitel, Videotext and EDI (electronic data interchange) had already been used for conducting such operations in the past, albeit on a much smaller scale. Furthermore, the relationships between the government and its partners are not commercial.

of the population. They can also be used when travelling. Digital television networks can be used for two-way communication and viewers can order programmes through their television sets. Cell telephone networks will offer more services as future generations of telephones offer higher transmission speeds. Certain segments of the population that have already adopted earlier networks, such as the Minitel, will continue to use them if they have no compelling reason to switch to the Internet. These media should be seen as complements to the Internet, and not substitutes. A visit to a website may be followed by a telephone order placed with a call centre, a shipment to a physical delivery point, online provision of after-sales service, etc.

The current lack of reliability with regard to transmission speeds and security means that the Internet is not suited for certain types of B2B transactions. Primarily for this reason, firms will continue to use the dedicated data links and networks that have been in place since the early nineteen-seventies. In most cases, the data transmission capacity is provided by telecommunications operators and the owners of physical networks, such as the French railways operator, SNCF. These networks link firms that have entered into bilateral agreements or subscribed to the same dedicated networks.

Once again, firms make simultaneous use of several communications media, even though the Internet will eventually become a platform for integrating all network services. This future platform will not, however, be the Internet we know today. IP will be the common standard for networks administered in different ways. As is the case today, differentiated communication services will be available. But, unlike today, they will use a common network infrastructure, instead of being implemented on separate physical infrastructures.

It should also be noted that systems being developed on the Internet today often rely on systems developed a long time ago for business use. Online financial market transaction systems and online airline ticket sales systems are in fact connected to the on-line trading systems and airline reservation systems that were developed in the mid-nineteen-seventies. Retail transaction systems would not exist without these older systems, which link major institutions and corporations and ensure secure and reliable transactions.

To measure e-commerce, therefore, we have to observe what is happening on other digital networks, far beyond the Internet. This observation requires us to analyse how the various channels for exchanging information are complements or substitutes for one another. The other channels may be digital networks, other means of telecommunication, the mail or face-to-face meetings. These various media for information exchanges are often thought of as substitutes for one another, when they are in fact largely complementary⁶.

Breaking Transactions Down into their Components

It helps to analyse the uses made of electronic networks in order to move beyond the medium-based approach. Uses can be captured by identifying the transactional functions that the parties choose to carry out online, with a distinction between *ex ante* functions and *ex post* functions (Williamson, 1985).

Before a transaction can take place, the parties must:

- find potential partners [1];
- negotiate with their partners [2];
- and then reach an agreement [3].

After the transaction has been concluded, the agreement needs to be carried out, which involves an exchange of information:

- specifying the parties' obligations in detail (especially if the contract is incomplete with regard to such information as volumes, delivery dates and addresses and certain technical specifications) [4];
- enabling the parties to make adjustments (delivery status, resource planning, etc.) [5];
- enabling the parties to reach a financial settlement (invoicing and payment) [6].

⁶ Analysis of telephone and e-mail traffic patterns, for example, show that the electronic exchanges are most intense between individuals who communicate regularly by other means. In commercial relationships, electronic media may also be complements to face-to-face meetings. In the American automotive market, for example, it is estimated that fewer than 1% of the sales are made online, yet nearly two-thirds of the purchases are prepared on the Internet, where buyers go for information about models and dealers.

Finding, Negotiating and Reaching Bargains on Digital Networks

Electronic markets emerge when the *ex ante* functions are carried out on digital networks and supply and demand actually meet online. Under circumstance, the parties' informations costs might be lower, which could enable them to make prospective counterparties compete for their business. In practice, however, contrasting forms of markets may emerge (Brousseau, 2000). Intermediaries can organise non-transparent markets, such as the airline reservation systems, where supply and demand information is centralised and managed according to the intermediaries' own rationales for adjusting the other agents' plans. Or, conversely, the market can operate as a double-blind auction, where all bidders and sellers are competing against each other (marketplace rationale; see Box 2).

In the same way, the actual operating procedures on the market can differ greatly, depending on whether all functions, or only certain functions, are carried out electronically. In the vast majority of cases, Internet-based e-commerce today relies mainly on an electronic search for potential partners (Function [1]). On the one side, product and service providers use websites to advertise and their websites can be seen as showcases. On the other side, consumers use the capabilities of more or less specialised search engines that list providers and, more rarely, compare the "advertised" prices. In practical terms, this limits the usefulness of such search engines to standardised products and services, where there is little uncertainty about quality. Typical examples are books, compact discs and software⁷.

The leading example in this field is the range of service provided by the automotive sales intermediaries that have emerged in the United States (Autobytel.com, Autoweb.com, Carpoint.com). These sites list the affiliated car dealers' prices for a given model and send them prospective buyers. They earn money by charging car dealers a subscription fee or a finder's fee. Buyers enjoy the lowest prices, which are made possible both by keener price competition and the economies of scale that affiliated dealers achieve as a result of higher stock turnover. A recent study (Scott Morton, *et al.*, 2000) reports that buyers save about 2% on the price of a car.

Parties are less likely to negotiate terms and place orders online (functions [2] [3]). Buyers do not have much assurance as to the quality of the products and services provided. Thus online negotiations and orders only involve highly standardised and not very complex products and services, since the relevant characteristics have to be described using an interface that does not leave a lot of room for detail. In addition, the products and services have to be ones that are used in a standardised manner, since online shoppers can only get fairly limited help in choosing the best product for their needs⁸.

In practice, even though consultants' estimates need to be taken with a grain of salt, more than 80% of the transactions on the Internet involve products with such clear-cut standard characteristics. They are travel tickets, which are defined by a departure date and city, an arrival date and city and the means of transport, or else cultural products, which are defined by the title and the artist or author, and computer products, which are defined by technical standards, capacities and, where appropriate, generation (see Table 3). There is a fourth category of such products, which is financial products. A growing share of retail trading orders is being placed via online brokerage systems.

Deliveries of these products and services do not raise any major logistical problems. They can be delivered electronically or via conventional circuits, such as the mail or parcel delivery services, since such products are compact, relatively light and do not require special treatment during shipment and storage.

⁷ The main sites in America are Dealtime, mySimon, Pricewatch, Pricescan, Pricegrabber, BottomDollar and Qix. However, as Ellison and Fisher Ellison (2000) point out, consumer surveys in America shown that most of the sales made over the Internet do not involve the use of such sites. For example, in 1997 and 1998, 70% of the buyers purchased recordings and books from a single site (Johnson *et al.*, 2000).

⁸ Several attempts to create online B2B systems failed in the nineteen-eighties, or else they had to be redesigned. This was because complex products and services are not easy to describe online. For example a system for exchanging real estate market information online was not successful since posting descriptions and photos could not replace visits to the properties in person to evaluate their true characteristics. In a similar vein, DEC, which was the leader for networked mini-computers at the time, had to limit its Electronic Store to taking orders for supplies and peripherals. Selling computers required DEC to give a great deal of advice and work with customers to determine their exact requirements. Customers were not necessarily able to express their needs in terms of hardware and software because they did not have a comprehensive grasp of what was available, technical developments and how certain solutions could match their requirements.

