Employment impact of electronic business

Electronic business both stimulates and dampens employment in many occupations and industries; however, assessments of those impacts can only be qualitative rather than quantitative

Daniel E. Hecker

Every 2 years, the Bureau of Labor Statistics develops 10-year projections of industry and occupational employment, taking into account likely changes caused by new technologies and business practices. The 1998–2008 series of BLS projections, published in the November 1999 *Monthly Labor Review*, did not specifically address the effects of electronic business (e-business) on the economy, because of the recent nature of the phenomenon and the relative paucity of information pertaining to it. This article presents a first look at the extent to which e-business could affect industries and occupations over the next decade. The impacts described will be reflected, to the extent possible, in the 2000–10 projections, to be published in the November 2001 issue of the *Review*.

E-business, consisting of marketing and other business processes conducted over computer-mediated networks, is changing the way organizations in many industries operate. It leads to the automation of some job functions and replaces others with self-service operations, raising output per worker and dampening employment requirements in some occupations, as well as in the industries in which those occupations are concentrated. In contrast, e-business has *spurred* employment in industries producing hardware, software, and systems used by e-businesses and in computer and other occupations associated with websites and networks. Because of its increasing pervasiveness, e-business may be affecting output per worker and employment in virtually every industry.

Interest in e-business has spawned a host of quantitative projections by private forecasters, most of whom focus on cost reductions and industry sales growth; none specifically addresses the impact on employment. Because of the general dearth of quantitative information, the assessment presented in this article is completely qualitative. Prospective changes are discussed in terms of e-business stimulating or dampening employment or output in an industry or occupation. This approach differs from discussions in previous *Monthly Labor Review* projections articles, which incorporate the impact of numerous factors and which present employment increases or decreases from the base year to the target year. The approach also focuses primarily on industries and occupations with the largest potential impacts and those which, reportedly, are uniquely affected by e-business.

What does e-business encompass?

Electronic business (*e-business*) is any process that a business organization conducts over a computer-mediated network. It includes buying and selling, as well as a wide range of customer-, production-, and management-focused processes carried out by for-profit, government, or nonprofit entities.[1] E-business is based upon the processing and transmission of digitized information, in-

Daniel E. Hecker is a labor economist in the Office of Employment Projections, Bureau of Labor Statistics.

cluding text, sound, and visual images, from one computer or some other electronic device to another. Most e-business processes are self-service, and some are or may soon become fully automated.

Electronic-commerce (*e-commerce*) is that part of e-business which involves buying and selling goods and services.[2] E-commerce may be classified into three groups:

- *Business to consumer* (*B2C*) includes retail transactions of goods, such as books and computers, and services, such as insurance, banking, and travel and ticket reservations.
- *Business to business* (*B2B*) includes transactions between manufacturers, wholesalers, retailers, construction firms, farms, service industries, governments, and nonprofit organizations.[3] Completely separating the impact of B2C and B2B is difficult, because online business establishments may use the same resources to deal with both consumers and businesses.[4]
- *Consumer to consumer* (*C2C*) consists primarily of individuals buying and selling through auctions.

Besides e-commerce, e-business encompasses many self-service and automated information transmission activities. Customer-focused processes enable buyers to obtain product information online and then complete the transfer of ownership offline, in stores, in sales offices, or with a telephone call or fax. Another component of e-business involves customer relations, including direct marketing by e-mail and numerous customer-self service transactions and after-sale processes and services, such as technical support (assistance in operating and maintaining technical products), requests for changes in service, updating records, transferring funds, and viewing the status of transactions, orders, and deliveries.

Management- or production-focused e-business activities involve the following functions or tasks:

- Procurement, including ordering, automated stock replenishment, payment processing, and other electronic B2B-related activities.
- Personnel-related activities, including online job postings, applications, and candidate screening; education, training, and testing; and employee self-processing of changes in benefits, travel arrangements, expense reports, supply orders, and the like.
- The use of networks for sharing information and databases, internally and with selected outside organizations, including suppliers, distributors, logistics partners, and customers; these links broaden and speed up the flow of information.
- The expansion of communication and collaboration through discussion forums, video- and audioconferencing, global calendaring, and team and project management.[5]

E-businesses rely heavily on physical systems—some unique, others used in "brick-and-mortar" (that is, physical) business operations as well. Among these systems are *intranets* and *extranets*—networks built on Internet-based technology. Unlike the Internet, intranets and extranets are accessible only by certain individuals or organizations. Intranets limit access to those within an organization and may or may not be linked to the external Internet. Extranets are networks linking organizations with a common interest—for example, customers, suppliers, and other business partners. Extranets greatly facilitate and speed the flow of information in management- or production-focused e-business activities.

E-businesses create *websites* that are digital versions of stores, catalogues, sales offices, branch banks, help desks, trading exchanges, and telephone and mail communications. These sites afford self-service or partially self-service sales transactions, eliminating or shortening the time sales and administrative support workers spend with customers. *E-mail* is used by sellers to communicate with customers, answer their questions, and inform them of the status of their orders or transactions, as well as to develop long-term relationships with those customers, offering them personalized, useful advice, articles of interest to them, and information on new products. Customers can submit product reviews and evaluations, register complaints, obtain product or procedural information, and resolve problems, dealing with workers in a customer service center. E-mail is also used for direct-mail marketing and advertising.

Companies are increasingly establishing *customer service* (*call*) *centers* that use e-mail or live phone connections to provide procedural or problem-solving assistance, advice, reassurance, product information not found on a website, or information on the status of orders. While most e-business transactions can be completely self-service, the availability of a physical customer service center increases the chances that a visitor will make a purchase (or complete another type of transaction), rather than abandon a site, and may also result in a larger purchase than otherwise. Many industries, such as catalogue and mail-order houses, store-based retailers, and banking, operated telephone call centers prior to the advent of e-business.

Companies engaged in "e-tailing" tend to keep their *inventory* in one or a few central *warehouses* for regional, national, or international delivery, except for digitized products, which are downloaded online. "E-grocers" handling perishables, online convenience stores, and some stationery and office supply stores maintain local warehouses. The most efficient warehouses are designed to "pick and pack" orders, ship packages to individuals, and handle returns, all with a sophisticated inventory control system. These warehouse are much different from traditional retail warehouses designed to ship bulk items to stores, but they are identical to warehouses used by catalogue and mail-order retailers. As regards *delivery services*, most sellers with local warehouses ship to customers, using their own fleet of vehicles; those with central warehouses arrange with air or trucking courier (package de-

livery) services or the U.S. Postal Service, as do catalogue and mail-order retailers.

Impact on occupations

Table 1 lists occupational groups and detailed occupations that, on the basis of research conducted for this article, are likely to be most affected by e-business activities.

E-business activities, in general, will spur employment needs for workers involved in e-business systems and organization and in website design. More computer workers are needed to set up, maintain, and oversee the additional hardware and software systems that e-businesses require. Among the workers needed are *computer and information systems managers*, *computer systems analysts*, *computer engineers*, *computer support specialists*, *database administrators*, *computer scientists*, and *computer programmers*. Some of these workers may have titles unique to e-business, such as web developer or web master; or they may bear more general computer titles, such as application developer or network systems administrator or engineer.

