2

Internet Economics and the Economics of the Internet

The Internet and electronic commerce change the traditional marketplace in two ways: (1) process and product innovations, and (2) new markets in time, information, and geography. These changes, along with their supporting technologies, appear to have important macroeconomic implications for economic growth and inflation. Indeed, they are the forces behind the ''new economy'' in the United States. They therefore have important implications for the scope and type of policy intervention into the marketplace. In particular, policymakers should want to do everything they can to enable these technologies that deliver so much in terms of economic well-being.

Macroeconomic Implications of Information Technologies

US Experience

Most available data include the Internet and electronic commerce with the broader IT sector, which also includes computers and software. These data show that information technologies hold many benefits for a nation's economic performance, including faster growth with low inflation, which is made possible by higher productivity and sharply lower prices for computers and other IT hardware.

In the United States, the IT sector has played a growing role in the economy and its continuing expansion with low inflation. Information

Table 2.1 Contributions to labor productivity growth in the nonfarm business sector in the United States, 1974-99

	1974-90	1991-95	1996-99
Growth rate of labor productivity	1.43	1.61	2.66
Contributions from:			
Capital deepening	.81	.60	1.09
Information technology capital	.45	.48	.94
Hardware	.26	.22	.58
Software	.10	.21	.26
Communications equipment	.09	.05	.10
Other capital	.36	.12	.16
Labor quality	.22	.44	.31
Multifactor productivity	.40	.57	1.25

Source: Oliner and Sichel (2000).

technologies, and in particular the production of computers, account for two-thirds of the one percentage point step-up in productivity growth in the United States between the first and second halves of the 1990s (Oliner and Sichel 2000). (See table 2.1.) The US Department of Commerce calculates that between 1995-99 (the last year for which the data were available), IT-producing industries contributed on average more than one-third of US real economic growth. The IT-producing industries' share of the US economy is building, from 6 percent in 1993 to an estimated 10 percent in 1999 (US Department of Commerce 2000, 16; Economic Report of the President 2000, 103-5)).

There is increasing demand for employment in IT industries. The US Bureau of Labor Statistics estimates that by 2006, employment in IT-producing industries will reach almost 6 million US workers. IT workers in the United States also earn far more than their private sector counterparts: an average of $53,000 annually, compared to $30,000 (US Department of Commerce 1999, 38-9).

Focus on Business-to-Business Electronic Commerce

Studies that separate out electronic commerce from the rest of the IT sector illustrate that, while still a very small percentage of total revenue, this new method of buying and selling goods and services is growing quickly, with a beneficial effect on macroeconomic performance. Particularly important for efficiency gains are Internet business-to-business transactions (B2B).

B2B transactions, whether trade in inputs or in finished products, overwhelmingly dominate electronic commerce, accounting for nearly 80 percent of electronic commerce revenue. Goldman Sachs projects that world-

wide B2B electronic commerce could grow from $39 billion in 1998 to over $1,500 billion in 2004 (Brookes and Wahhaj 2000). The dominance of B2B is already about 6 times the value of business-to-consumer electronic commerce (B2C), and could well grow to 12 times the B2C value.[1] Although there clearly are more consumers in the world, because production strategies increasingly fragment and recombine value-added into the final product for sale, there are a lot more B2B transactions associated with final consumption.

Examples of B2B electronic commerce include online trading of commodities like steel, plastics, chemicals, and Internet bandwidth; alliances between automobile, aerospace, and even retail companies to purchase inputs online; and production relationships between computer companies like Toshiba and package delivery companies like Federal Express to speed the delivery of made-to-order computers. Soon the online marketplace will offer bulk prices for services like pest control, insurance, and even electricity to big business, small business, and individual consumers.

The cost savings of B2B electronic commerce are substantial and pervasive across manufacturing, industrial supplies, and services; they could eventually translate into a lower rate of overall inflation. Martin Brookes and Zaki Wahhaj (2000) of Goldman Sachs estimate cost savings ranging from 10 percent in sectors like aerospace, paper and steel, and communications bandwidth and media advertising to more than 20 percent in electronic components and machining, forest products, and freight transport (see table 2.2).

Cost savings of this magnitude could affect about one-third of US GDP. Brookes and Wahhaj, applying their estimates of sectoral cost reductions to input-output matrixes of five large industrial economies (the United States, UK, Japan, Germany, and France), project that the index of GDP prices for each country could be lowered by about 3 to 5 percent as a consequence of B2B electronic commerce.

Modeling the Implications of Electronic Commerce for GDP Growth

Beyond cost reductions, however, electronic commerce increases the efficiency of resource utilization, which translates into faster productivity growth, which supports higher sustained GDP. Very different methods of modeling the implications of such cost reductions and efficiency gains show remarkably consistent results: electronic commerce undertaken by a country will bring significant increases in its GDP. These results hold for developing as well as industrial countries (see table 2.3).

Brookes and Wahhaj used a model (Multimod, used at the International Monetary Fund) that organizes time-series of data on many countries into

1. Initial estimate from Deloitte Consulting, as cited in *Business Week* (20 January 2000, 36). A similar initial estimate and projection is in ITU (1999).

Table 2.2 Business-to-business cost savings by industry (percent)

Industry	Cost savings
Aerospace machinings	11
Chemicals	10
Coal	2
Communications/bandwidth	5-15
Computing	11-20
Electronic components	29-39
Food ingredients	3-5
Forest products	15-25
Freight transport	15-20
Healthcare	5
Life science	12-19
Machinings (metals)	22
Media and advertising	10-15
Oil and gas	5-15
Paper	10
Steel	11

Source: Brookes and Wahhaj (2000).