E-COMMERCE TECHNOLOGY

E-commerce can be based on several types of technology, which correspond in part to technological progress. In fact, any use of an electronic medium to carry out all or part of a commercial transaction can be seen as an e-commerce operation. Consequently, a fax used for placing orders can be seen as an e-commerce technology. A number of digital network services are more specifically designed as media for commercial transactions. Some of the main ones are:

- Value added services (VAS), typified by airline reservation systems and financial information and trading systems, like Reuters. These systems operate on the principle of a centralised server. The "clients", which are travel agencies and fund managers in this case, have access to a service that is usually made up of an information component to help them carry out their transactions and a transaction component to record and validate orders and to handle payments. These are closed systems, since only subscribers have access to them and the services offered are specific to the network. Most of the time, the service provider plays an active role, matching supply and demand, defining precise operating rules for the market, etc. Most of the systems used today emerged in the nineteen-seventies. They were originally modelled on large centralised mainframe systems, which were interconnected in some cases (Brousseau and Quélin, 1991 and 1996).
- Videotext, typified by France's Minitel and systems developed in other countries in the early nineteen-eighties, is also based on a centralised computer system, which was the prevailing model before the advent of personal computers. The main differences between videotext and value added services are that videotext solutions are aimed at the general public and they are much cheaper, since they use public switched telephone networks and data transmission networks that are accessible to everyone. Dumb terminals are used to connect to the servers providing services. The success of France's Minitel system is largely attributable to the free distribution of the terminals and the invention of kiosk billing whereby the network operator bills customers for "minutes" on the network and then passes on a share to the information service providers. This type of solution provides a reliable and inexpensive system for handling "micropayments" that is well suited for the provision of information services aimed at the general public (Flichy et al., 1991; OECD, 1998).
- Electronic data interchange (EDI) is typified in France by the GALIA information sharing system used by car makers and their suppliers, or the GENCOD system used by major retailers. EDI is primarily based on standardised presentation of the information exchanges between firms so that the order processing systems can automatically generate and interpret messages. More importantly, EDI is linked to applications for inventory management, shipping, invoicing and payments, as well as production and sales management. The main attraction of EDI is not automation of information processing, but automation of coordination between firms. This requires more than just standardised message formats and involves rules governing interfirm transactions, contracts, etc. This explains

why most EDI systems are specific to given sectors of industry. EDI systems were developed in the late nineteen-eighties and, in most cases, they were integrated into dedicated data transmission networks that were well suited to very secure mainframe systems (Brousseau, 1994). However, since EDI standardisation is not very dependent on the infrastructures used to transmit data, WebEDI is starting to make its appearance, and EDI messages can now be transmitted over the Internet. This development will bring EDI within reach for smaller firms since the Internet is cheaper and it can be used to link personal computers.

- Secure web servers are generally used for e-commerce applications. These are Internet servers that use software techniques to protect themselves against intrusions by hackers and to secure the information exchanged with the computers connecting to the server. Data security is usually provided by encryption. In most cases, the servers currently in use offer access to online catalogues and ordering systems that are similar in spirit to VAS services and videotext. The main difference lies in the Internet technology used to connect computers to each other, instead of connecting terminals to central servers. The Internet makes multimedia presentations possible and customisation of information so that servers send data suited to the customers' requests or adapted to user profiles established by the "cookies" that servers leave and read on users' hard disks.

Servers can also use the processing and storage capabilities of client machines for online delivery of some types of information services (downloading). Servers can also organise dialogues between clients' computers. The rich potential and flexibility of web servers mean that they are used for services operating in very different ways (see Box 1). The first commercial web servers, such as Amazon, were developed in the second half of the nineteen-nineties. The fact that services are not dependent on the medium means that web techniques can be used to develop applications using mobile terminals, digital television sets, etc.

- Marketplaces organise genuine virtual markets by combining the technology of EDI with web servers and extranet, which is the capability of creating virtual controlled-access networks on the Internet. Subscribers have secure and anonymous access to the marketplace to make business propositions to all of the potential customers and suppliers connected to the network. Responses are received and selected, either by the party making the proposition or by a centralised system for managing anonymous bids. At present, most of the systems are still in the development or testing phases. There are formidable technical problems to be overcome. Such systems require an immense effort to standardise services and to come up with rules for interfirm coordination. Partnerships have been formed in practically every sector of industry since 1998, but it is not clear that such marketplaces are well suited to the specific characteristics of transactions in every industry.

Obstacles to Fully Electronic Transactions

There are several obstacles to performing functions [1], [2] and [3] electronically. These obstacles are the reason that only a minority of transactions involving a minority of products and services are conducted as wholly electronic transactions at this time (see Table 3).

First, in spite of technical progress, electronic media still face the problem of coming up with standardised language for describing products and services (*measurement* systems in the categories proposed by North, 1990). Without such language, consumers cannot evaluate the nature and quality of the products and services on offer and they cannot express their requirements. Of course, similar problems arise in the distribution of products and services through conventional bricks-and-mortar networks. However, personal contact and the physical presence of the products or service provider reduce uncertainty about quality. The local presence of conventional distributors and service providers also ensures that there are means of dealing with problems. A local operator's reputation is one of the main assurances of the quality of its service, since its reputation serves as a form of *certification* for the products that it distributes.

Secondly, there is also the problem of the reliability of e-commerce operators (*enforcement* problems in the categories proposed by North, 1990). If they have no local presence, or are

located in a different jurisdiction than their customers, they may be tempted by opportunism⁹ as regards the quality or even the reality of what they are offering. This can work both ways, since customers could also escape paying for goods and services rendered.

Thirdly, producers and consumers alike may fear that IT will make markets too transparent and that they will end up as the victims of this excessive transparency¹⁰ If we look at what has happened to airlines, we see that the growth of the market for online airline reservations has intensified price competition between airlines and made differentiation strategies pointless, with the result that airlines are engaged in a brutal price war (Dang N'guyen, 1996). In other industries, operators have responded by developing strategies to prevent such markets from emerging. For example, at the end of the nineteen-eighties, the major American insurance companies opposed the development of an online market for insurance products (Brousseau, 1993).

In addition, many producers impose restrictions on their distributors. These restrictions are moti-

⁹ In transactions cost theory, opportunism means not respecting the letter or the spirit of an agreement by misrepresenting the quality of products or services, or else by defaulting on one's obligations.

¹⁰ This argument relates more to conducting transactions on transparent electronic markets than to conducting transactions online per se, since sellers can set up their systems to prevent consumers from comparing offers by differentiating offers, using incompatible standards, setting fixed subscription fees, etc.

