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INFORMATION SERVICES: PERSPECTIVES FROM INDUSTRIAL ORGANIZATION AND TRADE THEORY

by

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Information Services:
Perspectives from Industrial Organization and Trade Theory

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0. Introduction

> "Animals are divided into: (a) belonging to the Emperor, (b) embalmed, (c) tame, (d) suckling pigs, (e) sirens, (f) fabulous, (g) stray dogs, (h) included in the present classification, (i) frenzied, (j) innumerable, (k) drawn with a very fine camel hair brush, (l) et. cetera, (m) having just broken the water pitcher, (n) that from a long way off look like flies."

Lacking the bold insight, or the intellectual courage, of a Chinese philosopher who produced this taxonomy for an ancient encyclopedia, we decided to refrain in this essay from either classifying or even defining information services. The chosen route seemed appropriate for a variety of reasons. First, economists and other experts differ in their assessments as to the proper classification of services themselves. Second, it seems that there is even less agreement on what is meant by information services. There is no disagreement, however, that the provision of information services comprises a variety of widely differing activities. These must invariably include giving directions to the Holiday Inn in Merida to a lost tourist, leasing the newest

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1 The authors would like to thank the National Science Foundation for financial support of their research and INPUT, Inc. for the use of some of their data. The C.V. Starr Center at New York University provided funds for the acquisition of some of the data for this article. Jeffrey Moore and Roger Ware made useful comments on the earlier version of this paper.

technology for producing sophisticated computer components, entering into a joint venture agreement whose one objective is to educate one of the co-venturers in the managerial techniques developed by the other co-venturer, generating and transmitting information about the rates of exchange between various foreign currencies, inputing and processing payroll account-receivable data for a large multinational corporation, transmitting videotex or teletext services; writing and de-bugging the software needed to launch and stabilize a geosynchronous satellite, ... the list can be made endless. Finally, information services form a part of the larger information technology sector, which Diebold defines as

> ... a cluster of industries whose products and services provide for the original entry of information and its subsequent processing for treatment, indexing, description and classification, storage and retrieval as well as its transport and communications.[2]

Companies that constitute the information technology sector are very diverse, although they have information as their common denominator. Some of these companies may be involved in acquiring information, others in storing, processing, transporting or distributing it. Some companies may handle information as a service, while others produce and market products to allow other companies and/or individuals to collect, process or distribute their own information. Many companies may provide several or all of these functions at the same time.

Much of the current interest in the information-based technology sector is due to the rapid and changing nature of companies that have traditionally provided electronically-based information services and systems. These would include telephone companies and a variety of companies involved in

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2 Diebold (1983), p. 139.

the manufacturing and marketing of computer, telecommunications equipment, semiconductors, office equipment, and consumer products that provide the necessary infrastructure through which information services are provided. Thus, information services belong to an extremely diverse group of industries, which include goods, equipment, and services.

The confluence of computers and communications[3] brought about by technological developments in microcomputers, computer architecture and software, has opened up new economic opportunities making information-based technology one of the most dynamic sectors of advanced market-orientated economies. It is also leading to dramatic changes in the nature and organization of many economic activities and, consequently, increasing the relative importance of jobs involving the manipulation and distribution of information rather than goods. Many of these new information-based jobs are in information services which primarily add value to raw data[4] by organizing, processing, manipulating and distributing new data and/or textual information. The provision of information services has become the fastest growing component of the information technology industry.

For the purposes of this study, we focus on a small but extremely dynamic subset of the information services industry: computer services.[5]

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3 This merging of computer and communications technology is often referred to as telematics, telematique, compunications, or teleinformatics.

4 Raw data are symbols that are handled and transmitted through computers, whereas, information is the combination of data into messages that are intelligible to human beings (i.e. the processed form of raw data).

5 The total information sector consists of primary and secondary sectors. The primary information sector includes all information products and services sold commercially on established markets. The secondary sector involves all information products and services which are developed and used for internal purposes, including by corporations. (See M. Porat, (1977)) Because of the lack of data on the volume of in-house information activities, we have chosen to examine only those companies which sell their information products and/or services on open markets. However, some implications of the growth of the secondary market are discussed later.

Computer (data processing) services involve the provision of a wide range of services and products that include: (i) data processing services, (ii) software products, (iii) professional services, and (iv) integrated (turnkey) systems. Excluded from this study, at least at this stage, are other sectors of the information services industry such as on-line databases, videotex and teletext services, and research and development in new products and technologies.

This essay is divided into four parts. Part 1 defines the computer services industry and its various components included in this study. Part 2 provides profiles of the computer service industries in the United States and Canada. The industry profiles present brief decriptions of each industry and their domestic competitive situation. Part 3 discusses international competition in the computer services industry from two different perspectives - international markets and trade in computer services and restrictions that may impede trade in these services. Part 4 presents a discussion of these issues from an industrial organization and trade theory perspective and attempts to increase awareness of problems that may result from restricting trade in information services and so-called "targeting" practices that serve to protect, or assist domestic information technology industries.

1. The Computer (Data Processing) Services Industry[6]

Technological developments in the computer and telecommunications industries have enabled companies to store, process, and distribute data or

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6 The definitions adopted here are essentially those used by INPUT, Inc. and used by the Department of Commerce (International Trade Administration), in their assessment of the U.S. data processing services industry. See Department of Commerce (1984a).

textual information to and for their customers in new and more efficient ways. Historically, the oldest and largest segment of the computer services industry has been that of data processing. In the early 1960s, data processing services were being provided by batch computing companies that performed their services within small, local areas. Today, the activity of processing information involves a variety of companies that provide remote and batch computing services, facilities management, value-added network services and other enhanced services. Many data processing service companies are now also offering proprietary software products, professional services and integrated systems. Together, these various activities make up the computer services industry.

Data processing services, in general, refer to the provision of processing functions using a vendor's computers and software programming and/or the provision of database access where vendors perform processing or convey data. These services can be provided in various ways, either in the form of remote or batch computing, processing facilities management or value-added network (VAN) services. Batch computing services involve the processing at the vendor's site of user programs and/or data which are physically transported (as opposed to electronically transmitted) to and/or from those sites. Remote computing services, including interactive time-sharing services, refer to data processing using terminals set up at the users' site and connected by a communications network (public[7] or private) to the vendor's central computer(s).

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7 Usually operated by Postal, Telephone and Telegraph (PTT's) agencies under the direct control of governments.

Remote computing requires a communications infrastructure through which data transmissions are made. Telephone networks represent the most basic form of this infrastructure. These networks, as a rule, are considered common (basic) carriers that provide universal communication services for a fee. The usefulness of these networks can be enhanced by adding various features such as packet switching, automatic rerouting, intermediate storage, various compatibility services, maintenance-related support services and electronic mail. A few common carriers now offer several of these services but they are primarily offered by VAN carriers. VAN's typically lease lines from common carriers and then combine them with computer equipment to create a communications network dedicated solely to the transmission of data.[8]

Processing facilities management is an additional service that involves the management of all or part of a user's data processing functions usually under a long-term arrangement. In this case, the vendor plans, controls, operates and owns the facility provided to the user, which can be located on-site or remotely.

The uses of such data processing services range from basic commercial and accounting operations to highly complex scientific, educational and engineering applications. Various data processing applications that can be applied to a wide class of industries, such as basic accounting and payroll services, are referred to as cross-industry (or generalist) services. Services that provide processing for particular functions or problems unique to an industry are called industry-specific (or applications-orientated) services.

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8 The distinction between common carriers, VAN's and data processing services companies is not always easily made because of a number of overlapping features. Although there are exceptions, common carriers essentially provide only a standard communications network, VAN's only offer enhanced telecommunication services, and data processing services companies primarily provide data processing and information retrieval services.