Table 2.3 The macroeconomic impact of electronic commerce

		Impact on GDP		
	Size of shock (percent)	**Long-run** (percent)	**Growth rate per year next decade** (percent)	**Long-run** (billions of US dollars)
Brookes and Wahhaj				
United States	3.4	4.4	0.22	392
Japan	3.5	5.8	0.27	256
Germany	3.7	5.1	0.32	110
United Kingdom	4.0	5.3	0.27	67
France	4.0	5.3	0.27	78
5-cty average	3.6	4.9	0.25	903
UNCTAD (adjusted * 3.5)				
Industrial countries	3.5	4.9	n.a.	1067
Asia	1.05	1.2	n.a.	30
Latin America	1.05	1.0	n.a.	15

Source: Brookes and Wahhaj, (2000); ''Shock'' from Table 2; Growth change from Table 3. Authors' calculations for column 4; UNCTAD, (2000); all data from table 3, multiplied by 3.5 to normalize shock to size of B&W; assumes linearity of the model results.

complex models of the individual macro economies as well as their global interrelationships. To examine the potential impact of electronic commerce, Brookes and Wahhaj simulated how electronic commerce, which they estimated as two-thirds improved resource utilization and one-third simple reductions in costs, will affect real GDP in the five countries. Their simulations suggest that GDP in these countries would be almost 5 percent higher after 10 years, and the annual growth rate of GDP during this period would be about 0.25 percentage points higher. For the United States, GDP would be higher by about $400 billion.

The United Nations Conference on Trade and Development (UNCTAD, 2000) investigated the same question, looking at both developed and developing countries. Its researchers used a different type of model (the GTAP model) that focuses on the long-run effect that electronic commerce might have on GDP for regions of the world.[2] In one of the simulations, they assumed the potential impact of electronic commerce was a 1 percent improvement in resource utilization by industrial countries and a 0.3 percent improvement in developing countries. They note, ''These percentages do not intend to reflect the actual differences in access to the Network . . . but simply represent a working assumption.''

If we re-parameterize the electronic commerce benefits in developed countries to the size that Brookes and Wahhaj estimate using data for the five industrial countries, the UNCTAD ''shocks'' should be 3.5 times as large. Adjusting the UNCTAD simulations this way yields the result that GDP in the developed countries in the long run would be about 4.9 percent greater (about $1 trillion)—about the same magnitude as B&W. Under the UNCTAD assumption that the benefits from electronic commerce yield only one-third the gains in the developing counties, GDP would be 1.2 percent ($30 billion) higher in Asia and 1 percent higher in Latin America ($15 billion).

Suppose, however, that developing countries reform the services sectors (as will be discussed in Part Two) to create a facilitating environment for IT to take hold, and put in place frameworks that help create an environment of certainty and trust. In this case, the developing world would enjoy benefits of resource utilization as large as those estimated for the industrial countries—and their increased GDP would be multiples larger than those shown.

In one of their other situations, the UNCTAD study shows the consequences of inefficient services sectors. Without an efficient services sector, gains from the resource efficiencies of electronic commerce are less than half shown. Electronic commerce and the Internet can help in the reform process to liberalize the key service-sector infrastructures. Consequently,

2. GTAP was developed at Purdue University in conjunction with a number of international organizations, including UNCTAD. See UNCTAD (2000, 28-30) for more discussion of the model results.

the potential gains for the developing world could be much greater than suggested by the UNCTAD study.

The gains to resource utilization and the GDP growth stimulated by efficient services sectors, IT, and electronic commerce are dramatic. This is clear from data on the behavior of the US economy in recent years; it is projected to hold true in the future, both for other industrial countries and developing countries. One reason for this global gain is discussed more fully in the next section: A key source of the benefits from the Internet and electronic commerce is the existence of network effects. The more numerous the countries that put into place a facilitating environment, the greater the benefits to one and all.

A "New Economics"?

Consumer activity, business strategy, and government activities and policymaking all respond to fundamental economic forces as filtered through the general business and policy environment. The Internet changes the environment in which these activities are undertaken, but does it change the principles that underpin the decisions? Or does the Internet only modestly change the incentives that affect how economic actors react to traditional economic forces? From the standpoint of policymaking, is learning the basics in Economics 101 enough, or must policymakers understand a "new economics" of the Internet in order to fashion policies?[3]

Basic economics still rings true, in that supply and demand are still the forces underpinning prices and choices. But the Internet does change how these forces manifest themselves: More rapid technological change and innovation increase the speed of transactions and the creation of new marketplaces. Information is a key component of all products and services, as well as the production processes. Networks—a fundamental structure and pervasive force—have unique economic attributes.

These factors have important implications for how the Internet marketplace develops and operates. To an even greater extent than with traditional economic activity, service-sector infrastructures and an environment of certainty and trust are prerequisites for economic growth and market development. Products increasingly embody information content, are created from inputs from around the globe, and tailored to specific demands. Technology, innovation, and speed put a premium on flexible markets and human capital.