Table 3
E-Commerce Structure in France and the United States in 1999*

Sector	France		USA	
	FRF millions	% of total	USD millions	% of total
Travel, transportation and hotels	620	47.18	7,798	38.33
Computers (hardware and software)	312	23.74	4,455	21.89
Cultural products (books - music - video)	137	10.43	2,376	11.67
Apparel	5	0.38	1,620	7.96
Flowers and gifts	15	1.14	656	3.23
Food and drink	33	2.51	513	2.52
Health and beauty	-	-	509	2.50
Furniture and appliances	25	1.90	446	2.19
Box office	7	0.53	300	1.47
Games	2	0.15	253	1.24
General retail (mail order, distributors, chain stores)	92	7.00	-	-
Miscellaneous	66	5.02	1,418	6.97
Total	1 314	100.00	20,344	100.00

* According to BIPE (2000), these amounts account for 7% of the book sales, 6% of CD sales and 3.7% of box office and game sales in the United States. In the travel industry, the FRF 620 million in online sales represent 0.3% of travel and hotel sales in France. Sources: Benchmark Group, 2000 for France (survey of the "75 most active commercial sites in France," http://www.internet.gouv.fr/francais/Forrester_Research, 2000), for the United States, <http://www.forrester.com/Home/0,3257,1,FF.html>

vated by strategic considerations aimed at creating and using market power or by the requirements of providing end consumers with related after-sales service and support (OECD, 1994). Service providers and manufacturers today often refuse to develop distribution circuits that would compete with their conventional circuits¹¹.

Consumers, on the other hand, may worry that private information revealed by their online buying habits (see below) may eventually be used for excessively discriminatory marketing. Many web users have already adopted the policy of giving false information when signing up for services that are offered to users for free if they will disclose personal information. Professionals estimate that 40% of the information obtained in this way is false.

Beyond the shipping issues that are frequently cited as arguments in favour of developing mixed systems combining online and conventional distribution channels (clicks-and-mortar), information and strategic issues are cited to explain why electronic distribution channels (click-and-deliver) have not taken the place of conventional channels (bricks-and-mortar)¹². It would be misguided to think of these elements as just so many obstacles that need to be removed in order to create markets that are truly efficient because they are truly electronic. Obviously, the best media and organisational structures for commercial transactions differ, depending on the specific characteristics of various goods and services. The most efficient exchange procedures in the “real” world are not the same for everything, as can be seen in the variety of structures and technologies used for offline transactions. There is no reason to think that a single model for e-commerce can be imposed, or even to think that e-commerce will be suited to all types of commercial transactions.

Commercial Functions of Digital Networks

Consequently, it is more important to see how digital networks change supply-and-demand relationships than to monitor the growth of online ordering. Furthermore, these supply-and-demand relationships rely on several media.

Digital networks, and the Internet in particular, provide several useful functions for commerce. The client-server structure of the Internet makes

it a good medium for providing personalised information. It is a multimedia network that can be used for carrying media content. It is decentralised, which means it can facilitate the constitution of self-managed communities. The combination of these elements:

- makes the Internet a channel for supplying dense information that is tailored to the characteristics of each individual user. In addition to the market for specialised information (served by the media, databanks, etc.), the Internet is a vector for targeted marketing messages. It is also a key to providing other services aimed either at simplifying the tasks of potential customers by helping them choose, make appointments, locate retail outlets, etc. or aimed at attracting new customers by providing free advice, for example.
- makes the Internet a targeted marketing resource. Digital network can automatically and accurately trace and store exchanges. This gives marketing experts the tools to draw up highly detailed individual profiles and identify target population groups for focused marketing campaigns. This trend emerged in the nineteen-eighties, when computer use became widespread in the retail trade. The development of digital networks accentuated the trend by making it possible to combine earlier databases with monitoring of cyber-consumers. The resulting marketing data has been used for discrimination strategies based on identifying consumption profiles and implementing customer loyalty schemes (Gensollen, 2001).
- makes the Internet the home for virtual communities based on cooperation and information sharing by individuals with common characteristics. The Internet was developed in a non-commercial context for sharing information and knowledge. It became the medium for the development of a number of tools, such as e-mail, discussion lists, newsgroups and chat

¹¹ This is especially true in some sectors, such as chain stores in France. The retailers' market power means that manufacturers considering direct online sales have very explicit fears about potential retaliation by retailers. In practice, manufacturers' and wholesalers' e-commerce services are differentiated from their conventional business so as to avoid competition between distribution channels. For example, Compaq's online offer of computers does not include its high-end products aimed primarily at the business market and wine dealers market imported and varietal wines online, but they sell their highest quality products only through conventional distribution channels (Giraud-Héreaud et al., 2001).

¹² In the early days of e-commerce, the contrast was between the click-and-deliver and the bricks-and-mortar models. Thus the model combining conventional distribution channels with the capabilities of digital networks was dubbed clicks-and-mortar.

rooms. These tools have come to play a key role in managing relationships between supply and demand. In the past, consumers organised themselves into groups in an attempt to reduce the asymmetry of information that put them at a disadvantage (see C2C in Box 1). But sellers are now using the power of these tools for their own ends by providing such tools to their customers and building communities around their products and services (Curien *et al.*, 2001). Amazon.com is a prime example, since it asks its customers to review and rate books to help guide other consumers in their choices. Software vendors use newsgroups to help identify bugs in products, thus making each customer a product tester. They also provide user support newsgroups that ease the workload of their after-sales service departments. These tools also help suppliers to identify the product features that consumers want.

If we measure only agreements entered into online (function [3]), then we only account for a fraction of the applications having an impact on the way markets work and we run the risk of underestimating the proportion of operations to find partners (function [1]) and negotiate deals (function [2]) that are carried out online.

On the other hand, it does not make sense to simply aggregate all of the sales volume that involves digital networks in one way or another, without making distinctions between the operations concerned. In the first place, such an aggregation would not enable us to determine which aspects of transactions are affected. Furthermore, the use of digital media would soon cease to be a discriminating variable, since such media will be used as the medium for one function or another in nearly 100% of the cases, as is the case with the telephone network today.

Relationship Management over Digital Networks

After an agreement has been entered into, electronic media become powerful tools for managing logistical coordination between the contracting parties (function [4]) and enabling the parties to provide each other with information services(function [5]).

One of the advantages of digital networks for coordination as part of function [4] is that they make automated information exchanges possible. They can link automatic systems for man-

aging interfaces between economic partners. This is done to manage purchasing and sales, inventories and shipping, and even production scheduling. This helps to reduce relative *ex post* adjustment costs and potential response times¹³.

The most striking example in this area has been the development of EDI in the automotive industry. The need to combine mass production and greater product differentiation led to the implementation of flexible just-in-time production methods. As more than 70% of the value added in a car comes from the carmaker's suppliers, it became critical to make inter-firm relationships more flexible and fluid. The old supply contracts, which stipulated the technical specifications and delivery schedules for products in the medium term, have been replaced by less complete contracts, where delivery types and schedules are redefined on an ongoing basis, according to the carmaker's sales and production requirements. These new production and coordination techniques would probably not be feasible without the development of the EDI systems that provide very close links between the suppliers' and the carmakers' computerized production management systems (Brousseau, 1994). The same type of just-in-time sourcing is now the prevailing practice in retail distribution.

Electronic media are also effective tools for providing personalised information services (function [5]). These media are either the main vector for the services on offer, as is the case with online information services, or else they are the vector for differentiating and enhancing services, as it the case of services developed by transportation firms. Many express delivery firms now offer customers real-time tracking of their shipments, so that customers can deploy or re-deploy their resources preventatively.