Software used and often provided by data processing companies consist of a set of programs or routines that control the operation of computer hardware. Software products, in general, can be divided into two broad categories: systems software and applications software. Systems software involves programs, or a combination of programs, that enable the basic computer and peripheral equipment to function more easily. Applications software consists of a program, or a set of programs or packages, which perform specific user processing tasks. There exists a great variety of applications software that are used to provide the entire range of data processing functions (e.g. payroll, inventory control, statistical analysis, airline reservation systems, etc.). As such, applications software can be further divided into cross-industry and industry-specific categories.

Software products can also be classified by their mode of delivery to users: packaged software, custom software, or as part of an integrated system. Packaged software, that includes both systems and applications categories, refers to a standard program, or set of programs, which can be used by a wide variety of users with little or no modification. In contrast, custom software is tailored to meet a particular users' needs. Development of this type of software may take place at the user's site or at the vendor's site on a contract basis. Integrated (turnkey) systems involve bundling of systems and applications software together with computer hardware, packaged, marketed and sold as a single product. The value added by the vendor in this case is primarily in the provision of the software.

Professional services include a number of activities such as custom software design and development, contract programming, education services related to businesses, consulting services and professional facilities

management services.[9]

2.1 The Computer Services Industry in the United States

2.1.1 Market Size and Growth

Statistics on the computer services sector are extremely limited, as is the case for most service industries. Only recently has there been an attempt to collect consistent, continuous statistics. In addition, it is becoming increasingly difficult to distinguish between the types of companies and the types of services provided by these companies. However, there is enough statistical information available to suggest certain trends in the industry.

The size, composition and growth of the U.S. computer services industry, including data processing services, software products, professional services and integrated systems are shown in Table 2.1. The industry grew at an annual rate of 22 percent in 1984 with total industry revenues amounting to $39.9 billion. Between 1970 and 1984 industry revenues have increased 2000 percent, the greater part occuring since the mid 1970s. Industry analysts predict that annual growth will fall slightly, but will remain relatively high at around 18-20 percent through 1990 and that industry revenues will reach the $100 billion mark.[10]

Data processing services have historically accounted for the largest share of revenue (over 50 percent prior to 1982) for companies providing

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9 Professional facilities management differs from facilities management services defined earlier in that the computers are owned by the user, not the vendor. The vendor in this case provides personnel to operate and manage the user's data processing operations when needed.

10 Financial Times, 10/04/85.

computer services. However, strong growth in other markets, especially in software products, has caused this proportion to fall in recent years (see Table 2.2). In 1983, data processing revenues were $14.6 billion representing an annual growth rate of 17 percent. Preliminary estimates for 1984 indicate that revenues from data processing have reached $15 billion.

As of 1983, remote computing services accounted for over 50 percent of data processing revenues, and it is likely to remain the mainstay of the processing sector (see Table 2.3). Of the three modes of delivering data processing services, batch computing has experienced the lowest rate of growth and this trend is expected to continue. Companies that deliver their services through facilities management account for the smallest share of processing revenue, but average annual growth rates remained comparatively high at around 13 percent.

Software products have dominated the growth of the computer services industry since the late 1970's. Revenues were $7.5 billion in 1983 and increased to $10.4 billion in 1984 representing an annual growth rate of 39 percent. Profit margins for the software products sector have been the largest among all the sectors that make up the computer services industry (see Table 2.4). Although the computer services industry accounts for a minority share of total software production in the U.S. in relation to software supplied separately by hardware manufacturers, it constitutes the fastest growing component (see Table 2.5).

Companies offering professional services and integrated systems have experienced relatively high rates of growth and this trend is expected to continue. Together, revenues from software products, professional services and integrated systems accounted for roughly 50 percent of total computer services revenue in 1981 but had increased their share to 63 percent by 1984.

2.1.2 Industry Structure

In the early 1960s it has been estimated that there were only 300-400 small, local companies offering primarily batch computer services.[11] Recently, U.S. Census figures report that the number of companies involved in the computer services increased from 3,845 in 1972 to 5,683 in 1977 and 6,707 in 1982.[12] INPUT, a private research company, has estimated the number of companies in the computer services industry to be approximately 6,470 in 1982 and 7,000 in 1983.[13] Of these 7,000 companies offering computer services in 1983, 32 percent were primarily involved in offering software products, 31 percent in data processing services, integrated systems companies accounted

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11 This is explained by the fact that at the time only first-generation computer systems were available during that period. Consequently, raw data and processed material had to be transported physically. D. Ernst (1983), p. 77.

12 1982 Census of Service Industries, Industry Series: Establishments and Firm Size, U.S. Department of Commerce, Bureau of Census, May 1985. U.S. Census data on Computer and Data Processing services (SIC 737) are available for the years 1972, 1977 and 1982. Included are data processing services (SIC 7374) that involve computer calculating services, computer management contracting, computer time-sharing, data processing service, data punch service, facilities management, key punch service, leasing of computer time, service bureaus, and tabulating services. Computer programming and other software services (SIC 7372) includes computer systems analysis and design, development of computer programs or systems software, programming, programming services, and computer systems engineering. Computer related services, not eleswhere classified (SIC 7379) includes computer and data processing equipment repair and maintenance, computer brokers and consultants, leasing of computers, and tape recertification services. The census definitions do not completely correspond to the definition of the computer services industry adopted in this study. Further, the census data do not allow yearly comparisons.

13 INPUT's figures are based on annual surveys and thus facilitate annual comparisons. However, definitons vary with those used in the SIC classification and are not easily comparable with the official statistics that do exist. It should also be noted that the statistics from various surveys and reports used in this essay can not be considered a comprehensive census of the computer services industry.

for 20 percent and companies primarily offering professional services made up the remaining 17 percent.[14]

The total number of companies in the computer services industry increased by 530, approximately 8 percent, between 1982 and 1983. Integrated systems experienced the highest rate of entry, increasing nearly 80 percent over the number providing these systems in 1982. The smallest increase was in the area of data processing services. The number of processing companies offering batch remoting computing, facilities management and VAN services declined slightly from 2,140 in 1979 to 2,132 in 1980, rising to 2,259 in 1981 but declined again in 1982 to 2,130. Of the 2,130 data processing services companies in 1982, 47 percent had revenues under $1 million, 47 percent had revenues between $1 and $10 million, 2.7 percent had revenues between $10 and $25 million, and 3 percent had revenues in excess of $25 million.[15] The top 25 data processing companies in 1982 are shown in Table 2.6. Together, these 25 companies (approximately 1 percent of all processing companies) accounted for nearly 30 percent of total data processing services revenue in 1982.

For the software products sector in 1982, 74 percent of the 1,879 companies had revenues under $1 million, 23 percent had revenues between $1 and $10 million and 3 percent had revenues greater than $10 million.[16] The top 3 percent captured 49 percent of total software products revenues. For the professional services sector, 70 percent of the 1,348 companies in 1982 had revenues less than $1 million, 24 percent had revenues between $1 and $10

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14 INPUT figures reported in Financial Times, 10/04/84.