Both the forces of the Internet and their implications in the marketplace should affect government activities as well as policies. As is clear from

3. Two excellent books that include substantive discussions on the *economics* of the Internet (rather than just business strategies to exploit it) are: Choi, Stahl, and Whinston (1997) and Shapiro and Varian (1999).

the econometric models, policymakers should want to harness the power of the global network, yet networks and the Internet can be uncompetitive: For example, information content is key to the creation of new products that yield great benefits, yet there may be market imperfections in the use and collection of information; government policy can sometimes lead to a better functioning of the marketplace. Finally, because this marketplace depends on well-educated, skilled, and flexible workers and seeks to create products and services to satisfy those workers, policymakers should consider how they can best use the technology and the marketplace to help develop those citizens and workers.

Information and Network Effects

Information technologies, and increasingly the information itself, are key drivers of the Internet and electronic commerce. On the one hand, information technologies (computers, hardware, and software) have been used to process numbers, create databases, and enhance corporate operations for quite some time. Information about prices, preferences, inventories, and inputs has also been collected, processed, and stored in databases. But most of this information has been kept internal to a firm, generally inaccessible to other firms, consumers, or governments.

The revolution of the Internet builds on and extends IT to give global reach, interoperability, and accessibility to these systems and to the underlying information. The information that these technologies can access and process, once fragmented, can now be combined and recombined to create a much richer web of information flows and uses. The coming together of technologies and information from many sources and their accessibility to many new users around the world are what create the Internet marketplace and make it both unique and substantial. This new global marketplace is where businesses, consumers, and governments can communicate and find new sources of supply, new products to meet their demands, new information to help them make decisions, and new ways to assist in economic development.

The information technologies and the information that flows over them are characterized by ''network effects.'' What are network effects? In simple terms, the whole is greater than the sum of the parts. That is, the more participants that use a network, the greater its value to all who use it.

Robert Metcalfe (Xerox, Palo Alto Research Center) considered this concept using the simple notion of access points to a network. Metcalfe's law says that the value or power of a network increases in proportion to the square of the number of access points to the network. For example, five PCs connected to a network would yield a value of 5^2 (25); add one more PC and the network's value becomes 6^2 (36); one more access point yields a value of 49 and so on. Thus, the value of a network increases

much faster than the number of access points. It is the compounding or square-factor that is the key to network effects. Metcalfe's law can be extended to broader network issues, such as the interoperability of ways to access a network, the information on a network, and even the language used.

Consider the interoperability of hardware and software systems to access a network. More people using one particular type of hardware or software system yields the first round of network benefits. But if several types of hardware and software systems are interoperable with each other, the overall network instantly becomes much more valuable to each participant. For example, suppose my hardware and system allows me to send electronic documents to a mobile phone as well as a PC. This additional capability is not very valuable if the person I wish to contact can receive electronic documents only via a PC. However, if many users have the joint capability, we can communicate and work using the phone as well as the PC. This increases the usefulness and value of electronic document handling, as well as of the phone and the PC. The value of the network is one force that creates pressure among firms producing different standards of equipment and software to make them technically interoperable (see chapter 3).

Information itself exhibits network effects. Consider a Web site that brings together different types of visitors—say, truckers with empty trucks and consignors with products to move. A few visitors to this kind of Web site do not generate much value to the participants, but many visitors of both types increases the likelihood that deals can be consummated and information about future opportunities transferred. The more visitors, the greater the likelihood that truckers and consignors will meet on the Internet to negotiate deals, improving their use of time, money, and trucks. Such a virtual meeting place can be of particular value for independent truckers and small businesses.

The two elements of the Internet—IT and information itself—work together to enhance network effects. IT makes it easier and cheaper to collect and process information, and the network connectivity makes it cheaper to access information that has already been collected.

For example, Cybertrader[4] in Sri Lanka is an electronic mall (e-mall) for both traditional and nontraditional exports. The creators of Cybertrader hope to broaden the base of Sri Lankan exports beyond tea, clothing, and gems to include more products, particularly those from small businesses. To attract a global audience, Cybertrader needs to have a wide range of products and information about the products and producers. To have a wide range of products, Cybertrader is making it cheap for small businesses to join the e-mall by setting up a state-of-the-art computer

4. See http://www.tradenetsl.lk.

facility, complete with customer support, Web site design, and individual e-mail accounts for each business. The more products on the site, the more likely that a buyer will find something to buy. More buyers increase the value of the mall to Sri Lankan producers, so they are more likely to display their wares on Cybertrader. Cybertrader makes a commission on transactions. Network effects from both the IT and the information on the Web site build the virtuous cycle of benefits.

A third extension of Metcalfe's law is language. English has become the language of the Internet in part because the Internet has its greatest dispersion in the United States. The Internet is not accessible to people who do not speak English or who cannot read. Not only is this detrimental to their well-being, it also reduces the value of the entire network to everyone who can currently access it. Looking forward, the Internet will be of greatest value to those in developing countries if there is content in their own language as well as *language interoperability*—the ability to translate content into the language of the user.[5] One example of language interoperability that builds on the interoperability of network technologies is a device being developed by Telecom Indonesia called Rural Voice-rich Information Community. This device translates text into voice, using the key pad on a common phone to allow illiterate farm workers in rural communities to ''download'' information on pests and health as well as ''upload'' questions that can then be answered by local officials (McBeth 1999, 51).

Economic Frictions and the Global Internet Marketplace

Economic frictions help define where businesses locate and the scope of their operations as well as what consumers buy and where. Aluminum plants tend to locate near bauxite deposits because the material is hard to move. McDonald's franchises follow a set recipe for french fries so as to maintain brand-level flavor regardless of where the product is cooked. Ford's River Rouge automobile plant in Michigan was so completely integrated that steel went in one end and a finished vehicle came out the other. Parts producers had to congregate around the facility to reduce the risk of interrupting the straight line of the production facility. Similarly, before road and rail, consumers went to the market once a year to trade farm and household output for the items that they could not produce at home—to go more frequently was a waste of time and money.