E-business activities also require more *artists and commercial artists*, *designers*, and *writers and editors*. Web pages used in e-business consist of text and visuals designed and developed by these workers. Some growth in the requirements for such workers, however, may be offset by reduced needs in print publication-related employment. E-business organizations also make use of *management analysts*, to develop strategies and integrate their Internet activities into existing operations. These analysts are employed in-house or are contracted through management consulting firms.

A number of factors could temper the need for additional website and systems-related workers. For example, shakeouts or consolidations of e-commerce firms, as have occurred over the past year, limit the number of systems. Because systems are highly scalable (that is, the need for workers depends mostly on the size and sophistication of the system), needs will not grow nearly as fast as the number of contacts or transactions. Finally, because e-business permits self-service technical support, it dampens the need for computer support specialists.[6]

Administrative support occupations, including clerical, account for more jobs—nearly 24.5 million in 1998—than any other major occupation group.[7] The group is projected to grow more slowly than the average for all occupations, primarily because of the effect of office automation on several large occupations, including bookkeepers, accountants, auditing clerks, and word processors and typists.[8] E-business, which automates many administrative support functions or makes them self-service, is expected to have a further dampening effect on employment requirements in these occupations. The reason is that much of the information that administrative support workers collect, manipulate, and distribute can be digitized and transmitted over networks. Self-service systems permit an organization's employees, customers, business partners, and others to input and retrieve information from the organization's computers without involving administrative support workers. This means that fewer workers are needed to answer questions, look up or enter computerized information, make reservations, produce and process documents, and prepare mailings. Affected occupations, among those employed in most industries, include secretaries, general office clerks, human resources assistants, order clerks, and receptionists; industry-specific occupations (discussed later in the section on industries) include reservation and transportation ticket agents and travel clerks, brokerage clerks, bank tellers, new-accounts clerks, loan and credit clerks, and postal clerks. The electronic delivery of digitized products, such as books, magazines, music and videos, business forms, and documents, eliminates the need for workers handling these items, including postal clerks, stock clerks, and shipping, receiving, and traffic

Table 1. Likely effect of e-business activities on employment requirements in selected occupations

[In thousands]

Occupation	Employment, 1998	Likely effect
All occupations	140,514	
Executive, administrative, and managerial:		
Engineering, science, and computer and information systems managers	326	Stimulates
Management analysts	345	Stimulates
Purchasing managers, purchasing agents, and wholesale and retail buyers	547	Dampens
Professional specialty:		
Artists and commercial artists	309	Stimulates
Computer systems analysts, engineers, and scientists	1,530	Stimulates, except dampens for computer support specialists in postsales technical support
Designers	335	Stimulates
Writers and editors	341	Stimulates
Technicians and related support:		
Computer programmers	648	Stimulates
Marketing and sales	15,341	Dampens
Administrative support workers, including clerical	24,461	Dampens
Customer service representatives (adjustment clerks)	479	Stimulates, but also dampens as more traditional duties are made self-service

clerks; at the same time, more efficient distribution systems and smaller inventories reduce the need for those workers who are still involved in physical distribution.

Among administrative support occupations, e-businesses may use more *customer service representatives,* also known as *adjustment clerks,* than traditional businesses. These workers investigate and resolve customer's problems with goods, services, or billing; take orders; or provide information and advice.[9] E-business has created a new role for customer service representatives. While operators of websites seek to provide all the information users need to complete transactions, they often do not succeed. Through phone or e-mail contact, customer service representatives provide e-business customers with procedural assistance, advice, reassurance, resolutions of their problems, and product information not found on websites; in brick-and-mortar businesses, many of these functions are performed face to face or over the telephone by sales and administrative support workers, including customer service representatives. The employment of representatives appears to be increasing as firms upgrade customer service operations, but most e-business transactions still do not require personal contact.[10] E-businesses may choose to hire more customer service representatives because they are finding that personal contact provided by these workers can stimulate sales and customer loyalty; however, to the extent that new technologies automate responses to e-mail questions, and as websites become more interactive, customized, and user friendly, as networks transmit information faster, and as customers become more "web savvy," the proportion of transactions requiring personal service could decline, offsetting somewhat the demand for additional clerks. Furthermore, e-business automation and self-service dampen the need for these workers in brick-and-mortar activities.

E-business activities are expected to dampen employment requirements for *marketing and sales occupations*. Self-service and automation using websites and e-mail permit sales without the need for workers in this major occupation group. For example, e-business dramatically streamlines the sales process by providing customers—businesses and consumers—with a potentially unlimited amount of information on products. E-business also helps users locate products, determine their availability, choose among alternative delivery arrangements, and process orders and payments. Furthermore, customers may have access to interactive devices that help them calculate their needs for certain products and custom-configure complex products such as computers and investment portfolios. Decision-support software offers tailored purchasing advice for complicated transactions. Developing technologies should permit increasingly sophisticated transactions to be undertaken without the need for sales workers.

E-tailing also permits partial self-service; that is, customers obtain information about products online before turning to sales workers to help them view or test products, to receive assurances, and to complete transactions. Each sales worker, in turn, handles more transactions, so the number of sales workers required is lower. Several other aspects of e-business also increase sales worker output; for example, e-businesses may use website advertising and e-mail to seek customers. Those customers found in this fashion are referred to sales workers, so the overall amount of time sales workers spend "prospecting" for customers may be reduced. E-tailing also facilitates and speeds up the flow of paperwork associated with real-estate, insurance, securities, and other complex transactions.

Online resources (for example, extranets and online conferencing) enable B2B sales workers to obtain more information about clients' needs and to improve communications with buyers and purchasing agents. Automated negotiation software, which determines prices, specifications, and terms of service, reduces or even eliminates the need for sales workers, as do online auctions and other business intermediaries.[11] These same e-business systems also dampen requirements for *purchasing managers*, *purchasing agents*, and *wholesale and retail buyers.*

Effect on industries and staffing

Table 2 lists industry clusters, industry divisions, and detailed industries that are likely to be most affected by e-business activities.

Infrastructure. Industries that provide the hardware, communication links, software, and knowledge needed for e-business are generally referred to as infrastructure industries.[12] For the purposes of this article, such industries include the following construction, manufacturing, and service industries: the *water, sewer, pipeline, and communications and power line construction* industry (SIC 1623) installs fiber-optic or other cable used for Internet communication networks and constructs other communication facilities for the "information highway." Establishments in *drawing and insulating of nonferrous wire* (SIC 3357) manufacture the cable. The *computer and office equipment* (SIC 357), *communication equipment* (SIC 366), and *electronic components manufacturing* (SIC 367) industries produce computers and related devices, including those through which users access the Internet; communication equipment through which the Internet operates, including switches, routers, hubs, bridges, modems, and servers; and components such as semiconductors and printed circuit boards for use in computers, communication equipment, and instruments. Establishments in the *telephone and cable communications services* industries (SICs 481 and 484) provide voice telephone and data transmission services and video programming via wire (coaxial or fiber cable) or wireless technologies and maintain the communication infrastructure used by e-business. Establishments in *computer services* (SIC 737) provide packaged software programs and numerous business services, including integration

Table 2. Likely effect of e-business activities on output and employment requirements in selected industries