15 U.S. Dept. of Commerce, (1984a), p. 8.

16 INPUT/U.S. Dept. of Commerce, (1984b).

million, and 1 percent had revenues exceeding $10 million. The top 1 percent accounted for 62 percent of total professional services revenue. For the 1,113 companies providing integrated systems in 1982, 59 percent had revenues under $1 million, 38 percent had revenues between $1 and $10 million, and 3 percent had revenues over $10 million. The top 3 percent accounted for 36 percent of total integrated systems revenues.[17]

For the entire computer service industry, 63 percent of the 6,487 companies had revenues less than $1 million, 34 percent between $1 and $10 million, and only 3 percent had revenues exceeding $10 million. Thus, the most notable characteristic of the computer services industry is that it involves a large number of companies but revenues are dominated by a small percentage of those companies. This feature is most evident within the data processing and professional services sectors. Software development companies have a reputation of being small, however, the highest concentration of small firms within the computer services industry is in the data processing services sector.

Census figures on industry concentration ratios for the U.S. computer services industry in 1972, 1977, and 1982, show that the percentage of total industry sales attributable to the 4 largest companies has declined somewhat during the period, from just over 18 percent to 12 percent (see Table 2.7). The concentration ratios for the 8, 20 and 50 largest companies also exhibit this decline. However, during the decade between 1972 and 1982, the number of firms in the industry had increased from 1,600 to 6,470. As a percentage of

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17 It should be noted that a few of the larger computer services companies acquire revenues from all activities, and that there appears to be a significant correlation between the extent of diversification of services and products offered and company size. (U.S. Dept. of Commerce (1984a), p. 15).

the total number of companies in the computer services industry, the 50 largest companies made up approximately 3 percent in 1972 but less than 1 percent in 1982, although they accounted for 51 percent and 42 percent of total industry revenues in 1972 and 1982 respectively.

2.1.3 Market Position and Strategy

In the data processing services sector, small, local or regional companies primarily offer only batch computing services. In general, larger companies will also provide batch services, but more significant in terms of their revenue base are remote computing services. The processing services sector is highly fragmented with many firms of various size offering industry-specific and/or cross-industry types of services. The key to a processing company's performance appears to be linked to how successful it is in finding specific market niches. There is evidence that profits and revenues of applications-oriented (specialist) firms, such as Electronic Data Systems and Shared Medical Systems, tend to be relatively higher than cross-industry (generalist) companies, although there are several exceptions. Traditional cross-industry companies, such as Automatic Data Processing (payroll, accounting and related services), face a higher degree of competition than companies offering industry-orientated services.

Despite indications that demand for data processing services will continue to grow, there are several major developments that will determine the fate of industry participants. Probably the most significant development is the access of increasingly easier-to-use microcomputers and sophisticated packaged software that will make in-house (captive) computing more attractive to users. As software becomes more user-friendly and hardware easier to use,

the need for companies to have their processing services done outside will continue to diminish. Moreover, because various traditional processing activities, such as accounting and financial analyses, are now easily available using small computers, those companies that continue to purchase services from outside vendors may be no longer interested in such basic services. The declining growth rates and share of revenues attributable to data processing, especially batch computing, appears to be correlated with the availability of newer and cheaper in-house systems.

With declining hardware costs making in-house processing more attractive to users, certain services and products that data processing companies now offer, such as software packages and integrated systems, may in the long run prove vital to their survival in the long run. There has been a tendency for data processing companies to develop and market their own packaged software and enhanced telecommunications services. The idea is to offer proprietary software packages or applications-oriented services at least as good as users could develop with their own in-house computer systems. Most remote computing companies now offer some microcomputer oriented services such as software compatible with microcomputers, integrated (turnkey) systems[18], or communications facilities that allow a users' microcomputers to serve as on-line terminals. Even industry-specific data processing companies that serve specific market niches have been affected by developments in the microcomputer market that have cut into the demand for interactive time-sharing services. Several of these companies have decreased their efforts on software developments for traditional time-sharing services and instead are focusing on offering enhanced telecommunications services.

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18 Traditionally, integrated systems were supplied only by original equipment manufacturers (OEM's).

In the software market, computer hardware manufacturers have traditionally and continue to dominate total software revenues, although software production is a limited part of their overall business. Of the 20 major hardware vendors in 1983, 11 were among the top software and service suppliers (compare Table 2.8 with Table 2.6). Of the major software and service suppliers, 3 were among the largest data processing companies (compare Table 2.9 with Table 2.6). For example, Control Data Corporation was not only the largest data processing company in 1982 but it was also the second largest supplier of software and services in 1982 and third largest hardware vendor that supplies both software and services. Of the largest data processing companies, 8 were among the largest software and service suppliers. In contrast, the revenues of major independent software suppliers (whose software business exceeds all other activities in terms of revenue) are relatively small in comparison to the revenues of the top software and service suppliers (Table 2.10).

Thus, there appears to be a significant correlation between the diversification of the types of services and products offered and the size of the company.[19] This observation suggests that the success of a computer services company may depend upon the extent of its diversification into various types of services and products, possibly explained by the existence of economies of scale and, more importantly, of scope.

There is no evidence of any price leadership in the computer services industry as there is in the computer mainframe industry where IBM dominates.

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19 Automatic Data Processing is an exception in that it is one of the largest processing services companies that has not diversified into other segments of the computer services industry and still has remained successful. However, it has expanded its data processing services to a larger number of niche markets.

The largest computer hardware vendor in the U.S. and the largest supplier of software and services worldwide, IBM, is not a major supplier of data processing services in the United States. This is because it was prohibited to provide such services in the U.S., as a result of an antitrust suit filed by Control Data Corporation in 1968. However, IBM has reentered the U.S. computer (data processing) services sector and is developing new services to offer. For example, IBM has recently been collaborating with Merrill Lynch in the on-line financial information sector; in 1984 it acquired Rolm, a major U.S. telecommunications equipment supplier, and has a 16-20 percent share of MCI, the second largest U.S. long distance telecommunications carrier. If IBM can successfully integrate its data communications technology with voice communications technology, the company will become a dominant player in the U.S. computer services industry.

In not quite the same way, but for similiar reasons, AT&T had been kept out of the U.S. computer (data processing) services sector which it is now entering. For example, AT&T is extending its voice telecommunications network to offer enhanced telecommunications services. Regulations, such as Computer Inquiry III, has stymied AT&T's ability to offer enhanced services and to extend its expertise in computer hardware and software to the fullest possible extent in the field of telematics. However, the entry of AT&T and IBM will certainly have an tremendous impact upon the computer services industry in the U.S. and add to the turmoil that has already been taking place within the industry.

At the same time, other "non-traditional"[20] computer services

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20 By non-traditonal we refer to companies that did not previously offer data processing commercially but may have done their own in-house computing (part of the secondary information sector, see fn. 5).

companies have entered the industry. For example, Citibank has been offering its own in-house computing to other banks. Others, including General Electric, McDonnell-Douglas Automation, TRW and General Motors, have entered either by extending their own well-developed in-house systems to outside customers or through acquisition of companies already in the industry.

2.1.4 Industry Consolidation

The previous section has shown that the computer services industry has been one of the fastest growing industries in the U.S. within recent years. The number of firms supplying computer services has increased four fold during the period between 1970 and 1984. Table 2.11 shows the number of firms operating in the U.S. and their distribution within various industry segments. The software products sector has experienced the largest increase in the number of entrants in the computer services industry. Data processing services had the lowest rate of entry and the number of companies actually declined in 1979-80 and 1981-82. This decline in the number of firms offering processing services was primarily due to consolidation within the industry through mergers and acquisitions . In response to lost revenues from customers moving their basic processing in-house and the recent tendency for companies to move out of their traditional market niches to offer broader product ranges, it is likely that such consolidation will continue. In most cases, the consolidations involved horizontal integration within a particular sector or vertical integration into other sectors of the computer services industry. However, a few of the larger consolidations involved companies diversifying into the processing services market by non-traditional processing services companies.