Technology changes all this. Aluminum can be reclaimed at smaller recycling facilities close to the users, often at less cost than smelting

5. A related issue is Internet accessibility for people with disabilities of sight or keyboarding skills, and so on. Private businesses have been working on Internet translation programs for language as well as other aspects of access.

new aluminum. Ford's River Rouge plant was shut down as just-in-time methods of outsourcing increased the productivity of a narrower scope of operation within a single factory. Ford is now leading the way to complete integration of workers, parts suppliers, and customers in an e-commerce platform. Consumers of products like electronics can now buy directly from the manufacturer, which sources inputs (both tangible and intangible) from the United States and abroad.

The structure and capabilities of the Internet further reduce frictions in the marketplace in the three dimensions of time, distance, and information. The Internet marketplace fosters global production of products and services, which, thanks to more easily accessed information, are tailored exactly to what a buyer needs and are available exactly when the buyer wants it. Moreover, because access to the full power of the network is relatively easy and cheap, small businesses have the same opportunity as large businesses—as both buyers and sellers of online goods and services—to meet market demand.

The Internet allows the full 24 hours of the day to be exploited for production, customer service, information-gathering, design, and development. For example, combining Internet telephony with a global database of questions and details on orders allows English-speaking customers to be serviced from India, Ireland, or countries in the Eastern Caribbean, depending on the time zone of the caller. Spanish or Mandarin-speaking customers can be served in their own language from telecenters in their home country, even when they are calling from abroad.

Geography and size also present fewer barriers to participation. Businesses can tender designs and procurement details and find suppliers in other countries. Small businesses can reach a global marketplace with a Web site or just one or two mouse clicks. General Electric (GE), which posts procurement orders for office supplies on its Web site, gets responses and fulfillment from countries as far away as Africa. Without the Internet, these firms would not know about the GE tender. BTG, Inc., a small systems integrator, can on the Internet design details, post that fabrication shops in Taiwan can download, determine if they can build it, and then bid on the contract.

Greater access to niches in time and space does not reduce their value but increases the possibilities for how they can be used. Using the greater access to information about buyer preferences and needs, businesses can tailor goods and services to exactly what the buyer wants. The Internet marketplace increasingly will offer product ''bundles,'' priced uniquely by time, location, and what was called the *final* good or service. Airlines have used this strategy for pricing seats for some time, as have package delivery services, such as FedEx, which has separate prices for overnight delivery of packages early in the morning, versus mid-day, and so on.

The Internet allows such bundling to become much more prevalent. Some Bloomberg clients pay for real-time stock prices; they can get the

information free but lagged 20 minutes if their time preference is less urgent. Some women buy clothing from landsend.com, some from the L.L. Bean catalog, and some at Nordstrom in the shopping mall, not only because the clothing is different but also because preferences for shopping by time of day, location, and other factors, such as entertainment, matter; the clothes are just one part of the product bundle. Even for intermediate goods like industrial supplies, the Internet enhances this ability to bundle and use time, geography, and information more effectively.

The lower frictions to using time and space combine with the information and network characteristics of the Internet marketplace to allow more ways for businesses to create value. Firms can focus on which part of the value-added chain they do best and outsource other parts to subsidiaries or strategic allies anywhere on the globe. Moreover, more stages of production can be digitized (software production, for example) where assembly and the delivery of value is via the network.

Since buyers have different needs, firms following different strategies can coexist in the same marketplace. For example, more than one company builds computers to order because there is more than one type of customer. Dell Computer builds computers to order from online requests. Parts, software, assembly, and packing, come from distinct locations—some by plane and some electronically—before being bundled together in response to a specific customer request. Gateway Computer, seeing a market opportunity in a different segment of the marketplace, offers a different bundle. Gateway assembles computers from delivered tangible inputs and digitally downloaded software, just like Dell. But they sell the bundle in a Gateway Country Store to the person who wants more customer service when she buys a computer, or simply wants to try it out first, or perhaps wants to lease a computer (rather than buy one) so as to reduce the initial costs and enable a trade-up to a more powerful model when her needs change.

Between bundling and fragmentation, it is increasingly difficult to determine exactly where (in a geographical sense) or when (in terms of the stage of a production process) value is created. Product bundles can be offered through firms that can locate anywhere, whose locations can change quickly, and whose ultimate residence may be hard to track down. Even tangible merchandise, purchased at a point in time and at a particular location, may only be identified by the delivery destination of record, not the ultimate user. With a bundle characterized by a digitized and downloaded transaction, neither the origin point nor the ultimate user may be determinable. These issues have important implications for governments, whose jurisdictions are bounded by political or geographic rather than economic lines.

Policy Implications of Internet Economics

The elements of network effects and frictionless markets create two forces: Network effects push toward a homogeneous approach in hardware and

software systems to developing the Internet and electronic commerce. Yet lower economic frictions allow greater heterogeneity in what is offered over the Internet and how production takes place. These two forces, rather than being in opposition, in fact are complementary. On the one hand, the desire to gain the benefits of network externalities suggests that key infrastructures and policy frameworks at home must be interoperable with the direction being taken abroad by the technological leaders. On the other hand, the ability of the Internet to reduce frictions to entry and to create unique product bundles means that heterogeneous tastes of global and local consumers and businesses can be satisfied. What are the broad policy implications of these two aspects of Internet economics?