Most of these information services are sold on a subscription basis (which may be combined with per-use charges). The idea is to lock in customers by providing a service for which there is no substitute or by "bundling" several complementary information services into a subscription service. Bundling actually presents many advantages that are well know in terms of indus-

¹³ *Technical potential must not be confused with organisational capability. A great deal of research on the use of ITC has shown that firms have to reorganise to achieve the full potential of ICT in terms of flexibility. In this particular case, the reorganisation concerns inter-firm interfaces. Organisational changes are a delicate matter and very costly (Brousseau, 1994; Brousseau and Rallet, 1999).*

trial economics, particularly with regard to discriminating customers and building customer loyalty (Gensollen, 1999; Gaudeul and Julien, 2001). Bundling information services makes it possible to solve security problems in information transactions, since the products that are less vulnerable to resale ensure the sale of more vulnerable products. Bundling also makes it possible to implement marketing strategies based on the tracking of consumer profiles mentioned above.

This is the Dawn of Alternative Payment Systems

Making payments via electronic media [6] is fast and cheap. Implementation problems are primarily related to organisational and institutional issues. In addition to access to secure networks and reliable encryption systems, the main problems lie in the development of sufficiently all-purpose systems so that the payment data exchanges are really universal equivalents and are reliable enough to maintain users' confidence. In other words, the new technical tools and, where appropriate, new service providers, have to be fitted into the conventional means of payment management system run by the banks and overseen by the banking authorities.

The emerging alternative payment systems, such as e-cash, secure protocols, private clearing systems, notarised systems and loyalty reward systems, all raise different issues, since they have differing impacts on monetary creation, bypassing the banking system, etc. Such systems are still in their infancy, which is why so few online payments are made over open networks. The use of conventional means of payment, and particularly the practice of giving credit card numbers online, still raises major security problems.

On the other hand, payments over secure networks are already widely developed. A growing share of such payments is made on customers' instructions to their banks. Interbank networks developed in the nineteen-seventies, including the international SWIFT network, are widely used for transfers between bank accounts. The main challenge today lies in the development of online payment systems that can reliably handle large numbers of small-value payments for the general public (Bounie, 2001). This may entail the development of genuine private cross-border monetary-issuance systems. Consequently,

online payment solutions raise very sensitive issues¹⁴.

All in all, the problems involved in the use of digital networks for *ex post* transactions management are very different from those involved in *ex ante* transactions management.

- *Ex post* transactions management systems have nothing to do with finding partners or negotiating bargains. Consequently, they have no direct influence on the way markets operate, which means their only impact should be on the efficiency of coordination. Nevertheless, such systems are so carefully tailored to fit the parties' specific needs very closely that they lock in the partners in the transactions concerned. Groups of users sharing the same technical and organisational standards (Brousseau, 1994) become *de facto* closed communities. Furthermore, the inter-organization information sharing systems provide services that are designed for differentiation, thereby increasing switching costs for users.

- Wholesale payments are already handled electronically on the whole, as are most transactions between banks and their business customers. This means that the critical issue now with regard to the development of electronic payment systems for emerging markets, such as online information providers, is the design of institutional frameworks for regulating payments between consumers and businesses.

Once again, the criterion of online ordering is a poor choice for capturing the influence of IT on coordination procedures in market economies.

Categories of Players and Differentiation of E-Commerce Forms

Another way of approaching IT uses is to identify the types of players that the different electronic commerce services bring together (see Box 1). The most common distinction between B2B and B2C relates to the transaction volume handled or likely to be handled via electronic systems. All of the measurements and forecasts estimate that online B2B business volume (see Table 4) is 8 to 10 times greater than online B2C

¹⁴ Online securities trading systems raise similar problems. Online brokers are capable of handling clearing amongst themselves and are setting up systems that bypass the conventional capital markets. This raises regulatory issues with regard to securities markets, even though competition between the various markets creates greater efficiency (Serval, 2001).

business volume. However, examining e-commerce in these terms raises problems (see above), especially as B2B transactions are very different from B2C transactions at present.

Most observers agree that B2C primarily concerns the operations leading up to a contract (functions [1], [2] and [3]). Most of the existing systems were designed to handle search and negotiation operations relating to a very narrow range of goods and a tiny proportion of transactions (see Table 3). Nonetheless, B2C sites play a substantial role in the markets concerned. The spectacular failure of some e-commerce businesses launched in other markets, such as clothing, suggest that the first B2C market segments were not so much trailblazers as segments that lent themselves particularly well to online handling of some or all of the operations leading up to contracts (see above).

The banking and financial sector offers the most substantial range of *ex post* transactions management in the B2C market. Banks first introduced home banking systems back in the mid-nineteen-eighties, when American households were buying personal computers and French households gained access to telematics through the Minitel system. The advent of the Internet as a commercial network greatly increased the capacities of such systems and opened the field to new operators, who brought sweeping changes in the way households trade on capital markets. Online trading systems make it possible for members of the general public to manage their market positions in real time. Online securities trading now accounts for some 45% of trading in the United States, leading to a fall in brokerage commissions of some 70%, according to the BIPE, as a result of greater competition and the savings on back office¹⁵ costs in online trading systems.

While B2C e-commerce mainly focuses on *ex ante* transactions management, B2B focuses more on *ex post* transactions management. The 1999 survey of French manufacturing firms by the Census Department of the French Ministry of Industry (Sessi) shows that online ordering is tiny in comparison to information exchanges between industrial and commercial partners (see Table 5 and Chart). The exceptions are the financial and airline sectors, which developed B2B online transaction systems in the nineteen-seventies. The oil industry also developed online brokerage systems in the wake of two oil shocks to manage a good that had come to have a very high unit price.

The vast majority of existing systems, such as EDI systems, were designed to handle *ex post* transactions management, including order scheduling, sharing technical information, synchronisation of production and shipping and handling invoicing and payments. As in the case of B2C, e-commerce transactions primarily concerned specific activity sectors. For example, Edifrance estimates that two sectors account for most of the FRF 800 billion volume of commercial EDI traffic in France: with distribution accounting for FRF 500 billion and the automotive sector accounting for FRF 200 billion (Observatoire du Commerce et des Échanges Électroniques, 1999)¹⁶.

But these two sectors are not the only ones to use e-commerce. In addition to EDI, there are many other systems for exchanging information between business that are based on less highly automated means of communication, such as the Minitel, or on less highly organised means of communication, such as e-mail. These systems can play a role in transactions management in other sectors. For example the Minitel plays a role in the transport sector (Brousseau, 1991). There are also long-established online information systems that rely on the dedicated networks that information service providers use to deliver their services to business customers (see Table 6).

Table 4
Online Business Volume in 2000*

In USD billions

	USA	Japan	France
B2B	449.900	29.618	9.102
B2C	2.262	38.755	818
Total	488.655	31.880	9.920

* The estimates are based on a definition of e-commerce where online operations are any transactions carried out over a data transmission network (Internet, EDI, etc.), regardless of the payment method used.

Source: Forrester Global eCommerce Model, 2000.