This move towards increasing concentration has been gathering momemtum. For example, in 1979 there were 107 mergers and acquisitions involving computer services companies worth an estimated $671 million. The 10 largest transactions accounted for nearly 73 percent of the total while representing only 9 percent of the total number of transactions. In 1980 there were 87 transactions with a total value of $688 million; in 1981, 118 transactions with a total value of $766 million; in 1982 there were 138 mergers and acquisitions valued at $436 million; in 1983, there were 146 mergers and acquisitions with a total value of more than $1 billion; and in 1984, there were 143 mergers and acquisitions valued at more than $3.5 billion. Of the 138 transactions in 1982, 53 percent involved processing services companies, 41 percent involved firms offering software products, and 6 percent involved companies offering professional services.[21] In 1983, 44 percent of the 146 acquisitions involved processing services companies, 54 percent in software products, and 2 percent involving companies offering professional services.[22]

Examination of mergers and acquisitions in the U.S. for the period 1983 to mid 1985, where the target company was primarily involved in SIC 737 (Computer and Data Processing Services), reveals that approximately 60 percent of the acquiring companies had already been providing some subset of these services prior to the transaction. For example, National Data Corp. and Automatic Data Processing, both primarily offering processing services, acquired companies that offered software programming. Most of the remaining

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21 Broadview Associates/U.S. Department of Commerce (1984b).

22 Broadview Associates/OECD (1985).

transactions involved companies whose major source of revenues comes from other lines of business such as, electronic communications equipment, aircraft and parts, guided missles, motor vehicles, telephone communications, consumer credit and management consulting companies. For example, Lockheed Corp. and McDonnell Douglas, primarily involved in the manufacture of aircraft, and General Motors, the largest U.S. automobile manufacturer, acquired data processing companies.[23]

The overall trend appears to suggest that the larger companies in the industry will acquire their smaller rivals but smaller firms that provide specialised services may survive the movement towards greater concentration. This will generally apply to applications-oriented software services where specific knowledge of the application concerned is required and quite difficult to obtain.

2.2 The Canadian Computer Services Industry

2.2.1 Introduction

The Canadian computer services industry, as defined by Statistics Canada, includes processing services, input preparation, software and systems services, systems development and maintenance, other software and systems services, and other computer-related services (ie. education, consulting and facilities management). This definition differs somewhat from that adopted by the U.S. Department of Commerce and that used in the previous sections. As a result, any comparisons between U.S. and Canadian computer services should be interpreted with care.

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23 McDonnell-Douglas's and General Motors Co.'s acquisitions were among the largest in the industry. McDonnell-Douglas purchased Tymshare in 1983 for $307.5 million; General Motors acquired Electronic Data Systems in 1984 for $2.6 billion.

2.2.2 Market Size and Growth

The sources of revenue, size and annual growth rates for the Canadian computer services industry are shown in Table 2.12 . Total industry revenues in 1974 were about C$211 million and grew to over C$1.3 billion in 1982. Annual growth rates reveal that the industry has been experiencing relatively high rates of growth, especially in the processing services, software and equipment sales sectors. The compound annual growth rate of computer services revenues was approximately 24 percent during the period 1974-1982.

Processing services have historically been the major source of revenue for companies primarily offering computer services in Canada (see Table 2.13). However, recent evidence indicates that this trend is not likely to continue, and the share of revenues attributable to processing services will decline over the next few years.[24] The reason given is that public data-base services and VAN's are not large enough components of the Canadian market to prevent loss of revenues from the the shift to in-house basic processing.

Software and software services have dominated the growth of the computer services industry in Canada much as they have done in the U.S. in recent years. Comparatively high growth rates for software products has made software the fastest growing component of the Canadian computer services industry. In 1974, software and software services accounted for only 24 percent of industry revenues while data processing provided approximately 60 percent of total revenues. By 1982, software and software service revenues contributed 33 percent to industry revenues, while data processing slipped to under 50 percent.

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24 Evans Research Corporation, EDP In-Depth Reports, December 1984.

2.2.3 Industry Structure

For the Canadain computer services industry, census data reports that there were 1,392 companies with total operating revenues of C$1,102 million. Figures for 1982 reported 1,752 companies with revenues of C$1,348 million.

The data processing services market is predominantly made up of Canadian companies (96 percent were at least 51 percent Canadian-owned) whose main operations are within Canada. Canadian-owned firms accounted for more than 80 percent of the revenues earned by the top 34 service bureaux in Canada (see Table 2.13). Firms vary in size in Canada, much as they do in the U.S., with numerous small companies providing services in local markets while the largest companies have extended their operations into the international market and have revenues exceeding C$100 million (e.g. I.P. Sharp, Canada Systems Group). Of the 1,752 companies offering computer services in Canada in 1982, 72 percent had revenues less than C$100,000 while another 26 percent had revenues between C$100,000 and C$500,000. Thirty-eight companies, representing approximately 2 percent of all Canadian service bureaux (16 of which had revenues between C$5 and C$10 million; 17 of which with revenues over C$10 million), accounted for over 43 percent of total revenues for the computer services industry.

In addition to illustrating the predominance of Canadian firms in the computer services industry, Table 2.13 also reveals that several U.S. computer equipment manufacturers and data processing services companies have established themselves in Canada via subsidiaries (ie. IBM Canada, Control Data Canada, Automatic Data Processing, Canadian General Electric Information

Services and Computer Sciences Canada).[25] However, Canadian-based companies such as I.P. Sharp and Canada Systems Group have managed to hold their own and compete effectively both within Canada and in the United States (also through subsidiaries).

There is also evidence that consolidation is taking place within the Canadian data processing services industry, and the trend, not unlike that in the U.S., is for larger companies capable of serving the national market to acquire their smaller competitors. Yet, as the numbers indicate, numerous small to medium size companies have survived by providing specialized services or serving geographically isolated market niches.

2.2.4 Market Position and Strategy

A significant feature of the computer services market in Canada is the degree of specialization of both services and products. Service bureaux have been developing their own applications-oriented software for their customer needs and have sought shelter within narrowly defined market niches. These range from scientific applications and enhanced telecommunications services to banking and financial systems.

Although Canadian data reported by Statistics Canada is not broken down by type of service, a private research company, Evans Research Corporation, has estimated the size of the Canadian information processing industry based upon survey data and provides some useful, although limited,

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25 U.S. computer hardware equipment companies have similiarily established subsidiaries in Mexico where they dominate computer equipment market. However, information processing is a very small part of Mexico's economy. Services are still essentially provided on a batch basis as the existing telecommunications network is inadequate for data communications. (See Martin del Campo (1985)).

information. Within the software products segment of the computer services industry in 1981, packaged software (both sytems and applications) accounted for 52 percent of total revenues for companies primarily engaged in providing computer services (see Table 2.14). In 1982, packaged software had increased its share to 63 percent while custom software declined to 37 percent. This would suggest that there appears to be a trend towards a greater proportion of software packages and a lower proportion of custom software purchased in Canada, similiar to the situation in the United States.

There are several major factors that will determine the fate of Canadian computer service bureaux. First, Canadian firms are, in general, less profitable overall than their U.S. counterparts. Canadian service bureaux face a cost disadvantage with respect to both computer equipment and communications, especially for long-haul transmission. These higher relative costs are said to reflect cost differences due to the differences on the size of operations. There is a much larger base of operations in the U.S., which permits lower costs, both on a per message basis in a switched network environment and on a per circuit basis in a private line network. Furthermore, cross-subsidization of local service from long-distance services unduly elevates long-distance transmissions costs.