The ingredients of the Internet marketplace—network benefits, frictionless markets, bundling and fragmentation, and global reach—have another feature of particular relevance for policymakers. These markets may be prone to certain kinds of imperfections, particularly when the reality of human and institutional pace is factored in. For example, competition in the marketplace for network access may be slowed by institutional inertia and vested interests. There may be an asymmetry in power between firms and users over the collection and use of the vast trove of information. These are two areas where government intervention by mandate may be considered, although the market may also be allowed to generate solutions. What motivates some governments to choose one approach or degree of intervention over another? What difficulties can arise when some governments choose intervention by mandate while other governments encourage market-oriented solutions?

Government Intervention and the Economics of Network Effects

Network effects underpin the success of the Internet and the uptake of electronic commerce. But does a country maximize its benefits and minimize its costs simply by joining *any* network? Internet policy and the economics of network effects need to be addressed at the individual level as well as the level of society (the policymaker's level).

For an individual, the decision is simple: if a network exists, join it. The economic benefits of joining a network will be immediate and large, and the costs of joining, relatively small. The individual does not bear the costs of setting up the network, just the costs to link to it. Nor does the individual have to wait until other participants join the network to reap benefits, because some already have—the network is already operating. It makes sense to ''draft'' in behind the leaders that incurred the costs for developing the network; the benefits are greater than the costs.

But what if the network is not a perfect fit for the individual, or the country? For example, an Internet infrastructure based on access via a PC will have greatest value to an individual who has a PC and to a

country where PC penetration is relatively high. The third-generation wireless standard that delivers Internet capability to mobile phones may be a better network to favor if mobile phones are common. Does a government have to choose? Should it? Or should the private sector point the way and shoulder the burden?

Two phrases should drive any government intervention: (1) policy interoperability and (2) preserving private-sector incentives to augment and innovate existing network capabilities (whether domestic or foreign). Any policy that impedes network interoperability or commerce will undermine the benefits.

How is interoperability best achieved? To rely on a centrally-directed approach to guide the development of a local network rather than on the decisions of buyers and sellers presumes (1) that the policymaker knows what constituents really want and what technological capabilities might be offered now and in the future, and (2) that the private sector (domestic or foreign) does not. Some policymakers see such benefits to electronic commerce and joining global networks that they want to start right away, rather than wait for their private sector to get organized, try, and fail, and only then slowly succeed. Government pilot projects can show the private sector the possibilities and help the private sector sort out alternative approaches (see chapter 9). But the more important role for government is to create the facilitating environment in which local and foreign entrepreneurs can thrive, in part by applying what is on the Web to the tastes of the domestic marketplace. Too much government intervention removes any incentive for the private sector to learn how to meet market demand.

Some policymakers may be concerned that low teledensity and PC penetration doom their countries to be laggards in uptake of the Internet. But the evidence (presented in chapter 9) shows that the private sector (domestic or foreign, or increasingly likely, in partnership) rises to the task. Network effects are so valuable that firms do everything they can to ensure the widest Internet audience for its activities and information.

While there are advantages to being the first to create a network, there are even greater advantages to convergence on interoperable approaches. For example, the technology to access the Internet is cheap relative to the benefits to be gained by having subscribers, so innovation in ways to deliver the Internet to a variety of devices is very rapid. Private-sector entrepreneurs and firms direct their attention to ways to deliver the Internet to whatever device the user has available. For example, rental cell phones licensed under Grameenphone in Bangladesh may soon enable Internet access in remote areas of one of the poorest countries on earth. A private firm (WebTV) has recognized that there are about twice as many televisions in the world than telephones (about four times as many in developing countries), and so is developing technology for Internet

access via TV. Microsoft, too, is pursuing this technology in China among other places.

Nevertheless, the legacy of telecommunications regulations can play a role in what technology ends up being favored—not by the government, but by the private sector. In Japan, the price of Internet access over traditional phone lines is among the highest in the world, and PC penetration is lower than would be expected based on per capita income. Internet usage as measured by access via phone and over PC thus has been slow to catch on there. However, deregulation of the cellular phone market yielded an explosion of hand-held devices, and DoCoMo is delivering the Internet (via I-Mode) to cell phones. Because the cell phone market is global, a consortium of hardware vendors (including Motorola, Nokia, and Ericsson) is working on interoperable standards so that the Internet can be delivered to any mobile device. In the end, network effects rule private-sector behavior and push for interoperability even if technologies do not converge.

Are there failures of the global marketplace that close countries from the global network? Most difficulties originate within a country; these are addressed in more detail in the next sections. Even in countries closed in the past, telecommunications deregulation and privatization have spurred private-sector initiative and capital to finance and support global Internet access. Diveo Broadband Networks offers high-speed Internet connection in urban centers of Brazil and Argentina. IBM Sri Lanka has about 25 points of presence scattered around the island so that virtually any citizen has local access to a global Internet connection via Singapore. The towers of the electricity grid in Ghana and neighboring countries are being used to hang telecommunications equipment that will access the Internet.

However, there may be some countries where private initiatives are lacking and so is the foreign private sector. There international programs of assistance help to finance global and regional Internet connectivity. The Leland Initiative of the US Agency for International Development (USAID) is networking 20 African nations; other programs are supported by the ITU and the World Bank. All this makes it increasingly difficult to argue that basic access to the Internet is unattainable for a country, or that it represents the most important hurdle to more fully developed usage of the Internet and electronic commerce.