[In thousands]

Industry	Wage and salary employment, 1998	Effect of e-business[1]
All industries	128,008	
Infrastructure:		
Water, sewer, pipeline, and communications and power line construction, SIC 1623	257	Stimulates output and employment needs.
Drawing and insulating of nonferrous wire, SIC 3357	73	Stimulates output and employment needs.
Computer and office equipment, communication equipment, and electronic components manufacturing, SICs 357, 366, and 367	1,321	Stimulates output and employment needs.
Telephone and cable communications services, SICs 481 and 484	1,188	Stimulates output and employment needs.
Computer services, SIC 737	1,599	Stimulates output and employment needs.
Management consulting services, SIC 8742, part of management and public relations services, SIC 874	367	Stimulates output and employment needs.
Sales related:		
Retail trade, except eating and drinking places and nonstore retailers, SICs 52–57 and 59, except 596	14,536	Dampens output and employment needs. Particularly affects marketing and sales workers (52), stock clerks (10), and store managers (about 3). Stimulates need for customer service representatives (0.5).
Catalogue and mail-order houses, SIC 5961	230	Both stimulates and dampens output and employment. Stimulates need for customer service representatives, but dampens need for other sales workers, order clerks, and customer service representatives (estimated at 30 percent for all 3) in catalogue and other activities.
Wholesale trade, SICs 50 and 51	6,831	Dampens output and employment overall. Particularly affects marketing and sales workers (24) and administrative support workers, including clerical (26). Stimulates output and employment in order fulfillment for e-tailing.
Arrangement of passenger transportation, SIC 472	219	Dampens employment needs.
Securities and commodity brokers and dealers, SICs 621 and 622	645	Dampens employment needs. Particularly affects marketing and sales workers (31), and administrative support workers, including clerical (31), but stimulates need for customer service representatives (1).
Insurance carriers, agents, and brokers, SICs 63 and 64	2,344	Dampens employment needs, but stimulates need for customer service representatives (3).
Real-estate agents and managers, SIC 653	1,471	Dampens employment needs. Particularly affects real-estate sales workers (12 percent of industry employment, as well as 245,000 self-employed) and administrative support workers, including clerical (29).
Videotape rental, SIC 784	165	Dampens output and employment needs.
Goods producing, except infrastructure related:		
Construction, SICs 15–17	5,985	Could dampen output and employment needs.
Manufacturing, SICs 20–39 (overall)	18, 772	Dampens employment needs.
Publishing, SICs 271–274	779	Dampens employment needs. Particularly affects printing workers (12) and workers handling stock (11). Could stimulate need for writers and other "content" workers (18).
Printing, SICs 275–279	766	Dampens output and employment needs.
Services producing, except infrastructure and sales related:		
Local and long-distance trucking and terminals, SICs 421 and 423	1,579	Stimulates output and employment needs in e-tailing package delivery, but dampens them in other activities.
Public warehousing, SIC 422	166	Stimulates output and employment needs.
U.S. Postal Service, SIC 43	867	Stimulates output and employment needs in e-tailing package delivery, but dampens them in other activities.
Air transportation, SIC 45	1,183	Stimulates output and employment needs in e-tailing package delivery, but dampens them in other activities.
Radio and TV broadcasting, SIC 483	247	Could dampen output and employment needs.
Mailing, reproduction, commercial art and photography, and stenographic services, SIC 733	316	Stimulates output and employment needs in commercial art and photography, but dampens them in other activities.
Depository institutions, SIC 60	2,042	Dampens employment needs. Particularly affects administrative support workers, including clerical (66), but stimulates need for customer service representatives (2).

See footnote at end of table.

Table 2. Continued—Likely effect of e-business activities on output and employment requirements in selected industries

[In thousands]

Industry	Wage and salary employment, 1998	Effect of e-business[1]
Employment agencies, SIC 7361	322	Dampens output and employment needs.
Health services, SIC 80	10,829	Dampens output and employment needs. Particularly affects administrative support workers, including clerical (18).
Education services, SIC 82	11,175	Little or none.

[1] Numbers in parentheses refer to employment in the occupation as a percent of the industry total.

systems design, programming, information retrieval systems, and management of computer facilities. A variety of services for e-business, along with Internet portals, are in this industry.[13] Establishments in *management consulting services* (SIC 8742), part of management and public relations services (SIC 874), provide counsel and assistance to managers of private, nonprofit, and public organizations in many areas, including e-business strategies, integration, and technology development.

The development of infrastructure, including facilities and systems that permit faster transmission of more information and improved software applications and technologies, is critical to making e-business more attractive to potential users and to fostering e-business growth. Such development is expected to stimulate output and employment in infrastructure industries.[14]

Sales related. E-sales have the greatest potential to affect employment in industries with a large proportion of sales workers. For this analysis, sales-related industries are defined as those with at least 20 percent of their employment in marketing and sales occupations.[15] In general, e-sales stimulate the need for workers among pure e-business retailers, while dampening it in industries in which sales and administrative support worker functions are made self-service, are automated, or are shifted to other industries.

Retail trade establishments (SICs 52–57 and 59), except *nonstore retailers* (SIC 596),[16] buy and resell merchandise, generally for personal or household consumption.[17] Most are stores designed to attract walk-in customers and with merchandise displays and a stock of merchandise, but some are warehouses servicing retail chain stores. These brick-and-mortar establishments are distinguished from pure electronic commerce operations. Some also have e-commerce (and catalogue) operations and may be known as "click-and-mortar," or multichannel, establishments. Retail trade establishments are further classified according to the products they sell.[18] Many "click-and-mortar" retailers seamlessly integrate e-business into their store operations. For example, they offer online ordering with the option of picking up or returning merchandise in a store, they place Internet kiosks in stores and connect cash registers to their websites to offer online product information and to permit online orders, and they integrate functions such as advertising, buying merchandise, and maintaining inventory.

E-business should dampen employment needs in this industry. Most e-tailing sales growth will be at the expense of traditional in-store sales. E-tailing permits sales transactions without the need for occupations that accounted for nearly 2 out of 3 retail workers in 1998. These occupations include marketing and sales workers (52 percent)—mostly sales workers, cashiers, and supervisors—stock clerks (10 percent), and store managers (about 3 percent). In contrast, the employment of customer service representatives (only 0.5 percent of workers in retail trade establishments) should be stimulated as they assume some functions formerly handled by sales workers. Operating a website and staffing a "pick-and-pack" warehouse (as opposed to a conventional one) spur the employment of computer specialists and stock clerks, but overall, lower in-store needs should more than offset these gains. Online ordering with in-store pickup (rather than delivery by a courier service) or other variations may have less impact on store employment.

E-tailing also permits partial self-service, as customers obtain product information online before coming to stores or sales offices, so that each sales worker handles more transactions. Furthermore, in-store sales may be lost to pure e-tailers classified in *catalogue and mail-order houses* (SIC 5961).