¹⁵ The financial sector makes a distinction between "front office" operations, which are necessary for carrying out trades on the markets, and "back office" operations, which are the internal and administrative procedures for preparing and processing trades.

¹⁶ It should be noted that EDI projects abounded in all sectors at the end of the nineteen-eighties, but EDI only plays a major role in two very specific areas today. The pattern is likely to be similar for Internet technology. The possibilities opened up by various forms of IT and by the various potential applications are not necessarily useful or applicable in all areas. This means there is little reason to believe that a single model of e-commerce will become the norm in all areas.

The Effects of E-Commerce Take Many Shapes, Which are Poorly Understood

Far from bearing out the myth of the Internet as a marketplace, the emerging pattern of e-commerce is one of marginal use of differing systems for:

- supporting and guiding consumers seeking suppliers and products (and ordering online occasionally), with B2C e-commerce used for very limited range of products;

- more efficient management of industrial and commercial partnerships with B2B e-commerce;

- providing online information services.

Naturally, qualitative and quantitative developments are to be expected. These should eventually have a major impact on the way markets and industries work, but it will vary from area to area, since different systems are being developed to work in different contexts. How will these developments affect future markets?

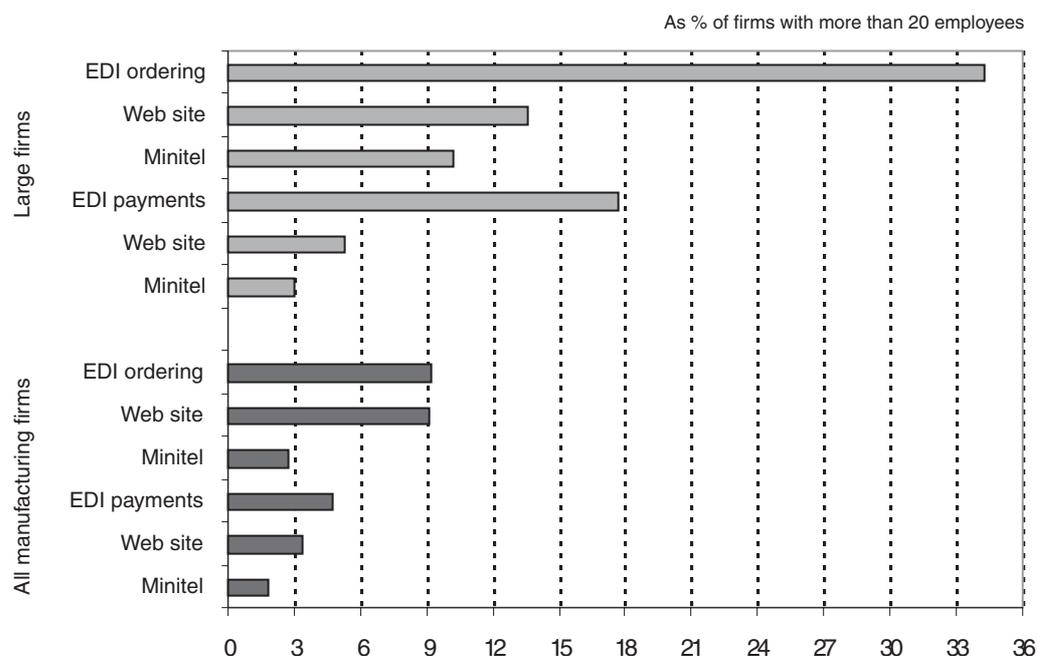
Table 5
Electronic Data Interchange (EDI)

As % of firms

	Number of employees					Total
	20 to 49	50 to 99	100 to 249	250 to 499	> 500	
With other firms (subcontractors, suppliers, customers, banks, etc.)	29	39	47	60	76	36
Between divisions within the firm	10	16	21	31	40	15
With government agencies and public bodies	11	14	20	26	34	14
For one of the three functions	36	47	57	69	82	44

Field: manufacturing firms with 20 or more employees, including the energy industry and excluding the agri-food industry.
Source: TIC survey, 1999, Sessi.

Chart
The Advent of E-Commerce



Key: The percentage of firms offering customers online ordering (via EDI, web sites or minitel) and online payments (via EDI, web sites or minitel) are shown for each of the two groups (all manufacturing firms and large firms with more than 500 employees).
Field: manufacturing firms with 20 or more employees, including the energy industry and excluding the agri-food industry.
Source: TIC survey, 1999, Sessi.

Two Generations of Research

Rigorous research in this area is still rare. This is undoubtedly due to the relative newness of the phenomenon. However, there is nothing new about using digital networks as a medium for commercial transactions (see above). Electronic markets and data exchanges between companies have been around for more than 20 years. Therefore, we need to draw a distinction between two generations of research.

The first generation started in the nineteen-eighties and analysed the impact of inter-organisation information sharing systems (e.g., Barette and Konsisky, 1982; Brousseau, 1993; Clemons and Row, 1988; Faulhaber, Noam and Tasley, 1986; Malone, Yates and Benjamin, 1987; Scott Morton, 1991). This research was mainly intended to determine whether ICT brought about changes in the governance of inter-organisation transactions through disaggregation of “hierarchies” into “markets”, changes in the economics of certain industries or productivity and competitiveness gains. Most of the research focused on analysis of B2B e-commerce.

At the end of the nineteen-nineties, a second generation of research started to analyse the impact of the development of e-commerce on the Internet. Very few findings have been published, since the advent of Internet-based e-commerce is still very recent. Most of this research focuses on B2C e-commerce, since the development of Internet B2B e-commerce is still in its infancy¹⁷. In both cases, we do not have enough perspective to observe the impact of different types of e-commerce applications

on the Internet. The potential organisational changes triggered by these applications have barely started to be seen and, more importantly, the services offered and the strategies used are changing constantly. Applied research based on proper scientific foundations is therefore rare, which fuels a great deal of purely speculative writing about the presumed impact of the Internet and the advent of B2C e-commerce.

The context for the second generation of research is different from that of the first. The focus is primarily on testing the reality of the myth of the Internet being the medium for competitive markets with no intermediaries.

These two issues (competitive markets and disintermediation) need to be clarified before taking a more general look at the type of research that needs to be promoted.

Prices are not Always Lower on the Internet

Some research has been done on retail sites in the last five years to test the reality of the myth that IT has made markets more transparent. This type of research raises major methodological problems, because there is no guarantee that the products and services being compared are truly equivalent and because web sites do not always give prices. The research also has to focus on a

¹⁷ Even though the volume of B2B traffic is greater than B2C traffic, most of the B2B traffic consists of EDI exchanges relating to ex post transactions management. Internet-based e-procurement, with the development of virtual marketplaces (see Box 2), is just starting to get off the ground. Therefore, looking at the B2C activity gives us more perspective on how large-scale virtual markets work than observation of the B2B market does.