Competition Policy, Information Aggregation, and Network Legacies

The Internet reduces substantially the economic frictions in the marketplace thus allowing entry of new firms, new ways to fragment the production process, and new ways to bundle products to meet the needs of buyers. However, frictions remain: There is only so much screen space

on a PC or on a mobile phone. Human inertia can be another friction. Incomplete privatization of domestic services industries and government regulation of the marketplace can affect the conduct of firms in the global marketplace. In conjunction with Metcalfe's law, such frictions can generate uncompetitive corporate behavior, which suggests that there is an important role for competition policy.

The strategy that a firm might take for presenting Web sites and their information to the user is a potential area of government concern. Portals (AOL, Yahoo, Sina, StarMedia) serve this function. A user can also ''bookmark'' a Web site that he or she visits frequently. How valuable is it to be the ''first mover''—either in establishing a site that offers a particular product, service, or information, or in being the first portal to offer access and information aggregation to users? First movers do have advantages, but their power to keep out new entrants, and therefore the potential for uncompetitive results, is reduced by the technology itself. A site that does not meet the demands of the user has competition that is only one or two mouse clicks away.

On the other hand, human inertia to change can allow less desirable sites and portals to persist. Government policy toward both Internet entry and competition between Internet and virtual sellers can tip the balance. First movers reap the initial revenues, which tend to enhance capital market access, both of which enable first movers to finance development of superior products and services to keep them on top.

The key issue for competition authorities is whether sites or portals actively try to subvert the technological ability that allows users to change. For example, while AOL 5.0 added many useful features, it also made it difficult for users to connect to other portals. However, AOL's behavior was altered not by government intervention but by the demands of the users, who forced the company to make AOL 5.0 interoperable with other systems.

A second concern for competition authorities is strategic alliances between Internet portals and favored sites or products, or between ISPs and telecommunications and media companies. For example, a portal or information aggregator can favor one site or one firm simply by choosing strategically where to put the link on the screen. The favored firm then typically gives kickbacks to the aggregator based on the activity the aggregator directs to the site. If the aggregator is owned by or owns a telecommunications company (see chapter 3) or if the aggregator owns a media company, there is the potential for concentration of power and uncompetitive behavior. Thus the description of free-wheeling competition and easy access to a global Internet marketplace by even the smallest firm in the remotest country may be questionable. How much should policymakers worry? What should they do?

There are two ways the marketplace itself can correct these potential problems. The first depends on the continuing advance of technology.

For example, *bots* or *web crawlers* like mySimon.com search all Internet sites for the lowest price of a particular product. Such companies return to the user a list of sites by price; the lists can also include ancillary information like tax liability or delivery details. This technology reduces the power of incumbents and limits the role of strategic alliances, at least with regard to prices. While it is difficult to program a bot to include everything a buyer might want to know, such as quality, customer support, or method of production, a buyer who is choosy can initiate human-directed Internet searches.

The second way to allay concerns over uncompetitive practices depends on the diversity of businesses and consumers in the Internet marketplace. Even if there are some gains to being first into a market, there are infinite new markets to be the first into. Once the key access and usage infrastructures are in place, small businesses and those from developing countries can create products for individual consumers as well as reach out to the global marketplace. Of particular interest to developing countries, incumbents from the industrial countries are not likely to be interested in smaller markets, thus leaving opportunities open for local entrepreneurs who know these markets best. (See chapter 9 for examples of local entrepreneurs with global reach.)

There is another possibility for uncompetitive behavior: In many countries the service infrastructures on which the network depends are not fully private or enjoy partial or complete monopoly power. In some countries there is no competitive access to the telecommunications markets. Since network effects do give incumbents an advantage, competition authorities must be vigilant to prevent hoarding of bandwidth or cross-subsidization on the back of public-sector network infrastructure. Similarly, the legacy of state-owned companies can affect cross-border competition. Partially privatized firms often generate supranormal revenues in the domestic marketplace, which can be used to purchase private competition in the open marketplace.

It may be necessary to apply existing competition policy on both domestic and international fronts. On the domestic front, a first strategy is more rapid privatization and deregulation. Competition policy that requires full disclosure might be appropriate, such as demanding arms-length pricing or breaking the link between the ISP and the public telephone network are other points of government intervention. On the international front, consultations among domestic competition authorities are needed, although these are not always successful. (Part Two of this book reports on cases where jurisdictions of government authorities overlap in the global marketplace. Part Three addresses ways to improve the environment for cross-border and intergovernmental discussions about overlapping jurisdictions).

The objective of government policy is ultimately to foster an environment where economic activity and value-creation is directed less to *creating*

the network and more to creating an interoperable framework of technologies and policies that in turn encourages businesses and individuals to *use* the network, making it more valuable to all participants.

Government Guidance and the Economics of Imperfect Markets for Information

Information collection, aggregation, and use underpin the value of the Internet. The market for information is prone to imperfections of three types: incomplete markets, asymmetric market power, and pure market failures. Each of these imperfections has analogs in other areas of economics where they are perhaps more familiar.