E-tailing facilitates outsourcing of functions, and therefore output and employment, to other industries. Arrangements include routing orders directly to wholesalers (SICs 50 and 51) or warehouse operators (SIC 422) for fulfillment;[19] outsourcing the operation of a customer service center to business services (SIC 738); and delivery to air or truck transportation firms or the U.S. Postal Service. Online delivery of digitized products eliminates the need for stock clerks, shipping, receiving, and transportation clerks, and truckdrivers. Online sales of computers and motor vehicles could reduce in-store sales to the point that some motor vehicle dealers and computer stores become largely repair facilities; if so, they could be reclassified from retailing to repair services. However, the impact of e-business on motor vehicle dealers is not at all clear.[20]

Establishments in *catalogue and mail-order houses* (SIC 5961), part of *nonstore retailers* (SIC 596), buy and resell mer-

chandise, generally for personal or household consumption.[21] Pure e-commerce (that is, online-only) establishments and those using television commercials (home shopping) are included in this industry, as are establishments of manufacturing firms, located apart from their plants for the purpose of marketing their products online to consumers.[22] Most of these enterprises ship merchandise from a warehouse directly to customers and maintain a telephone customer service (call) center to take orders or assist with online purchases. They may maintain stock for sale or have third parties maintain stock and fill orders. Many traditional cataloguers and mail-order houses entered e-tailing early, because their existing call centers, warehouses, and delivery arrangements were similar to those needed for e-tailing and because their customers were comfortable buying on the basis of pictures and descriptive text.

The sale of goods over the Internet stimulates output and employment needs in both pure e-tailing establishments and the e-tailing component of traditional catalogue and mail-order houses. However, several factors may limit their growth. These establishments face competition from store-based ones (SICs 52–57 and 59, except 596) that have e-tailing operations. In addition, within the industry, some e-tailing sales growth will be at the expense of catalogue and mail-order sales. This shift dampens employment needs, because e-tailing permits ordering and servicing without order clerks, sales and related workers, or customer service representatives (estimated at 30 percent for all three occupations in 1998).[23] However, such a shift also spurs the need for customer service representatives involved with e-tailing purchases. In addition, operating a website stimulates computer and art-related employment, although, on balance, employment losses appear to outweigh gains.[24] On average, a Web transaction costs half as much to process as a catalogue transaction.[25] Employment growth could also be moderated because many pure e-commerce operations outsource customer service and order fulfillment to establishments in other industries.

Establishments in *wholesale trade* (SICs 50 and 51) are intermediaries in the distribution of merchandise. Most provide their customers—retailers, manufacturers, other wholesalers, governments, construction contractors, farms, and other organizations—with goods made by many manufacturers and allow them to devote minimal time and resources to transactions. In addition to selling, these establishments may provide clients with transportation, credit, marketing assistance, technical advice, and installation and repair services. There are three types of wholesalers: (1) wholesale merchants or distributors, which purchase goods from manufacturers and sell the goods to other organizations; (2) wholesale agents, brokers, and exchanges; auction companies; commission merchants; and manufacturers' representatives, which coordinate the sale of goods from one party to another, but seldom take title to or handle the goods in the process; and (3) sales branches and offices of manufacturing firms, located apart from their plants, that market their own products.

In one e-tailing model, wholesale distributors fill orders for online retailers, including ownership of inventory, picking and packing orders, and handling returns. This arrangement stimulates output and employment requirements. However, a number of other changes wrought by e-business should reduce employment requirements. For example, wholesaler-distributors use websites to serve customers, permitting them, like retailers, to operate with fewer marketing and sales workers (24 percent) and fewer administrative support workers (26 percent).[26] In addition, within this industry, online agents, brokers, and business exchanges operate with fewer sales and administrative support workers than do traditional wholesalers. The greater use of online brokers and exchanges may also shift the employment of precision production, craft, and repair workers, as well as operators (including vehicle operators), fabricators, and laborers (30 percent), to other industries.

The *arrangement of passenger transportation* industry (SIC 472) includes travel agencies that furnish travel information and act as agents in selling tours and transportation, rental car services, and lodging services. The industry also has tour operators who arrange and assemble tours for sale through travel agents or who sell on their own account. Airlines' joint-venture online travel websites that are separate from airline operations are in the industry as well.[27]

E-business dampens employment needs in this industry. Online travel information sites of airlines, hotels, government tourism offices, convention and visitor bureaus, and others could reduce the number of people who turn to agents for information. Online travel agencies permit self-service reservations, without the need for travel agents and supervisors (55 percent) or for reservation and transportation ticket agents and travel clerks (10 percent).[28] Online travel agencies also automate some functions performed by other administrative support workers (14 percent).

Securities and commodity brokers and dealers (SICs 621 and 622) buy and sell securities and commodity contracts and provide advice to investors. Traditionally, full-service firms bundled the execution of trades and investment advice into one transaction fee, with advice provided by securities, commodities, and financial services sales workers (registered sales representatives) assigned to specific customers. Discount brokers, who existed before the advent of online sales of securities, allowed customers to place buy or sell orders that were neither solicited nor recommended by sales workers, generally provided less advice, and charged a commission that was discounted from the one charged by full-service brokers. Online brokers are an extension of discount brokers, but are able to offer a vast amount of investment information and advice through their websites and e-mail; these brokers are currently developing the ability to customize their online investment advice.[29] (Full-service brokers also provide account

and market information and research online.)

E-business dampens employment needs in this industry. E-trading permits security sales without the need for marketing and sales workers (31 percent), who are primarily securities, commodities, and financial services sales agents (25 percent). To the extent that transactions entail assistance by customer service representatives (1 percent),[30] employment requirements in this occupation will rise. E-business also permits partial self-service as customers of traditional brokers obtain account, market, and investment information online and then place orders with sales agents (who can handle more customers in this model). E-trading also makes self-service or automates functions of administrative support workers (33 percent), such as brokerage clerks (9 percent) and secretaries (6 percent), who help open accounts, provide information to clients, write up orders, and handle account records.

Insurance carriers (SIC 63) underwrite annuities and insurance policies against various risks, pay benefits, and may also sell their own products. *Insurance agents and brokers* (SIC 64) sell annuities and insurance policies issued by one or more carriers, primarily as independent contractors. Websites of pure e-insurance businesses, as well as those of traditional establishments, permit customers to calculate their insurance needs and design policies, and insurance malls permit customers to fill out just one application, yet receive quotes from a number of companies.

By permitting the sale of routine personal insurance (including auto, homeowner, health, and term life insurance), as well as less complex commercial insurance, without the need for insurance sales agents and brokers (15 percent of industry employment, as well as 114,000 self-employed), e-business dampens employment needs in this industry. Transactions that require assistance from customer service representatives (3 percent) stimulate employment in that occupation. E-business also permits partial self-service, with customers obtaining product information online and then purchasing those products they desire through a sales agent (who can handle more transactions in this model). Websites obtain leads for agents, so the time they spend "prospecting" for customers may decrease.[31] Intranets and extranets reduce the time it takes to conduct business, because agents have faster access to (1) information on products offered by companies they represent, (2) explanations of processes and procedures, (3) downloadable forms, and (4) links to sites with useful information.

Self-service permits customers to file claims, resolve problems, update personal information on policies, request changes in coverage, pay bills, and negotiate other, similar transactions. This reduces the need for both sales agents and administrative support workers (42 percent), including policy processing clerks, claims clerks, and general office clerks.