Table 6
Manufacturing Firms and the Internet

As % of manufacturing firms

	Internet access	Web site	Online ordering	Intranet	Extranet
Major firms	97.7	70.5	13.6	79.1	37.2
SMEs	67.6	38.1	8.9	19.3	8.6
High tech	85.6	51.5	9.2	36.5	16.8
Low tech	64.3	36.2	8.9	17.4	7.8
Export rate over 25%	83.0	52.4	10.2	33.4	16.7
Export rate under 25%	64.0	35.0	8.6	17.3	7.3
Group subsidiaries	82.1	47.9	9.5	38.4	15.8
of which foreign group subsidiaries	85.7	46.3	9.8	46.5	20.0
Independent firms	59.2	33.3	8.6	9.5	5.3
Innovative firms	80.5	49.6	11.1	28.6	13.2
of which innovative product firms	81.6	51.1	11.3	29.5	13.5
Non-innovative firms	58.7	30.5	7.3	15.2	6.6

Source: TIC survey, 1999, Sessi.

very specific range of products, which are primarily books and compact discs. Furthermore, research has led to contrasting findings, which make us think that reliance on electronic media is far from being the sole factor to consider in current developments and that other aspects, such as market structures and marketing strategies, also need to be considered.

The first study by Bailey (1998a and 1998b) was based on 24,000 prices collected on the American market for books, compact discs and software in 1997. This study concluded that prices are not lower on the Internet than they are in stores. It further found that price dispersion is greater on the Internet and that price adjustments are more frequent. According to Bailey, Internet price levels are explained by the profile of Internet consumers, who have high educational attainment and income levels and who use the Internet not so much to find the best bargains as to save time. Many other observations have upheld this view (see footnote 7). Contrary to common belief, it is relatively expensive to find information on the Internet¹⁸ and most of the consumers using the Internet at this time are more concerned with saving time than they are with saving money.

At this stage in the development of the Internet, we tend to see distribution channels using the Internet more to target specific types of consumers rather than consumers using the Internet to shop for the lowest prices and increase competition between sellers. A great deal of subsequent research has borne out Bailey's observations: Degeratu, Rangaswamy and Wu (1998) on grocery prices; Shankar et al. (1998), along with Clemons, Hann and Hitt (1998), on travel prices and Lee (1998) on used car prices.

However, more recent and more in-depth investigations have added greater detail to the earlier observations. In some cases (Scott Morton et al., 2000), Internet shoppers do enjoy lower prices (see above). Brynjolfson and Smith (1999) looked at 8,5000 prices for books and compact discs to conclude that prices on the Internet are 9% to 16% lower than in stores. On the other hand, their research also showed that the price levels are proportional to the prominence of web sites and traffic levels. Thus, despite offering lower prices, less well-known sites are not able to attract Internet shoppers away from the top sites, which is proof that the market is not perfectly transparent.

In fact, more recent research (e.g. Friberg, Ganslandt and Sandstrom, 2000) has shown that the

Internet is a means of implementing personalised pricing policies. This observation is in line with the more qualitative observations that the possibilities of the Internet make mass-customisation policies feasible. These policies aim for a subtle combination of differentiation and targeting (see above and Gensollen, 2001). Internet shoppers enjoy services that are adapted to their main needs, which are saving time, shopping from home and obtaining expert advice. In exchange, consumers let sellers adjust prices according to their propensity to pay.

No Progress towards Perfect Virtual Markets

Up until the bursting of the dot-com stock market bubble, the press and some of the Internet "gurus" thought that disintermediation was a key to productivity gains stemming from e-commerce. The thinking was that digital networks would squeeze conventional commercial intermediaries out of business by making them obsolete. Events have not borne out this widely held belief. Far from being dominated by manufacturers and service providers, e-commerce is mainly a business for conventional intermediaries, such as chain stores, specialised retailers and mail-order firms. The Internet is obviously a complementary channel for these retailers, alongside their other channels for selling goods, rendering services and finding customers.

This stands to reason when we look at the economics of intermediation in commerce. Far from being intermediaries that merely provide information, commercial intermediaries provide shipping, financial services and security. These services are closely linked (economies of scope) and require specific know-how (Spulber, 1996). The advent of new media has modified the economics of commercial intermediation, but it has not resulted in radical change (Brousseau, 2002). Thus, for reasons that relate to both logistics and strategy (Dang N'Guyen, 1999; Rallet, 2000; Gensollen, 2001), intermediaries in commerce continue to enjoy a competitive advantage in the intermediation function, as long as they are able to adapt digital technologies and make them complementary to their conventional tools.

¹⁸ One method for cutting search costs is to use "Shopbots (Shopping Robots) which are smart search engines that shop the Internet for the e-commerce sites with the lowest prices. However, as Bailey (1998a and 1998b) points out, e-commerce site administrators tend to prevent shopping bots from accessing their sites.

There was never any guarantee that many of the new intermediaries created in the wave of innovative start-ups over the last five years would be viable. Revenues failed to cover costs and the survival of many start-ups depended on the new-economy stock market bubble. Now that the bubble has burst, their continued existence is in jeopardy. The start-ups are either being taken over by conventional intermediaries or they are going bankrupt. Some of these firms managed to build up world brand images, as in the case of Amazon. They are bound to survive and become leading retailers. Eventually, however, they are likely to become multi-channel retailers just like their competitors are. They will have to acknowledge the fact that the most efficient distribution channels vary depending on population densities and consumer habits and that commercial and logistical systems vary from one country to the next.

Recent research on Internet-based e-commerce tends to discredit the assumption that we are moving towards perfect virtual markets. E-commerce takes contrasting forms in different sectors. It complements rather than replaces conventional distribution channels and technology. Players turn it to their own purposes. This is particularly true of commercial intermediaries, who use e-commerce to serve their differentiation and targeting strategies. These strategies produce very different levels of profitability and very different divisions of the surplus in various competitive environments.

This recent stream of research upholds one of the main conclusions of earlier research on inter-organisation information sharing systems. ICT per se is not a determining factor. Everything depends on how ITC is used and on the environments where it is implemented. When inter-organisation information sharing systems were deployed, there was a strengthening of quasi-integration around dominant firms in some industries and, simultaneously, disaggregation of other forms of industrial organisation. Similarly, the measurement of the impact of e-commerce in the future is likely to depend largely on the types of systems deployed in various environments.

Lessons for Statisticians

Debate is still continuing at the French Council for Statistics (CNIS), Eurostat and the OECD (CNIS, 2000), but the tendency is to prefer a very restrictive definition of e-commerce, with

the criterion of online ordering, as the basis for the statistical observations now being developed. From a technical point of view, such a definition has the advantage of being clear and simple. From the economic point of view, however, all of the previous discussion stresses that it will lead to a strongly biased view of the influence of ICT on coordination procedures between firms and between businesses and consumers.

This bias could be detrimental for macroeconomic and microeconomic analysis of current changes. The issue of faster factor productivity growth and its relationship to ICT diffusion (the productivity paradox) is still largely an open question, since, with a few exceptions, the research done up until now lacks basic microeconomic data about organisational changes related to ICT. Even though more recent research has tended to fill this gap with regard to coordination within firms, we will need more reliable data to examine changes in relationships between firms and between businesses and consumers.