Secondly, there are no domestic manufacturers of computer mainframe equipment or of microcomputers (although there are subsidiaries of U.S. hardware manufacturers operating in Canada). Hardware manufacturers are typically the major suppliers of systems software and, consequently, this type of software development is absent in Canada. Finally, although the Canadian software market is well established, there has been little development in software products, especially applications packages. Most software packages

purchased in Canada are developed in the U.S. or Europe. Although there are indications that some small Canadian companies have begun developing packaged software, new companies that need substantial initial funding as well as skilled programmers and strong management support to meet the rising costs of developing, marketing and maintaining software products have had difficulties obtaining financing. The lack of strong venture capital in Canada (and in Japan and several Western European countries) has been blamed for its comparative weakness in the packaged software market. Indeed, as demonstrated by the United States, the information services industry, like other high-technology, information-based industries, strives best when venture capital is readily available. Problems of asymmetric information and moral hazard, which beset entrants' attempts to obtain equity funding make public offering an unwielding and generally unfeasible financing mechanism.

3. International Competiton, Trade and Restrictions in Computer Services

3.1 International Competition and Trade in Computer Services

The computer services industry has become an international business. The U.S. market is by far the largest market in the world with estimated total revenues of $32.6 billion in 1983 and $40 billion in 1984. The Western European market is the second largest in the world with computer services revenues of $12.2 billion in 1983 (see Table 3.1). In Europe, France has the largest computer services industry with 1983 revenues of $2.8 billion and $2.9 billion in 1984 (see Table 3.2). West Germany has the second largest market in Europe followed by the United Kingdom and Italy. While more recent figures were not available, Japan's computer services market is quite likely the second largest market (defined by country) in the world with 1980 revenues of

$2.7 billion. Overall, the total information technology industry is largely limited to North America, Europe and Japan, although many of the developing countries have become important sources of both demand and supply.

Data processing services have less involvement in international trade than either the computer hardware or software industries. One reason for this is that data processing markets have always tended to be local, regional or national in character. Batch computing services require close proximity to the users' sites. Remote computing services do not require such close proximity. Other factors, however, tend to limit the extent of internationalization.[26] Offering specialized services requires specific knowledge about accepted local business practices and language that foreign suppliers of data processing services will not, in general, have. Thus, establishment of foreign operations has typically been through association with a local company, e.g. joint venture, or by directly locating in the foreign market via a subsidiary.

There is also a tendency for foreign governments to protect or assist their domestic computer and data processing markets, making access to those markets difficult. Similiarily, connection to government-owned or controlled communications facilities in other countries is necessary to provide international processing services, which could create problems for organizing competition in these markets. Finally, restrictions on the movement of data across national boundaries will likely impede the development of globally distributed information processing.[27]

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26 These disadvantages can be overcome. For example, the routing program for the fire department in Malmo, Sweden, was located in Cleveland, Ohio.

27 These last two issues will be discussed further in section 3.2.

Even faced with these restrictions, several of the top U.S. data processing services companies are involved in multinational operations. Because of the restrictions on the internationalization of data processing mentioned above, these companies usually operate through subsidiaries in the host country. Often, these subsidiaries are established to provide data processing services to U.S. multinational companies. For example, Automatic Data Processing has the largest foreign operations, having commercial centers in Canada, the United Kingdom, the Netherlands, Belgium, West Germany, France, Italy, Brazil and Hong Kong. Services offered include payroll-based employer services, dealer services, and treasury management services. Computer Sciences has operations in Canada, the United Kingdom, Kuwait, Malayasia, Mexico, the Netherlands, Saudi Arabia, Singapore, West Germany and Spain, offering financial services, social services, defense and insurance services. These companies have thus been able to sucessfully parlay the expertise gained in the U.S. market into the provision of similiar services in other countries. This is not unexpected, given the economies of scope in the provision of data processing services.

Overall, U.S. competitiveness in international markets for computer services, including data processing, is likely to be correlated with its competitiveness in computer hardware and software. Over the past few years, the U.S. lead in computer hardware has been declining, but it maintains its dominance in the world software market. The U.S. software industry held a 70 percent share of the world market (estimated to have been $18 billion in 1983).[28] U.S. software revenues were also 10 times larger than those of its

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28 U.S. Dept. of Commerce (1984b).

nearest competitors, France and Japan. Packaged software has been the major source of worldwide software revenue for U.S. suppliers, accounting for 52 percent, 56 percent and 60 percent of revenues for the years 1981, 1982, and 1983, respectively. In contrast, custom software has provided the main source of revenue for foreign suppliers of software, especially in Europe.

U.S. computer services companies are also major competitors in Western Europe, having 7 among the top 30 computer service companies in that market in 1983 (see Table 3.3). In the United Kingdom, West Germany and Italy, 3 of the top 10 computer services companies in 1984 were U.S. companies.[29] The computer services companies with the most foreign business are also American, IBM, Automatic Data Processing, and GEISCO. In contrast, U.S. computer services companies face very little foreign competition in their home market. Although there are subsidiaries of British, West German, French, Japanese, and Canadian companies, these are not major players in the market. An exception is Cap Gemini Sogeti (France) which has, through an acquisition, become a major supplier of systems and utilities software, custom programming and consulting.

Although the computer services industry has become an international business, few statistics pertaining to international aspects of industry operations are available. This is because the industry is relatively new, and because internationalization has taken on a variety of forms (e.g. exporting, establishment of subsidiaries or joint ventures, registration or licensing, etc.). However, a recent INPUT survey reveals that 14 percent of the 1983 noncaptive revenues of U.S. computer services companies was attributable to international operations (see Table 3.4).[30] Foreign sales of processing

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29 Financial Times, 10/04/85, p. II.

30 INPUT defines noncaptive revenue as revenue received for services provided within the U.S. from users who are not part of the same parent corporation as the vendor.

services, software products, professional services and turnkey systems accounted for 8, 23, 12 and 15 percent of their respective market revenues. Relatively high rates of foreign revenue growth, especially in software products and professional services, illustrate the growing importance of international trade in computer services. The low share and growth of foreign revenues for data processing services companies reflects the barriers facing international trade in data processing, as mentioned earlier. Table 3.5 illustrates a similiar trend, although it adds a new element. In 1982, data processing revenues received from users who are part of the same parent corporation as the vendors (captive revenues) accounted for 10 percent of total data processing revenues. This indicates that there is a substantial amount of data processing flows that are not reflected in the commercial sales of computer services.[31]

Although U.S. companies dominate in most sectors of the international computer services industry, they are by no means the only companies operating internationally. Since most of the other major markets are small in comparison with the size of the U.S. market, it is likely that foreign companies are more concerned with international trade in computer services. For example, 20 percent of total French computer service revenues in 1983 were derived from international markets.[32] British computer services companies earned 14 percent of their revenues in 1983-84 from foreign sales. The computer services industry has become an active participant in the international arena and can

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31 For example, it has been estimated in Canada that 10 percent of all transborder data flows are commercial flows and that 90 percent are corporate (intra-company) flows.

32 OECD (1985), p. 72.

be expected to become even more important with growth of markets in many of the developing countries.

3.2 Restrictions on International Trade in Computer Services: Software and Data Processing Services

3.2.1 Restrictions on International Trade in Data Processing Services

Many services are not tradeable internationally because they require the physical proximity of the seller and the buyer. The classic example of haircuts is a case in point. Many other services, however, do not require such proximity but rather that the seller receive from the buyer certain orders and information and send some kind of receipt together, perhaps, with other information, back to the buyer. Thus an American insurance company can insure a Mexican factory, provided data concerning the factory can be sent to the insurance company and details of the policy and claims procedures can be sent to the factory owner.[33] Similarly, a Canadian bank can provide cash-management services to a U.S. client, provided data concerning the client's accounts can be transfered to the Canadian bank and the processed data can be shipped to the client's director of finance. These services are, therefore, internationally tradeable, but, just as trade in goods requires the ability to transport goods physically, so trade in these services requires the ability to transport data.