Real-estate agents and managers (SIC 653) sell, rent, buy, manage, and appraise real estate for others. E-business dampens employment needs in this industry by permitting partial self-service as customers obtain information about neighborhoods, properties, and financing online and then use sales workers to visit properties and complete transactions. This arrangement reduces requirements for agents (12 percent of industry employment, as well as 245,000 self-employed). It also has the potential for online sales with little or no involvement by sales workers, but it is not clear how many buyers would want such a service or whether legal restrictions on signing contracts online can be overcome. Brokers' websites obtain leads for agents, so the time they spend "prospecting" for customers may decrease.

Real-estate transactions are complex, requiring title searches, credit reports, appraisals, inspections, and mortgage agreements. Intranets and extranets facilitate coordinating the process and permit the participants to track the status of transactions. This may raise the productivity of sales and administrative support workers (29 percent), allowing them to handle more transactions.

Videotape rental establishments (SIC 784) rent recorded videotapes and disks for personal or household use. E-business dampens employment needs in this industry. With the existing in-store delivery model, websites permit customers to search inventory, reserve titles, and prepay for rentals. This requires less involvement with customers on the part of counter and rental clerks (68 percent), supervisors (14 percent), and cashiers (7 percent), but creates work retrieving and preparing tapes for pickup. Online delivery of digitized movies (video on demand) eliminates the need for these workers. Industry output levels depend on whether delivery is provided by establishments in this industry or by those in the communications or entertainment industry.[32]

Goods producing. E-business could dampen retail store and office construction as more transactions are conducted online. E-business also could dampen hotel construction because of lower business travel due to more online communication, collaboration, and training.[33] This would affect establishments in *construction* (SICs 15–17) that build these types of structures.

Manufacturing industries (SICs 20–39) include establishments that engage in the mechanical, physical, or chemical transformation of materials, substances, or components (including their assembly) into new products. E-business could dampen employment in this industry. E-business permits build-to-order manufacturing, which allows lower inventory levels of both parts and finished products and helps firms avoid making products that are difficult to sell.[34] This may dampen the need for precision production workers, machine operators, and assemblers, as well as for workers handling stock.

Manufacturers' websites permit self-service or partial self-service operations for their customers' purchasing agents and buyers, who obtain product information and technical materials and who use interactive devices to calculate their product needs. At the same time, online resources enable sales work-

ers to obtain more information about customers and markets and to improve communication with purchasing agents and buyers. Both changes permit sales workers (3 percent) to handle more transactions. Sales through online business exchanges use few or no sales workers, so a shift of transactions to them also lowers employment requirements. In addition, e-business facilitates direct sales from manufacturers to consumers, eliminating the need for workers selling to wholesalers.

Establishments in *publishing* (SICs 271–274) publish, or print as well as publish, newspapers, magazines, books, directories, technical manuals, and other items. Most traditional newspaper and magazine publishers generate revenue from both sales (either through subscriptions or by selling single items) and advertising. Online publishers, with a few exceptions, generate all of their revenue from advertising and from links to retailers.[35]

E-business could dampen employment needs in the publishing industry. The Internet is a new advertising medium. Website and e-mail advertising through Internet service providers, portals, e-tailers, online employment agencies, and other e-businesses, as well as e-mail direct advertising, could draw away advertising from newspapers and magazines.[36] However, e-businesses also place advertising in print media.

Online delivery of publishers' "content" eliminates the need for precision printing workers and printing and binding machine operators (12 percent); shipping and stock clerks; helpers, laborers, and material movers; and truckdrivers (11 percent). Workers who develop content—writers and editors, reporters and correspondents, photographers, artists, and designers (18 percent)—as well as those who sell advertising (15 percent), are less likely to be affected.[37] In fact, because the content of websites is updated more often than that of print media, employment requirements for content workers could increase.[38] To date, print newspaper readership remains high among Internet users, according to a Newspaper Association of America study,[39] but things might change as portable reading device technology improves.

Establishments in the printing industry (SICs 275–279) print books, newspapers, magazines, catalogues, business forms, checkbooks, direct-mail flyers, advertising inserts, directories, and other items. E-business dampens output and employment in this industry. Online delivery of information eliminates the need for printing. However, the net impact on catalogue printing is unclear. Websites can substitute for catalogues, but because sites are passive, some erstwhile pure e-commerce firms are issuing print catalogues to find customers and stimulate sales.[40] E-business also allows marketers to develop individual client profiles, through online questionnaires and customer surveys. This and other technologies permit more narrowly focused mailings, decreasing the need for printing traditional catalogues and direct-mail pieces.[41]

Services-producing, except infrastructure and sales related. Transportation industries move goods (including those shipped by e-tailers), mail, and passengers and provide warehouse services. Establishments in *local and long-distance trucking and terminals* (SICs 421 and 423) handle bulk freight generally weighing more than 100 pounds or are courier services (except by air) that deliver individually addressed letters, parcels, and packages generally weighing under 100 pounds. E-business both stimulates and dampens output and employment in this industry. E-tailing adds to the number of package deliveries, stimulating output and employment requirements in courier services. However, e-tailing eliminates the need for warehouse-to-retail-store bulk shipments, handled either in this industry or in retail or wholesale trade, thereby lowering employment requirements in local and long-distance trucking. Online delivery of documents and digitized goods also dampens employment.

Establishments in *public warehousing* (SIC 422) handle and store goods for others and may also manage inventory; pick, pack, ship, and track single orders; and handle returns. E-business stimulates output and employment requirements in this industry. E-commerce warehousing and fulfillment require specialized equipment, computer systems, and skills. Many e-tailers have neither the resources nor the time to build and operate warehouses, so they turn to warehousing specialists, raising output and employment requirements in public warehousing. However, opinion is divided on whether outsourcing is a good long-term strategy, and some firms are setting up their own warehouses.[42] E-business also facilitates the outsourcing of other activities to warehouses, such as inventory handling and less-than-bulk shipments for build-to-order or just-in-time manufacturing and other supply chain functions.

The *U.S. Postal Service* (SIC 43) delivers letters, documents, periodicals, direct-mail advertising, catalogues, and packages to homes and businesses. E-business both dampens and stimulates output and employment needs in this industry. E-business electronically delivers letters, including bills and payments, documents, direct-mail advertising, and digitized goods, while websites serve as electronic catalogues. Taking the anticipated impact of e-business into account, the Postal Service projects that first-class mail, which covers about two-thirds of institutional costs, will peak in 2002 and then decline at an average annual rate of 2.5 percent a year in fiscal years 2003 through 2008. The Postal Service also projects that the rate of growth of advertising-related mail that is not first class will slow down after 2002. These expected changes should have a dampening effect on employment. As more packages are shipped by Internet retailers, however, the Postal Service projects continued robust growth in priority mail and parcel post, which should have a positive impact on employment requirements.[43]

The *air transportation industry* (SIC 45) consists of passenger and air cargo carriers; air courier services that deliver

individually addressed letters, parcels, and packages (generally weighing under 100 pounds); and airports and related services. E-tailing both stimulates and dampens output and employment needs in this industry. On the one hand, e-business raises the number of package deliveries—spurring output and employment in air courier services. On the other hand, the online delivery of documents and digitized goods has a dampening effect. Both factors particularly affect truckdrivers (14 percent) and helpers, laborers, and (hand) material movers (15 percent), who are concentrated in the sector. Online travel reservations automate the reservation process, eliminating the need for reservation and transportation ticket agents and travel clerks (15 percent). (See also *arrangement of passenger transportation services* (SIC 472) under sales-related industries.) Online training, conferencing, collaboration, and B2B selling dampen the amount of business travel and, therefore, output and employment requirements in passenger carriers.[44]

Establishments in *radio and TV broadcasting* (SIC 483) broadcast programs to the public and derive revenue from advertising. The Internet is a new advertising medium. Website advertising through Internet service providers, portals, e-tailers, and other e-business establishments, as well as e-mail, could draw away advertising from broadcasting,[45] thereby dampening output and employment needs in this industry. However, e-businesses also place advertising with broadcasters.