We need more microeconomic data to inform players' and public authorities' strategies. It will be difficult to promote the most promising forms of e-commerce if we do not have tools for measuring how using digital technologies to handle various transaction functions affects new organisational structures in commercial intermediation – and thus employment and the division of labour in the retail and shipping sector –, as well as productivity gains, and commercial practices with regard to differentiation and discrimination strategies – and thus the division of the surplus among the various “players” in the system –, etc.

All of these are good reasons to use investigative methods that go far beyond simply measuring the business volumes affected by the use of digital networks. Surveys of e-commerce need to come up with better measurements of the various categories of uses and more systematic evaluation of the business environments (particularly market structures and industrial organisation) where such uses are implemented, and their impact (particularly on organisational structures). Furthermore, a comprehensive set of measurements is needed to conduct more relevant analyses of the microeconomic and macroeconomic impact of e-commerce. In addition to looking at price levels and price dispersion, or transactions costs, which are not the same as information costs, we need to enhance the analysis of the impact of

e-commerce systems on the quality of distribution services, on positive and negative externalities, on suppliers' efficiency, etc.

These are the keys to developing an accurate analysis of the impact that new digital tools have on price formation, industrial structures, competition structures, households' welfare, the efficiency of production systems, etc. This effort is bound to require targeted surveys rather than general statistical classifications, which are

unlikely to be accurate because of the diversity of uses and practices from one sector to the next and from one country to the next. We need to adapt our methods and measurements to the diverse range of e-commerce and the different ways of organising transactions in different contexts. It would also be worthwhile to look into the possibility of putting together reliable statistical series on the development of e-commerce, now that we have some historical perspective on some of its forms. □

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REFERENCES

- Arthur, B. W. (1989)**, "Competing Technologies, Increasing Returns and Lock-In by Historical Events," *Economic Journal*, 99, pp. 116-131.
- Bailey, J. P. (1998a)**, "Electronic Commerce: Prices and Consumer Issues for Three Products: Books, Compact Discs and Software," DSTI/ICCP/Ie(98)4, OECD, Paris.
- Bailey, J. P. (1998b)**, *Intermediation and Electronic Markets: Aggregation and Pricing in Internet Commerce*, Ph.D., Technology, Management and Policy, Massachusetts Institute of Technology, Cambridge, Ma.
- Barett, S. and B. Konsisky (1982)**, "Inter-Organization Information Sharing System," *MIS Quarterly*, Dec., 6, pp. 93-104.
- BIPE (2000)**, *Bonjour la nouvelle économie ! Les enjeux prospectifs de la révolution numérique*, BIPE, Paris.
- Bounie, D. (2001)**, "Monnaie électronique: nature économique et incidences monétaires" *Revue Économique*, Numéro Hors-Série, "Économie de l'Internet", sld. E. Brousseau & N. Curien, octobre 2001, vol. 52, pp. 313-330.
- Brousseau, E. (1991)**, "Telematics and Professionals: from the Absence of Discrimination to the Limitation of Uses", in Flichy, P., J. Jouët and P. Beaud (eds), *European Telematics, the Emerging Economy of Words*, North-Holland, Amsterdam, pp. 33-59.
- Brousseau, E. (1993)**, *L'économie des contrats ; technologies de l'information et coordination interentreprises*, PUF, Paris.
- Brousseau, E. (1994)**, "EDI and Inter-Firm Relationships, Toward a Standardization of the Coordination Processes?", *Information Economics and Policy*, vol. 6, No. 3-4, pp. 319-347.
- Brousseau, E. (2002)**, The Governance of Transaction by Commercial Intermediaries: An Analysis of the Re-engineering of Intermediation by Electronic Commerce, *International Journal of the Economics of Business*, 8(3), forthcoming.
- Brousseau, E. (2000)**, "What Institutions to Organize Electronic Commerce: Private Institutions and the Organizations of Markets", *Economics of Innovation and New Technology*, 9:3, July-September, pp. 245-273.
- Brousseau, E. and B. Quélin (1991)**, "Stratégie de coopération et formation d'un marché : les nouveaux services de télécommunications", in collaboration, *Revue d'Économie Industrielle*, No. 56, 2nd quarter 1991, pp. 77-100.
- Brousseau, E. and B. Quélin (1996)**, "Asset Specificity and Organizational Arrangements: The Case of the New Telecommunications Services Market", *Industrial and Corporate Change*, vol. 5, No. 4, pp. 1205-1230.
- Brousseau, E. and A. Rallet (eds) (1999)**, *Technologies de l'Information, Organisation et Performances Économiques*, Commissariat Général du Plan, Paris, September. (<http://atom2.univ-paris1.fr/FR/membres/eric/eric.htm>).
- Brynjolfsson, E. and M. D. Smith (1999)**, "Frictionless Commerce? A Comparison of Internet and Conventional Retailers", Proceedings of