The first imperfection—incomplete markets—has been recognized in the financial markets. Seminal work by Professors Arrow and Debreu showed that the prices quoted in financial markets would not perfectly reflect all available information and would not properly price risk unless there was a financial instrument that paid off in every possible financial circumstance. But financial instruments for some risky circumstances may not exist. Data on financial outcomes, which are necessary for financial intermediaries to price risky circumstances, may be hard to obtain, particularly if the event is rare. Potential buyers of these financial instruments might not see their value because the occasion where the instrument would be valuable hardly ever happens. The costs of transacting in illiquid markets with few buyers and sellers may deter financial intermediaries from creating some financial instruments. In the Internet marketplace, if there are incomplete markets, the pricing and treatment of information by those who supply it and those who demand it will be imperfect.

The second imperfection—asymmetric market power—has an analog in negotiations, particularly in the literature on union bargaining. An individual worker has little power to negotiate pay and working conditions vis-à-vis a larger firm, particularly if the worker has few unique skills and can be easily replaced by someone else. A union effectively collects workers into a group which then has more power to negotiate with the firm, since if a whole group of workers were to strike, the cost to the firm would be much greater and its ability to replace the whole group quickly would be much smaller. With asymmetric market power, individuals' demands about how the Internet works may be ignored by the relatively fewer firms that collect the information.

Finally, the third imperfection—pure market failure—has as its apocryphal example ''The Tragedy of the Commons.'' In England in the 1800s, farmers grazed their cows on common land. Too many cows and too much grazing on the common land ruined the grass. Even if the farmers recognized the source of environmental degradation (their collective activity), no one farmer had the incentive to not graze his one cow on the

common land (since some other farmer would just put two cows out to graze). Yet each farmer was worse off for failing to value properly the common resource. The social value of the commons exceeded the sum of the private valuations of the commons.

This problem can exist even if there are complete markets in the Arrow-Debreu sense, and even if power among the participants in the marketplace is symmetric. There is no way for the market as a set of uncoordinated individuals to properly price or value this spillover, a public good.

The Internet marketplace has elements of all three market imperfections: Incomplete markets may arise through the human factor—users may not know what information is being collected about their activity on the Internet, or how it is being aggregated and used. Asymmetric power can arise from differences in market power between firms that collect and aggregate the information and users in the marketplace that provide the information. Pure market failure occurs when the market mechanism fails to account for a difference between the private and the social costs or benefits of a transaction—in this case, the collective value of information obtained via the Internet and other activities diverges from the value that each individual puts on his or her contribution to the pool of information. Indeed, network effects absolutely imply that there is a difference between the social and the private value of information on the Internet.

The previous section argued that the private-sector solution to achieving *technical network accessibility* has been good. What about the private-sector solution to imperfections in the Internet marketplace specifically for information? Is there a rationale for government intervention to correct some or any of these imperfections?

The example of using personal data on the Internet makes notions of market imperfections more concrete, and sets the stage for alternative policy approaches to improve how the Internet marketplace for information functions.

When a visitor clicks on a Web site, a computer program known as a ''cookie'' can collect information from that visitor—information that escalates in detail as the complexity of the visitor's activity on the site increases. This information may include name and e-mail address and place and type of work; it may also include the pattern of an individual's movements on the Internet (''clickstream behavior''). Other databases, including phone directories, financial services credit histories, car registration, electric bills and so on, can be aggregated and cross-referenced with the online behavior. Data mining companies like DoubleClick, Microstrategy, and Experian harvest, analyze, and sell the information for marketing purposes, among other activities.

Individuals may want to limit the collection, combination, and sale of their personal data, but they face several difficulties in doing so. First, some visitors do not know what is being collected online or what is in

off-line databases; the firms themselves may not really know. Demanding that more detailed information be given to the individual as to the potential uses of these data, or offering greater choice in how much data need be revealed, may not help users better control the flow of information. Individuals may not know what their privacy preferences are. They may not be able to value them properly anyway.[6] In the Arrow-Debreu sense, policies on privacy do not "span the set" of desired information flows. Consequently, the markets for personal data are incomplete.

Second, there is asymmetric power between the collector of information and the user who is providing the information. Because there are relatively few portals and firms, and many users, firms have relatively little incentive to meet the demands of any single user. An individual can choose to not use the Internet (equivalent to the worker striking the firm), but that does not improve the outcome for either the firm or the user. Both lose the benefits that come with network participation.

Perhaps the most important market imperfection is pure market failure. Because collecting information on individuals is part of the value of the information itself (as discussed in the context of network effects), firms will want to collect information from everyone, even when users as a group would like less personal data collected. In the "commons" sense, the collected value of information to the firm is greater than the sum of the private valuations of information. From the perspective of society, society values privacy more than does the private firm.

What can government do to rectify any of these imperfections? Broadly, there are two strategies: A government can *mandate* a standard for collecting and using private data. For example, the EU Privacy Directive requires adherence to a standard in the use of personal data of EU residents by firms outside as well as inside the European Union. A *market-oriented* approach (for example, the US) encourages innovation by firms to close the market imperfections—to self-regulate by offering a range of services.[7]

Is there a winner (in an economic sense) between the US and the EU approaches to solving the problems of market imperfections and market failure? The economic "theory of the second best" shows that the market solution (the US approach) and the mandated solution (the EU approach) cannot be ranked in terms of which one comes closer to achieving the highest level of general well-being. In neither case will the needs of all individuals be met; nor can we be sure that society's needs are met.

On the one hand, the market approach yields an incomplete set of policies for meeting the privacy preferences of each individual. Some

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6. Users of iWon.com are being paid (or at least may be) to reveal clickstream behavior. Do they know what information is being absorbed? Are they being paid enough? Do they care?