Establishments in the *mailing* (direct-mail advertising services), *reproduction* (photocopying and duplicating), *commercial art and photography*, and *stenographic services* industries (SIC 733) afford a variety of services to businesses. E-business both dampens and stimulates employment needs in these industries. E-mail direct advertising requires less labor than traditional direct-mail advertising. In addition, e-business-based systems, including those using individual client profiles developed through online questionnaires and surveys, are capable of providing a surfeit of information about customers. These systems permit narrower targeted mailings, which could lower the number of catalogues, inserts, and direct-mail pieces handled. Both factors should result in lower employment requirements in direct-mail advertising services. Online document delivery dampens the need for reproduction and duplication services and, therefore, output and employment. The demand for Web content and advertising spurs output and employment in photographic and commercial art services, but some of this may be at the expense of output and employment generated by content and advertising in print publications.

Depository institutions (SIC 60) include banks, savings institutions, and credit unions, which accept deposits, make loans, service checking and other accounts, issue credit cards, provide financial advice, and sell securities and insurance. Pure electronic banks and most brick-and-mortar banks offer online services, including opening of accounts, payment of bills, transfer of funds, and application, processing, and approval of loans and credit cards.[46] Remote, self-service electronic banking has been available through telephones and automated teller machines since the 1980s, permitting customers to check their account balances, transfer funds between accounts, order checks, and make deposits and withdrawals. This technology has contributed to an overall employment decline of 9 percent between 1988 and 1998.

E-banking dampens employment needs in depository institutions by automating or making self-service functions handled by administrative support workers (66 percent), including tellers, new-account clerks, loan and credit clerks, and general office clerks, and, to some extent, by managers (25 percent), but stimulates the need for customer service representatives (2 percent). E-banks generally operate without branch managers (financial managers). However, some e-banks have set up branches because they are effective in attracting customers; for the same reason, physical banks that offer online services may continue to add branches. Online financial advice and online sales of insurance and securities dampen employment requirements for managers and sales workers.

Employment agencies (SIC 7361) solicit job listings from employers, interview jobseekers, and match their qualifications and skills to those being sought by employers. E-business dampens employment needs in this industry. Job postings on employer websites, e-mail ads to likely candidates, online newspaper classified ads, and job-matching sites operated by educational institutions and professional associations compete with the industry, thereby affecting its output and employment. Within the industry, online employment agencies operate without employment counselors and need fewer administrative support workers.[47]

Health services (SIC 80) includes establishments furnishing medical, surgical, and other health services to persons. Among these establishments are hospitals; nursing homes; offices of physicians, dentists, and other health practitioners; and medical laboratories. E-business dampens output and employment needs in the health services industry. The Internet gives patients access to all types of medical information, as well as access to discussion groups and support communities, permitting the patients to better evaluate their health risks, understand their problems and possible treatments, and manage chronic medical conditions.[48] Patients are being encouraged to assume a greater role in their own health care, and the Internet makes it easier to do so. This turn of events might also contribute to fewer patients using brick-and-mortar medical resources. The Internet also automates or speeds up administrative processes such as the transmission of prescriptions to pharmacies, verification of health insurance coverage, submission and payment of claims, approval for referral to specialists, the entry of information into medical records, the processing of such information, the scheduling of appointments, and similar functions. Together, these dampen the need for administrative support occupations (18 percent), including receptionists, information clerks, and secretaries.[49]

Internet-delivered services provide physicians, dentists, and other clinicians with rapid access to medical records, drug databases, and a vast amount of information on diagnosing and treating medical problems (virtual consultations with specialists), from the examining room or from anywhere, using handheld devices.[50] These services also permit medical practitioners to collaborate from various sites as they view the same data and images. Together, such services could dampen employment needs. Output and employment requirements in the industry also could be dampened as better recordkeeping and a more efficient flow of information lead to less duplicated effort and fewer medical errors.[51]

Establishments in *education services* (SIC 82) provide academic or technical instruction and include elementary and secondary schools, colleges and universities, and business, computer, vocational and technical, and professional and management development schools. Most services are delivered by teachers or instructors, who develop courses; explain, demonstrate, supervise, and direct learning; and encourage and evaluate students. Much education content can be digitized and delivered online and is sometimes referred to as "webucation" or e-learning. Adult and college-level distance learning, through correspondence courses, television, and videotape, have been around for a long time. However, e-learning permits interaction between students and faculty and among students through two-way interactive video, teleconferencing, e-mail, chat rooms, and bulletin boards. E-learning also permits teachers to convey much more information to students, through prerecorded video, multimedia, and libraries of information.

There is little evidence that e-learning will affect the employment of schoolteachers (33 percent), teacher assistants (9 percent), and college and university faculty (8 percent), although it could change their job duties. Teachers in webucation develop courses, arrange for access to resources, act as coaches and monitors, respond to e-mail questions, facilitate online discussions, and assess academic performance—activities similar to those in classroom teaching. A National Education Association survey of the organization's members in higher education found that respondents were concerned that preparing for and teaching a distance-education course would take more time than would preparing for and teaching a traditional course.[52] In traditional classrooms, the use of the Internet may permit less lecturing and more coaching and guiding.[53]

Some e-learning, including employer-sponsored training for specific skills, may be conducted without directly involving teachers. However, the primary employment impact of employer training may occur outside the education industry, as 69 percent of formal employer-provided training is handled by in-house staff.[54] E-learning courses for specific skills may also result in fewer adult education, vocational education, and other teachers (6 percent) if such courses replace classroom learning. To the extent that the availability of these courses attracts students who would otherwise not have taken classroom-based courses, employment requirements may be raised. A similar effect for college-level courses could spur faculty employment.

INDUSTRIES THAT PROVIDE THE HARDWARE, SOFTWARE, COMMUNICATION LINKS, AND KNOW-HOW that underpin e-business activities, in general, are likely to enjoy higher levels of output and employment than would occur in the absence of e-business. Also, e-business stimulates output and employment in the catalogue and mail-order houses industry, in which pure e-tailers are located, and in those parts of the transportation and wholesale trade industries which handle and deliver goods for e-tailers. Much of this stimulus, however, may be at the expense of traditional retailers. In addition, e-business stimulates employment needs, across all industries, for computer-related occupations and for other occupations associated with websites and networks.