The development of electronic data transmission and computing power has had the same impact on trade in services as the development of the steamship and steam locomotive had on the trade of goods. However, while regulatory

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33 In reality, the U.S. insurer must first receive the approval of Mexican authorities to insure a Mexican company.

interference with the physical means of trading goods is highly visible, e.g. requirements that certain percentages of trade should be carried in domestic bottoms, similar restrictions on the physical means of trading services are frequently much less obvious; a problem compounded by the fact that there are many more ways of interfering in the trade of services than in the trade of goods. As the vital importance of international transmission of data to trade in services is most clearly seen in the trade of data processing services, in this section we will describe some of the barriers to trade in this area. Many of these barriers are of more general importance because they raise the costs of transferring data across borders and so will hinder trade in all services.

International trade in data processing is directly affected by many diverse types of governmental restrictions and policies and some classification of these policies is necessary if a clear picture of the situation is to be obtained. Towards this end we have divided all restrictions and policies having a direct impact on trade in data processing into three groups. The first group includes the usual tools of trade policy namely tariffs and quotas. A second group of barriers to trade involve restrictions on transborder data flows which constitute the medium by which data processing services are traded. The final group of restrictions consists of the policies, pricing or otherwise, of the domestic PTT. Although this third group of restrictions is formally a subset of restrictions on TBDF it is worth treating separately. General restrictions on TBDF are enacted at the national or local legislative level and so directly reflect the incentives facing politicians. In contrast, the domestic PTT, though politically sensitive, also faces strong commercial incentives. Moreover, while the

Ministry of Trade, or an equivalent body, can have a direct effect of TBDF restrictions, its rule does not run, in most countries, to the PTT. For these reasons the PTT's policies pose a peculiar problem for the development of trade policy in data processing services.

Notice that we are only dealing here with policies that have a direct effect on data processing trade. There are, in addition, many policies that provide varying degrees of positive or negative effective protection for the domestic data processing industry. For instance, the Canadian tariffs on imported computer hardware result in negative effective protection for the Canadian data processing industry. The same holds true for Mexican tariffs and quotas on hardware.[34] And in Brazil, the attempts to stimulate an indiginous computer industry has led to prices that frequently are fourfold the world prices. Each of the three categories of barriers to trade is dealt with in turn below.

A. Tariffs and Quotas

Direct tariffs and quotas on importing data processing services are rare, Brazil being the major exception. As a practical matter it is extremely difficult to police the importing of these services. When goods are imported they can be observed crossing the border and so taxed or counted. Trade in data processing services is much harder to track because it requires only a transfer of information out of the country and then a transfer of processed data back to the country. As the data flows will typically be carried out via

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34 We should note that Mexico has targeted its computer industry and provides various tax credits, incentives, preferential treatment by the public sector and government, a quota system, and an import permit requirement to encourage domestic development which may, for the reasons suggested above and in the following section, distort its trade in computer services. Eckelmann (1984).

telephone cable or satellite communications, they will leave no physical trail to aid the authorities in their enforcement of tariffs or quotas. Only if the government is willing to ignore privacy considerations and monitor international telecommunications will it be able to enforce its tariffs, though even in this case "reading" the flow of electronic signals after tapping the telephone line or earth station is often very difficult. To compound these technical problems, in the case of data processing much of the international trade occurs within transnational corporations. Given the volumes of data flowing between parts of such corporations, the task of spotting those that involve trading data processing services internationally appears to be daunting. Conversely, blanket regulations on TBDF aimed at preventing or regulating such internal trade in data processing services would cause immense problems by interfering with TBDFs unrelated to data processing services.

Imposition of tarrifs on information flows raises additional policy problems which is whether these taxes should be levied on the quantity of information crossing the border or on the value of the embodied information. It is too early to tell whether the German experiment in taxing value flows will be deemed a success from the implementability and public finance standpoints.

B. Direct and Non-Tariff Restrictions

Much more common than tariffs or quotas are regulations that, though ostensibly concerned with other matters, effectively require consumers to use domestic data processing facilities. An example of such a regulation is Subsection 157(4) of the Canadian Bank Act (1980). This requires that banks maintain a copy of all records relating to customers' accounts in Canada.

Such a regulation is required so that the Canadian banking authorities can monitor and supervise banks operating in Canada. However, it also has the effect of making it necessary for foreign, especially U.S., banks in Canada to maintain data processing facilities in Canada even when the volume of Canadian business might be low enough that it would be more economical to rely on the U.S. parent bank for these services.[35] Similarly, to meet Canadian requirements, Socal kept a data processing unit in Canada despite excess data processing capacity at its facilities in the United States.[36]

In addition to these kinds of restrictions there is also the matter of government procurement policies. There is no data on this issue for data processing, although it is worth noting that the GATT Code on Government Procurement does not extend to services.

Direct trade barriers in the form of tariffs and quotas are, for technological reasons, rare. Moreover, in the cases of Canada and the U.S. such barriers would go against the general trade policies of these countries. The U.S. position on the desirability of free trade in services is clear and is now embodied in the Trade and Tariff Act of 1984, which explicitly includes data processing as a service and mentions restrictions of TBDFs as a nontariff barrier.[37] Although the Canadian position on the issue of free trade in data processing services has been muddied in the past by the Clyne Report (1979), the Canadian government is now committed to the policy of not restricting such trade by the use of tariffs or quotas. It has, for instance, joined the OECD

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35 Pipe (1984), p.53.

36 Bache (1984), p.1.

37 Freeman (1985), p. 9.

"Declaration on Transborder Data Flows," which was adopted in March 1985 by the OECD Committee for Information, Computer and Communications Policy, and was endorsed by the April 1985 meeting of the OECD Council of Ministers.[38]

In the trade of goods, restrictions on shipping, and therefore on the trade of goods, are quite transparent. Moreover, there are certain limits to how indirect such restrictions can be. In the case of trade in data processing services the range of possible restrictions, deliberate or otherwise, on the transfer of data is enormous and the restrictions themselves can be highly opaque. The most obvious of these restrictions involve the banning of electronic TBDFs for the use of trade in data processing services. Brazilian restrictions on precisely these TBDFs are an explicit attempt to protect and develop the Brazilian data processing industry .[39]

Direct restrictions on TBDFs for the purpose of protecting the domestic data processing industry are quite rare. However, for many other reasons TBDFs have been restricted, and these restrictions have affected the trade in data processing services. There are two primary reasons for restrictions on TBDFs, other than cases where national security is at stake, namely privacy and vulnerablity. The spread of computer databases and the ease with which they can be accessed has raised concerns about privacy in most countries. While these concerns can be met in many different ways, e.g. licensing databases, restricting who may hold certain data and whom it may be passed to, all such policies can be circumvented, in principle, by shipping the data abroad. To close this loophole there have been attempts to prevent

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38Sauvant (1985), p. 215.

39 Brizida (1984).

individual-identifiable data from being shipped abroad. The Scandinavian countries have taken a lead in this issue. As a result some data processing that would have taken place abroad, in particular payroll accounts, has been repatriated. For instance, Xerox moved its Swedish payroll data processing from its London data processing center to a service bureau in Stockholm following the 1973 Swedish privacy act.