7. Both the EU approach and the US approach are discussed in greater depth in chapter 8.

individual privacy demands will not be met. And, by definition, if there is a pure market failure (of the ''spillovers'' or ''public-good'' type), the market cannot achieve the best outcome by itself. A freewheeling, market-oriented policy might lead to individuals who are concerned about the use of their information on the Internet refusing to log on. If users balk, the value of the network to everyone is by squared lower (network effects working in reverse).

On the other hand, the mandated solution assumes that each person has the same privacy preference as is determined by the government directive. Because people are heterogeneous, some individual privacy demands will still not be met. In this case those left out would probably be willing to disclose more in order to get more tailored products and services. A mandated policy of ''one-size-fits-all'' could lead to too little information collected and therefore too little Internet use by buyers and sellers who demand a high level of tailored service. The value of the Internet for everyone is again reduced.

One critical difference between the market and the mandated strategies is that with the market approach, firms continue to get incentives to try to satisfy individuals' privacy demands, particularly if those demands are communicated to the firms with enforcement measures as back-up. The incentives come in part from the very network benefits that are lost if the privacy policy is insufficient and users defect. Under the government-mandated approach, the private sector has fewer incentives to innovate to resolve market imperfections—and the enforcement issues remain.

Beyond the theory of these alternatives and how they work within the domestic marketplace, an even more important issue for global electronic commerce is the overlap of government jurisdictions and the potential conflict between a national jurisdiction and a cross-border economic activity in the global marketplace. Will the mandated approach create a barrier to cross-border trade, and with many governments and many strategies, yield a sort of Balkanization that limits the global reach and global benefits of electronic commerce? Or can the mandated and the market approaches be made interoperable so that the benefits of the network accrue to all?

Finding an interoperable policy approach that nevertheless is heterogeneous matters. Governments can, and perhaps even should, disagree on the degree of intervention in the marketplace. That is, societies do differ in their preferences for degrees of government intervention to achieve privacy, consumer protection, content filtering, and so on. To the extent that policymakers are elected to represent these views, diversity in the amount of government intervention into some areas of electronic commerce could be appropriate. Diversity appears to be inevitable in any case. The objective of policymakers should be to ensure that this diversity in approaches to governance becomes a niche opportunity for private firms to devise ways to bridge the different approaches, rather than a

barrier to cross-border electronic commerce. A set of ''best practices'' would help to ensure that both domestic and international benefits are achieved.[8]

The Human Factor, the Institutional Factor, and the Pace of Technology

In the midst of the emerging technological and market capabilities of the Internet, there are the human and the institutional factors. People ultimately are at the heart of the marketplace and are the focus of many government objectives; governments are composed of agencies and institutions that already have functions. There are potential clashes between the pace of humans and institutions and the pace of technology. On the one hand, technology can outpace the ability of people and governments to respond to and implement it. In this sense technology moves too fast. On the other hand, human expectations can outpace the implementation of technology. In this case, technology moves too slowly. How do these human and institutional factors affect policy choices?

Too much hype about what the Internet and electronic commerce *can* offer runs the risk of overreaching what it *does* offer. Some people, particularly those outside the United States but also some groups within, find that the Internet does not offer them interesting or relevant content or products. The language is wrong, and there is nothing that matches their cultures or desires. For them, the Internet has little immediate value. This first impression poisons the waters for further exploration. How can these disappointed explorers be transformed into entrepreneurs, so that they and others like them find a more congenial and interesting environment—so that they become part of a community of users with common interests and therefore become part of the global network?

Getting individuals online and creating entrepreneurs require the infrastructures of services, standards, and laws that create an environment of efficiency, certainty, and trust.

A somewhat different problem arises when people hear about the great technological breakthroughs made possible by the Internet, but the technology fails under the weight of demand. A famous example was when Victoria's Secret, an upscale lingerie house with lovely models, hyped their new online fashion show and was so swamped with activity that the site server crashed. Another example is the failure of online banking thus far to deliver seamless bill-paying services because most companies that issue bills cannot process individual electronic transactions. In this

8. A set of ''best practices'' (or maybe a presentation of ''avoidable outcomes'') will be a sequel to this primer.

case, expectations for what the technology can (and ultimately will) do outpace the current implementation of the technology.

Finally, in many places around the world, the pace of technology exceeds the pace of adaptability. Governments may want to embrace technology, but it still takes time to put infrastructures in place. Coordinating the policy changes necessary to move forward quickly and comprehensively is very difficult within the often fragmented fiefdoms of government agencies or between the various legislative bodies. Perhaps worse, policymakers may hope that electronic commerce can be the ''silver bullet'' to kill problems ranging from slow economic growth to fiscal imbalance to a trade deficit without the hard work of changing the fundamental infrastructures and legal framework. In society at large, people may be slow to recognize the benefits of using the Internet; or they may be too burdened by their daily lives to invest in developing the human capital needed to work with the technology.

Within government, an ''e-commerce czar''—a minister without portfolio—could embody the necessary cross-cutting, synergy, and vision and be the motive force within government to keep momentum going. This person also could be the international voice for the government.

For the people, policymakers have the responsibility to make sure that institutional inertia does not stop the virtuous cycle, where use of technology enhances the further uptake of technology, with the result of greater well-being. Proactively, using the Internet for human capital development is a strategic point from which to start this virtuous cycle—a cycle, moreover, where human capital development itself also improves how societies use the Internet.