Concomitantly, however, this investment in e-business infrastructure should lead to labor-saving efficiencies throughout the economy that *dampen* employment requirements.[55] For instance, e-business sales and administrative transactions require fewer workers, and the online delivery of digitized products eliminates the need for handling and delivery workers. E-business also reduces the amount of time workers in a wide range of occupations spend searching for information and may eliminate some traveling.

This article has sought to identify some ways in which e-business is likely to affect output, output per worker, and employment in selected occupations and industries. As in these pages, the 2000–10 projections will not provide separate numbers for e-business, because existing data systems are not designed to measure e-business employment or output. Although proposed 2002 revisions to the North American Industry Classification System (NAICS) will permit data collection relating to the pure electronic shopping and electronic auction industries,[56] NAICS will continue to classify establishments that provide a combination of electronic shopping and brick-and-mortar shopping with store retailers. Also, all stockbrokers and all travel agents, including those which operate solely online, will continue to be in their respective industries.

E-business is pervasive and increasingly is being integrated into existing activities, with organizations being referred to as "click and mortar" or as "digital" or "e-business" operations. It is unlikely that the impact of e-business on output and employment will ever be fully measured. □

Notes

[1] See Thomas Mesenbourg, Assistant Director for Economic Programs, Bureau of the Census, "Measuring Electronic Business, Definitions, Underlying Concepts, and Measurement Plans," on the Internet at **http://www.census.gov/epcd/www/ebusines.htm**. Computer-mediated networks are electronically linked devices that communicate interactively over network channels. Such devices include computers, personal digital assistants, webTV, Internet-enabled cellular phones, and telephones linked together interactively. Networks include the Internet, intranets, extranets, electronic data interchange networks, and telecommunications networks.

[2] *Ibid.* E-commerce is defined by Mesenbourg as "any transaction completed over a computer-mediated network that involves the transfer of ownership or rights to use goods and services."

[3] B2B includes electronic data interchange (see note 1), which is large and predates commerce on the Internet, but is conducted over private networks, not the Internet.

[4] Examples of establishments dealing with both types of clientele include building material and hardware dealers, stationery and office supply stores, banks, and insurance agents.

[5] Mesenbourg, "Measuring Electronic Business." Because e-commerce consists of sales activities, it is potentially measurable; many of the other e-business activities mentioned may not be measurable.

[6] "Roughly 85 percent of Cisco's 800,000 monthly customer queries are handled via the Web, eliminating the need for thousands of customer-service reps (support specialists)." (See Scott Thurm, "Eating Their Own Dog Food—Internet Builder Cisco Goes Online to Buy, Sell, Hire, Keep Customers Happy," *Wall Street Journal*, Apr. 19, 2000.

[7] See Douglas Braddock, "Occupational employment projections to 2008," *Monthly Labor Review*, November 1999, pp. 51–77, especially table 1, p. 52.

[8] *Ibid.*, p. 53.

[9] In the *Revised 2000 Standard Occupational Classification Manual*, adjustment clerks are subsumed under customer service representatives, whose duties may overlap those of sales representatives, sales clerks, or order clerks. Employers may also report workers who assist e-business customers as working in these occupations.

[10] Among selected e-businesses, the percentage of buyers using customer service ranged from 37.5 percent to less than 10 percent, according to Harris Interactive, Inc. (cited in "Reality Bytes," *Wall Street Journal*, June 5, 2000, p. B8).

[11] *Research Priorities in Electronic Commerce*, report of a National Science Foundation–University of Texas workshop, Jan. 25, 1999; on the Internet at **http://crec.bus.utexas.edu/workshop/ecdraft.html**.

[12] For example, see "Measuring the Internet Economy," Center for Research in Electronic Commerce, the University of Texas at Austin and Cisco Systems, January 2001, pp. 9–17; on the Internet at **www.internetindicators.com** and **internetindic.html**.

[13] Online portals are websites that generate income through advertising fees and charges for links to e-commerce sites.

[14] "Increased use of the Internet and continued expansion of corporate Intranets will be the principal forces driving the demand for computer equipment (and therefore employment) over the next 5 years." (See *U.S. Industry and Trade Outlook: 2000* (New York, the McGraw-Hill Companies and the U.S. Department of Commerce/International Trade Administration, 2000), chapters 27 and 31.) However, employment in SIC 357 is projected to decline by 0.3 percent annually from 1998 to 2008, according to BLS projections, despite a 14.5-percent annual growth in output. (See Allison Thomson, "Industry output and employment projections to 2008," *Monthly Labor Review*, November 1999, pp. 33–50.) The aforecited *U.S. Industry and Trade Outlook: 2000* also discusses the impact of e-business on many other industries.

[15] Automobile rental and leasing, without drivers (SIC 751), also has at least 20 percent, mostly counter and rental clerks, but e-business may not have a major employment impact on that industry. Industries with 10 percent to 19 percent of employment in marketing and sales occupations include radio and TV broadcasting (SIC 483), telephone and cable communications services (SIC 481), publishing (SIC 271), advertising (SIC 731), and miscellaneous business services (SIC 738).

[16] Eating and drinking places (SIC 58), also part of the retail trade group of industries, are much less affected by e-business than are retail stores.

[17] Such establishments may also process or repair products or serve food, but these are subordinate activities.

[18] Major industry groups include building materials, hardware, and garden supplies (SIC 52); general merchandise, including department stores (SIC 53); food establishments, including grocery stores, supermarkets, convenience stores, and specialty stores (SIC 54); automotive dealers and gasoline service stations (SIC 55); apparel and accessories stores (SIC 56); furniture, home furnishings, appliances, and electronics (SIC 57); and miscellaneous establishments, including drugstores, sporting goods stores, bookstores, stores selling stationery and office supplies, jewelry stores, toy stores, and florists (SIC 59, except 596). To date, e-tailing has taken a more significant share of the market in SIC 57, which includes stores that handle computer hardware and software and prerecorded-audio and -video, and in SIC 59.

[19] While Amazon.com has moved to ownership of stock and operation of warehouses, other firms continue to outsource.

[20] The Internet arms potential car buyers with massive amounts of information, and margins on Internet-facilitated purchases are significantly lower than on other purchases. (See Susan Helper and John Paul MacDuffie, "E-volving the Auto Industry: E-Commerce Effects on Consumer and Supplier Relationships"; on the Internet at **http://e-conomy.berkeley.edu/conference-main.htm**.) This suggests that the industry will employ fewer sales workers.

[21] These establishments may also process products, but that function is subordinate to selling.

[22] Proposed changes to the North American Industry Classification System (NAICS) for 2002 would define three separate components of industry group 4541, corresponding to SIC 5961: electronic shopping, electronic auctions, and (catalogue and) mail-order houses. (See "North American Industry Classification System—Update for 2000," Federal Register *Notice*, Apr. 20, 2000; on the Internet at **http://www.census.gov/epcd/www/naics.html**.)

[23] Data are available only for nonstore retailers (SIC 596).

[24] Some jobs would also be lost if fewer or smaller catalogues are used. In the local-delivery grocery store model, delivery is handled in-house, increasing the need for truckdrivers.

[25] Ranjay Gulati and Jason Garino, "Get the Right Mix of Bricks and Clicks," *Harvard Business Review*, May–June 2000, p. 32.