A second concern of governments is that of vulnerability. If TBDFs were cut off because of technical failures, war, civil disturbance or other reasons, would the costs to the country concerned be high?[40] Although such concerns have not given rise to significant restrictions on TBDF, there is a potential for such action. For instance, in Malmo, Sweden, the city's road plan was computerized to enable the fire department to respond more efficiently to fires. This dataset was stored in Cleveland, Ohio and accessed by satellite. At one point communications were down because of technical problems and there was a fire in Malmo. This incident caused considerable concern in Sweden and resulted in the repatriation of the dataset.[41]

C. PTT Policies

Given the importance of TBDFs for trade in data processing services the policies of the carriers of such TBDFs play a major role in determining the size of such trade flows. For instance, a PTT pricing policy that made international calls or leased lines very expensive would have the effect of protecting the domestic data processing industry from foreign competition.

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40 Notice that this is the same justification given for protecting the merchant marine in the U.S. and protecting agriculture in many European countries.

41 U.S. Government (1983).

Although many different types of PTT policies can affect trade in data processing services, the area in which there has been most concern has been regulations relating to the use of and charges for private leased lines.[42]

Although public lines can and are used for TBDFs, they have three disadvantages for vendors of data processing services. First of all the time taken to connect a call through the public system is longer than that for a leased line, which can make the use of the data processing vendor's services more costly to the consumer. This is especially true when, for instance, the consumer wants to quickly interrogate a database maintained by the vendor, e.g. to check on someone's credit. Secondly, public lines are less secure than leased lines,[43] which can be a serious concern notably for flows of financial data. Finally, and most importantly, the quality of public lines (voice grade) is less than on private leased lines. This means that in order to maintain the integrity of data transmitted, the transmission rate must be kept considerably lower on public lines than on leased lines.[44] This reduction in transmission rate is not only inconvenient but also raises telecommunications costs. For all these reasons data processing vendors, both captive and independent, will use private leased lines whenever volume permits.

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42 The second largest concern has been restrictions on the type of equipment that can be connected to domestic systems and the choice of vendors of such equipment.

43 In a system that uses public lines the telephone number must be kept secure.

44 The maximum rate of transmission over public lines is 2400 b.p.s. while over leased lines it can be as high as 9600 b.p.s.. OECD (1979), p.50.

PTTs have always viewed individual leased lines, and especially networks of leased lines, ambivalently because they represent potential competition for their own services. This competition has always been kept to a minimum by forbidding lessees from providing communications services. Usually this is accomplished by banning the lessee from receiving a message from one location and then transmitting it to another location. Only in rare cases have the PTTs allowed leased lines to be used for this kind of communication, e.g. the airline reservation system, SITA, and SWIFT, an international funds transfer system. In these cases the service concerned must involve such message transmission, and so the PTTs have allowed such use of leased lines but only for information strictly required by these sevices and only for use in a closed-user data network.

With the growth in demand for electronic data transmission since the beginning of the sixties many PTTs have decided to construct public data transmission networks. These public networks are, of course, in direct competition with private networks using leased lines. Given this situation it is hardly surprising that many PTTs have changed the terms of leases in order to protect public data transmission networks. In the period 1976-1981 Nippon Telephone and Telegraph restricted the kinds of services that Control Data Corp. and Tymshare could provide through leased lines in Japan, apparently in order to protect the public data transmission network they were planning to set up .[45] Similarly, the West German PTT prohibits users who are connected to its public system from transmitting unprocessed data over international private leased lines to foreign private networks for processing. [46]

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45 Spero (1982), p.142.

46 Ibid., p.143.

Apart from restrictions on leased lines, restrictions on transborder communications can seriously affect trade in data processing services. For instance, in the case of telecommunications via telephone lines between Canada and the U.S., calls can pass between the two countries only at certain "gateways". Because the revenues from a crossborder call are split according to the length of line covered in the two countries, a rule is followed which is designed to split the revenues "fairly". Thus although U.S. long-distance charges are lower than Canadian charges, consumers cannot take advantage of this by routing calls through the smallest section of Canadian territory. Therefore this revenue sharing rule raises the cost of TBDFs and so reduces the amount of cross-border trade in data processing services.

Finally, a growing concern to providers of financial services is the growth of monopoly private data networks. For instance, to provide a given service it may be necessary to use an automated teller machine network or a reservation system. If such a network is provided by a private monopoly in a given country then foreign firms must rely on getting access to the system in order to be able to provide its services.[47] Although not of direct concern to international vendors of data processing services, this does highlight the fact that it is not only the restrictions of the domestic PTT that are important.

The above description of the barriers to trade in data processing services emphasizes two points. First, in most developed countries there are few tariff or quota barriers to trade in these services. Indeed, even in the developing countries only Brazil stands out as using such barriers on a large

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47 Freeman (1985), p.5.

scale. While this is encouraging from a free trade perspective, the second point highlighted is that the potential for the creation of accidental or deliberate non-tariff barriers seems to be much greater in this area than in the trade of goods. Not only do the usual barriers such as idiosyncratic national rules on product designs or government purchase policies show up in the trade in data processing services but also far more obscure regulations have an impact on trade. Privacy legislation, which deals with a topic that governments have a legitimate concern with, can have an impact on the trade of data processing services. The policies of the national PTT, which are seldom set with foreign trade considerations in mind, can severely affect the degree of protection provided to domestic data processing firms. Thus the lack of tariff and quota barriers in this area compared with that of many categories of goods seriously understates the problems involved in accurately stating the existing levels of effective protection awarded domestic data processing industries and the difficulty of both proposing a coherent trade policy and insuring that such a policy is not inadvertently subverted.

3.2.2 Restrictions Affecting International Trade in Software Products

Regulation of international trade in software products has been relatively liberal although there have been several recent developments that have raised some concern about future restrictions. Unlike remote processing services, commercial sales of software require proximity between the vendor and user. Thus, entry into international markets has been typically through some form of international investment by computer services companies, either by direct establishment (subsidiaries) or by association with a domestic company (joint venture). As such, international sales of software are often

included under international investment or trade policy in the services sector or are covered by technology sales legislation where a license fee or bond is paid. Under these classifications, imports of software are subject to customs duty only on the medium (e.g. floppy disks, tapes, etc.) on which the software is brought into the country. An exception is when software is integrated and included into the price of the hardware. In this case, software is charged duty at the same rate as the hardware.

Recently, many governments of both developed and developing countries have recognized the importance of software to the development of their domestic information technology industries and have initiated programs to promote or assist indigenous development. Such programs will have some effect on restricting the internationalization of computer services suppliers.

It was stated earlier that restrictions on transborder telecommunications could seriously affect trade in data processing services. In much the same way, restrictions on capacities and speed of transmission, the level of network liability, industry standards and tariffs will have an effect upon the design and management of corresponding software systems and consequently either encourage or discourage software systems with a high degree of telecommunications content (e.g. videotex, teletext, telesoftware and telecomputing services, and sales management systems). Governments that intentionally place relatively high tariffs on international traffic will undoubtedly affect inter- and intra-company transfers of software, local users and the domestic computer services industry in general. Similarly, industrial policies that attempt to encourage the development of computer hardware manufacturing are synonymous with public policies supporting specific types of software that are compatible with the domestically produced equipment. Thus,

developments in the software sector, as well as in the entire computer services industry, will be constrained by the type of indigenous hardware that will hinder the industry's international competitiveness, especially if the hardware being promoted is inefficient in terms of the international hardware market. For example, a duty on imported hardware will initially result in higher costs and subsequently higher prices for computer services, thereby discouraging growth in demand and the industry's efficiency.