- “Understanding the Digital Economy Data, Tools and Research,” U.S. Department of Commerce, Washington, D.C., May 25-26. (<http://ecommerce.mit.edu/papers/friction>).
- Clemons, E. K., I. H. Hann and L. M. Hitt (1998)**, “The Nature of Competition in Electronic Markets: An Empirical Investigation of Online Travel Agent Offerings”, Working Paper, The Wharton School of the University of Pennsylvania, June.
- Clemons, E. K. and M. Row (1988)**, “McKesson Drug Co.: a Case Study of Economost, a Strategic Information System”, *Journal of Management Information Systems*, 5:1, Summer, pp. 36-50.
- CNIS (2000)**, *Rapport du groupe de travail du CNIS (Conseil National de l'Information statistique) sur l'observation statistique du développement des TIC et de leur impact sur l'économie*, CNIS, Paris.
- Cowan, R. (1990)**, “Nuclear Power Reactors: a Study in Technological Lock-In”, *The Journal of Economic History*, 3.
- CRIC (1999)**, *Exploring the Effects of E-Commerce, Report Retail and Consumer Services Foresight Panel*, ESRC Centre for Research on Innovation and Competition, University of Manchester & UMIST. (<http://les.man.ac.uk/cric/e-commerce>).
- Curien, N. (2000)**, *L'économie des réseaux*, La Découverte, Collection Repères, Paris.
- Curien, N., E. Fauchart, G. Laffond, J. Lesourne and F. Moreau (2001)**, “Forums de consommation sur l'Internet : un modèle évolutionniste,” *Revue Économique*, Numéro Hors-Série, “Economie de l'Internet”, sld. E. Brousseau & N. Curien, octobre 2001, vol 52, pp. 119-136
- Dang N'Guyen, G. (1996)**, “Les systèmes de réservation aérienne et l'économie des réseaux,” in Brousseau, E., P. Petit and D. Phan (eds), (1996), *Mutations des Télécommunications et Réorganisation des Activités et des Marchés*, Economica, Paris, pp. 231-261.
- Dang N'Guyen, G. (1999)**, “Du commerce électronique à l'intermédiation électronique,” in Brousseau, E. and A. Rallet (eds), *Technologies de l'Information, Organisation et Performances Économiques*, Commissariat Général du Plan, Paris.
- David, P. A. (1985)**, “Clio and the Economics of QWERTY,” *American Economic Review*, 75:2, May, 332-7.
- Degeratu, A., A. Rangaswamy and J. Wu (1998)**, “Consumer Choice Behavior in Online and Regular Stores: The Effects of Brand Name, Price and Other Search Attributes,” Presented in *Marketing Science and the Internet*, INFORM College on Marketing and Mini-Conference. Cambridge, Ma. 6-8 March.
- Ellison, G. and S. Fisher Ellison (2000)**, “Search, Obfuscation and Price Elasticities on the Internet,” *mimeo*, MIT & NBER.
- Eurostat (2001)**, “Statistiques sur la Société d'information,” *Statistiques en Bref*, Thème 4, 4-2001, Eurostat.
- Faulhaber, G., E. Noam and R. Tasley (eds) (1986)**, *Services in Transition, the Impact of ICTs on the Service Sector*, Ballinger, Cambridge, Ma.
- Flichy, P., J. Jouët and P. Beaud (eds) (1991)**, *European Telematics, the Emerging Economy of Words*, North-Holland, Amsterdam.
- Friberg, R., M. Ganslandt and M. Sandstrom (2000)**, “E-Commerce and Prices: Theory and Evidence,” Stockholm School of Economics, EFI.
- Gaudeul, A. and B. Julien (2001)**, “E-Commerce, vers une analyse économique,” *Revue Économique*, Numéro Hors-Série, “Economie de l'Internet”, sld. E. Brousseau & N. Curien, octobre 2001, vol 52, pp. 97-118
- Gensollen, M. (1999)**, “La création de valeur sur Internet,” *Réseaux*, 17(97), November, pp. 15-76.
- Gensollen, M. (2001)**, “Internet : marché électronique ou réseaux commerciaux ?,” *Revue Économique*, Numéro Hors-Série, “Economie de l'Internet”, sld. E. Brousseau & N. Curien, octobre 2001, vol 52, pp. 137-164
- Giraud-Héreaud, E., L. G. Soler and H. Tanguy (2001)**, “Internet et la distribution des biens physiques : analyse de l'émergence de nouvelles structures verticales dans le secteur du vin,” Numéro Hors-Série, “Economie de l'Internet”, sld. E. Brousseau & N. Curien, octobre 2001, vol 52, pp. 213-234
- Johnson, E. J., W. Moe, P. Fader, S. Bellman and J. Lohse (2000)**, “On the Depth and Dynamics of World Wide Web Shopping Behavior,”

- Columbia University Graduate School of Business, *mimeo*.
- Katz, M. and C. Shapiro (1985)**, "Network Externalities, Competition and Compatibility," *American Economic Review*, June 424-40.
- Lee, H. G. (1998)**, "Do Electronic Marketplaces Lower the Prices of Goods?," *Communications of the ACM*, 41(1), pp. 73-80.
- Lorentz, F. (1998)**, "Commerce électronique : une nouvelle donne pour les consommateurs, les entreprises, les citoyens et les pouvoirs publics," Rapport du Groupe de Travail sur le Commerce Électronique, Ministère de l'Économie, des Finances et de l'Industrie, Paris.
(http://www.finances.gouv.fr/mission_commerce_electronique/rapports/).
- Lorentz, F. (1999)**, "Commerce électronique : une nouvelle donne pour les consommateurs, les entreprises, les citoyens et les pouvoirs publics," Rapport du Groupe de Travail sur le Commerce Électronique, Ministère de l'Économie, des Finances et de l'Industrie, Paris.
(http://www.finances.gouv.fr/mission_commerce_electronique/).
- Lucking-Reiley, D. and D. F. Spulber (2000)**, "Business-to-Business Electronic Commerce," *mimeo*, Vanderbilt University and Northwestern University.
- Malone, T. W., J. Yates and R. Y. Benjamin (1987)**, "Electronic Markets and Electronic Hierarchies," *Communications of the ACM*, 30(6), 484-497.
- Nabarette, H. (2002)**, "Internet en santé : quelle utilisation pour les patients ?," *Réseaux*, forthcoming.
- North, D. C. (1990)**, *Institutions, Institutional Change and Economic Performance*, Cambridge University Press.
- Observatoire du Commerce et des Échanges Électroniques (1999)**, Les Chiffres clés du Commerce électronique.
(<http://www.edifrance.org/>).
- OECD (1994)**, *Les accords de franchise*, OECD publication.
- OECD (1998)**, *L'expérience française du Minitel: leçons pour le commerce électronique*, Groupe de travail sur l'économie de l'information, DSTI/ICCP, Paris.
- OECD (2000a)**, "Internet and Electronic Commerce Indicators Update,"
(<http://www.oecd.org/dsti/sti/it/ec/index.htm>).
- OECD (2000b)**, "The Economic and Social Impacts of Electronic Commerce: Preliminary Findings and Research Agenda,"
(http://www.oecd.org/e_commerce/summary.htm).
- Rallet, A. (2000)**, "Le commerce électronique et l'évolution des modèles de distribution et de production," Séminaire 2000 de la Direction des Statistiques d'Entreprise de l'Insee, "e-commerce : Quels faits ? Quels effets ?," 6 December 2000.
- Scott Morton, F. F. Zettelmeyr and J. Risso (2000)**, "Internet Car Retailing," *mimeo*, Yale University & NBER.
- Scott Morton, M. S. (ed) (1991)**, *The Corporation of the 1990s, Information Technology and Organizational Transformation*, Oxford University Press, Oxford, UK.
- Serval, T. (2001)**, "Lorsque les réseaux d'information deviendront des bourses," *Revue Économique*, Numéro Hors-Série, "Économie de l'Internet", sld. E. Brousseau & N. Curien, octobre 2001, vol 52, pp. 249-266
- Shankar, V., A. Rangaswamy and M. Pusateri (1998)**, "The Impact of Internet Marketing on Price Sensitivity and Price Competition," Paper Presented at Marketing Science and the Internet, INFORM College on Marketing Mini-Conference. Cambridge, Ma. 6-8 March.
- Shapiro, C. and H. Varian (1999)**, *Information Rules*, Boston, Harvard Business School Press.
- Spulber, D. F. (1996)**, "Market Microstructure and Intermediation," *Journal of Economic Perspectives*, 10:3, 135-152.
- U.S. Department of Commerce (1999)**, "The Emerging Digital Economy II, Economics and Statistics Administration," Office of Policy Development, June,
(<http://www.ecommerce.gov>).
- U.S. Department of Commerce (2000)**, "Digital Economy 2000," June,
(<http://www.ecommerce.gov>).

U.S. Census Bureau of the Department of Commerce (2000), *Retail E-Commerce Sales in the First Quarter 2000*, (<http://www.census.gov/mrts/www/current.html>).

Varian, H. R. and C. Shapiro (1999), *Économie de l'information*, De Boeck, Brussels.

White, E. (2000), "No Comparison. Shopping 'Bots' Were Supposed to Unleash Brutal Price Wars, Why Haven't They?," *Wall Street Journal*, October 23, 2000, R18.

Williamson, O. E. (1985), *The Economic Institutions of Capitalism*, The Free Press, New York.