[26] *U.S. Industry and Trade Outlook: 2000*, pp. 41–4 through 41–6.

[27] According to the American Society of Travel Agents, cited in *U.S. Industry and Trade Outlook: 2000*, p. 50–8, retail travel agencies sell 80 percent of all airline tickets, book 90 percent of all cruises, and make 25 percent of all hotel reservations.

[28] Lori Enos, "Report: Corporate Travel Energizing Online Market," *E-commerce Times*, Feb. 8, 2001.

[29] Full-service brokers now allow substantial discounts in commissions to certain individuals, and most also offer online trading. See *On-line Brokerage: Keeping Apace of Cyberspace* (Washington, DC, Securities and Exchange Commission, 2000), pp. 18–19.

[30] Only workers registered with the Securities and Exchange Commission (SEC) may accept telephone orders.

[31] Under a new system with Allstate, agents who work exclusively for the company will earn a 10-percent commission on new business and renewals, but only a 2-percent commission on customers who are obtained via the Internet or the firm's 800 number. (See Barbara Bowers, "Allstate: Major Distribution Shift," *Best's Review Magazine*, May 2000; on the Internet at **http://bestreview.com/2000–05/coverallstate.html**.)

[32] Broadband service is needed to deliver movies. (See Martin Peers, "Video on Demand Arrives—Sort Of," and Anna Wilde Mathews, "Studios Have Their Own Movies-On-Demand Plans," *The Wall Street Journal*, Jan. 29, 2001, p. B1.)

[33] See Bernard Stamler, "Making Face-to-Face Time Possible on the PC," *The New York Times*, E-Commerce Special Edition, Oct. 25, 2000, p. 24.

[34] Helper and MacDuffie, pp. 4–9, 14; and Adrian J. Slywotzky, "The Age of the Choice Board," *Harvard Business Review*, January–February 2000, and "Getting Rid of Guesswork," *Business Week*, Aug. 28, 2000, p. 142.

[35] The NAICS categorizes publishing as an information industry, along with software, motion pictures, music, and broadcasting, while leaving printing within manufacturing.

[36] Jack Myers, "Media engine gathers head of steam," *Advertising Age*, Feb. 14, 2000, p. 1; and "Report: Digital Advertising Set for Rebound," *E-Commerce Times*, Jan. 26, 2001. Since the 1960s, another electronic medium—network television—has reduced the market for evening newspapers and limited their share of advertising expenditures. Classified advertising accounts for more than 40 percent of the newspaper industry's revenue. Advertising on a publishers' website is provided free or at little charge if the ad also appears in the newspaper's printed edition. Newspaper websites also serve as electronic portals, generating revenue through links to other sites. (See *U.S. Industry and Trade Outlook: 2000*, pp. 25–3, 25–5, and 25–8. For a discussion of the impact of online employment agencies ("job boards") on newspapers, see David H. Autor, *Wiring the Labor Market*, Working Paper 7959 (Cambridge, MA, National Bureau of Economic Research, 2000). See also John Schwartz, "Marketers Turn to a Simple Tool: E-Mail," *The New York Times*, special section on e-commerce, Dec. 13, 2000; and Bernard Stamler, "You Want Repeat Customers? Try E-Mail," *The New York Times*, technology section, Apr. 18, 2001.)

[37] Producing original content requires not just writers and graphic artists who are employed in the industry, but many of the self-employed as well. (See Nick Wingfield, "Webzines Join Forces to Survive Net Shakeout," *The Wall Street Journal*, July 10, 2000, p. B1.)

[38] Jennifer Greenstein, "The Web Content Conundrum," *The Standard*, June 26, 2000; on the Internet at **http://www.thestandard.net/**.

[39] Rebecca Gardyn, "The Future of Fine Print," *American Demographics*, May 2000, pp. 26–29.

[40] Bob Tedeschi, "Online Retailers Try Printed Catalogues," *The New York Times*, July 10, 2000.

[41] *U.S. Industry and Trade Outlook: 2000*, p. 26–6.

[42] Clare Saliba, "Report: Shipping Costs Bleed E-tailers Dry," *E-Commerce Times*, Feb. 9, 2001. Those outsourcing ownership of inventory as well as warehousing rely on wholesalers. (See note 19.)

[43] "U.S. Postal Service: Challenges to Sustaining Performance Improvements Remain Formidable on the Brink of the 21st Century (General Accounting Office testimony, Oct. 21, 1999, GAO/T-GGD-00–2), pp. 5–7.

[44] Stamler, "Face-to-Face Time"; and Susan Stellin, "Employee Training Without the No-Doz," *The New York Times*, technology section, Apr. 18, 2001.

[45] Myers Group, cited in *Advertising Age*, Feb. 14, 2000; and "Report: Digital Advertising Set for Rebound."

[46] E-banking relies on automated teller machines (ATM's) or mail for deposits and withdrawals.

[47] Data are available only in the aggregate for SIC 736. (See Peter Capelli, "Making the Most of On-line Recruiting," *Harvard Business Review*, March 2001, p. 139.)

[48] For example, patients have access to MEDLINE, a database of information found in medical journals, through the National Library of Medicine of the National Institutes of Health. MEDLINE may be reached on the Internet at **http://www4.infotrieve.com/mewmedline/search.asp** or at **http://www.medportal.com**. (See also *Networking Health: Prescriptions for the Internet* (National Research Council, February 2000), pp. 38, 57–62; on the Internet at **http://stills.nap.edu/books/0309068436/html/**.

[49] *Ibid.*, chapter 2.

[50] *Ibid;* see also MEDLINE, cited in note 48.

[51] *Ibid;* see also Jennifer Steinhauer, "In a Health Revolution, a Hospital's Baby Steps," and Sandeep Juahar, "Residents

Discover a Handy Helpmate," *The New York Times*, e-Commerce Special Edition, Oct. 25, 2000.

[52] Sarah Carr, "Many Professors Are Optimistic on Distance Learning, Survey Says," *The Chronicle of Higher Education*, July 7, 2000, p. A35. (See also David B. Gordon, ed., *The Digital Classroom*: *How Technology Is Changing the Way We Teach and Learn* (Cambridge, MA, Harvard Education Letter, 2000), p. 57; and Lawrence E. Gladieux and Watson Scott Swail, *The Virtual University & Education Opportunity* (Washington, DC, The College Board, April 1999). Gladieux and Swale state that institutions are likely to find "that online courses are works in progress, requiring ongoing outlays for maintenance, revamping, upgrading, and staff training" (p. 15).)

[53] Kenneth J. Cooper, "Internet at School Is Changing Work of Students—and Teachers," *The Washington Post*, Sept. 5, 2000, p. A2.

[54] The 69-percent figure is from a *Training Magazine* survey in 1997, cited in *U.S. Industry and Trade Outlook: 2000*, p. 49–8. Furthermore, many instructors may be classified as *practitioners* of the subject they are teaching, rather than as teachers.

[55] Including efficiencies in infrastructure industries, in which e-business also *stimulates* employment. (For example, see footnote 6, referring to labor savings at Cisco Systems, a provider of infrastructure hardware.)

[56] There is also a new industry for Internet publishing and broadcasting and for B2B electronic markets. (See note 22.)