Software, especially packaged software, has become increasingly more expensive to develop and market. Also, rapid new technological developments in software design and engineering limit the life-cycle of any software product, and it has become more difficult for new companies to raise the finance necessary to support the development of domestic markets. Canada and the Western European countries have blamed their inability to establish themselves in the international packaged software market on the lack of venture capital to finance such high risk operations. Of course, the solution to this problem does not lie in protectionist measures but, rather, in finding the solution to the failure in the venture capital market. The search for the solution would reveal that excessive regulation of financial markets may be to blame.

In response, governments in several countries have been attempting to support the development of domestic software markets. There are several ways they can try to accomplish these goals. Several countries have subjected imports to high customs duties to inhibit imports of foreign software (e.g. Australia, Japan and several developing countries). This, in effect, represents a tax on the intellectual property of the software program, just like any other piece of merchandise. Yet, customs duties are not completely effective because they can be circumvented by the processing of software transmitted through a variety of telecommunications channels.

Many other countries have attempted to assist or promote their domestic software industries by erecting non-tariff barriers (see Table 3.6). These measures include mandatory registration or licensing of software, preferential treatment in terms of government procurement contracts to domestic suppliers, market reserve policies, and establishing standards that discriminate in favor of the domestic companies. In addition, these countries may provide financial assistance, such as subsidies or some form of tax relief. Japan has been very successful in promoting its domestic computer hardware sector and is now doing the same for its software industry (although against the wishes of the U.S. government). Brazil has also followed such a restrictive program and may serve as a role model for other developing countries.[48]

The international trade flows in software are also affected by the varying degrees of copyright protection afforded to software in different countries. It is much easier to engage in the provision of custom software where appropriability is less of an issue than in the transnational provision of generic software where appropriability is of the essence. It is clear that international trade in software rests on the global recognition that property rights in software must be guaranteed.

4. Industrial Organization and Trade Perspectives of the Computer Services Industry

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48 The Government of Mexico has recently adopted policies to foster the domestic data processing industry, including both products and services. These policies are not as well established as that in Brazil but certainly in line with restricting data processing activities offered from outside of Mexico. Also, data processing equipment sold in Mexico must be made in Mexico and by Mexican companies.

Part 2 of this essay has shown that the computer (data processing) services industry proper does not fit neatly into any of the standard industrial organization market structures. Rather, the industry is populated by large firms with multi-million dollar revenues and widely diversified operations and by small firms that offer more or less differentiated products and which, frequently, are nothing more than late-twentieth century examplars of cottage industries characteristic of the earlier Industrial Revolution. Industry structure is still in a state of turmoil, being driven by unprecedented advances in computer hardware, especially microcomputers, which are making in-house data processing more competitve with vendor data processing. This growing attractiveness of in-house computing is being further aided by the efforts of the software industry to produce diverse and versatile software packages.

The enhanced attractiveness of in-house data processing for routine operations is forcing data processing companies to seek niches in which to operate with less pressure from head-on competition. This, of course, requires the development of specialized, proprietary software. However, software (especially custom software) programming and development requires substantial initial costs which are, in effect, sunk costs. Furthermore, software products, especially off-the-shelf software, as opposed to data processing services, have characteristics of public goods. This suggests that the famaliar problems of provision of goods and/or services with a strong public goods component are important within the computer services industry. As a result, trends towards concentration and horizontal integration as well as towards an increase in the importance of product and service differentiation, which appears to be the case in the software, are likely to persist and may even be identified in the future.

We should note that the cost burden of software development and maintenance has encouraged the development of new modes of software production and engineering such as software packages and new forms of subcontracting (starting from software conversion right to the development of more flexible specific applications packages). Also, entry barriers into packaged software are low when compared to computer hardware, for example. Nevertheless, profit margins have been high, resulting in a surge of packaged software creation, production and distribution. It appears that in packaged software, profitability is ensured through first-mover advantages on a particular software application, but that this advantage is not long-lived. To maintain steady profitabilty and market presence, software companies need both a portfolio of products and a continued flow of new offerings; otherwise, survival becomes problematic. Of course, many firms have entered the software market with a single product, after perceiving an unfilled consumer need, but their long-run viability is problematic. However, it is becoming increasingly difficult to develop and market new computer programs. The biggest problem now being faced by new entrants is reaching the consumer. Without the assistance of a software distribution company, smaller companies cannot afford to market their products and/or services adequately.[49]

Thus, we have seen that the data processing services and software segments of the computer services industry are characterized by intense competition, quite extensive product and service differentiation, and surprisingly low long-run entry barriers. Thus, the picture that emerges in

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49 The number of new programs being developed is phenomenal. For example, Soffsel, one of the major U.S. software distributors, receives as many as 4,000 new programs each month. It ususally chooses only 40 or so to distribute.

the area of computer information services is quite distinct from that in the computer hardware sector, which is significantly more concentrated and whose various segments are dominated by IBM. The picture is also different from that for the telecommunications equipment sector. In that sector, the concentration, at least in the United States, increases in steps as one moves from consumer products such as telephones, which are manufactured by many highly competitive firms, through more sophisticated private branch exchanges (PBX's), to central office switches, whose provision is dominated by a few world class switch makers.

In order to understand the forces of competition in data processing and software sectors, therefore, one must understand the workings of an industry in which the main assets, which are skilled manpower resources including technicians, engineers, programmers, and sales personel etc., can freely move from one firm to another.[50] In such a market, market power tends to be transitory, and high profitability is often difficult to maintain. Consequently, industrial and trade policies, if at all desirable, must reflect the peculiar nature of the data processing and software markets. In particular, targeting of firms may not be feasible because a firm's assets are easily transferable. Also, because entry tends to drive (long-run) rates of return to a competitive level, grabbing market share from foreign competitors

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50 The main asset to which dynamic market power attaches is undeniably human capital (manpower resources), especially when it comes to the programming and software related activities. Human capital is, however, a notoriously movable asset. Whereas machines can be bolted down and land fenced off, top programmers (and salespersons) cannot be tied down. It is not surprising that several entrants into both data processing and software products have been started by former employees of the incumbent firms. Of course, in the short-run, market power also attaches to the products of human capital, viz. the software created to perform data processing and other computer services.

may be expensive in welfare terms although it may be quite effective when measured by such standard measures of success as market share. Here the argument is that if foreign firms are placed even at a small relative disadvantage they will not be able to maintain market share because entry of domestic advantaged firms continues until the domestic firms get all (or most) of the market and returns are driven to zero. Now, of course, if there are inframarginal firms at home and in the foreign country, policies may divert profitable market share from inframarginal foreign firms to home firms, and a policy aimed at diverting market share may be welfare enhancing.[51]

Inasmuch as in the computer information services industry human capital is a critical input (the equipment being available, if at distorted prices), public policies aimed at curing market failures in the production of human capital are more likely to serve the social welfare goals than are conventional trade promotion or trade restriction policies.

With respect to information services in general, it must be admitted that the information technology sector, including the services component, belongs squarely to the elite group of high technology or sunrise industries. This in and of itself renders a levelheaded discussion of economic issues surrounding information technology sector almost impossible.

What are these economic issues? For the purposes of discussion we can divide them into four categories. The first category consists of more or less standard industrial organization type of concerns, the paramount being whether or not these high technology or sunrise industries are likely to underperform both in terms of short-run and long-run resource allocation metrics. The

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51 See Dixit (1985b) for a more complete articulation.

fundamental reason for this expressed concern stems from the fact that high technology industries rely heavily on knowledge and information as one of the main inputs and produce knowledge and information (or information as knowledge) as one of their main outputs.

Information, when viewed as a commodity has special characteristics that make those markets entrusted with its creation and dissemination more prone to market failure than markets in which informational aspects are less important. These key characteristics are (i) the difficulty of excluding non-payers from utilizing produced information and (ii) low (often zero) incremental costs of serving additional users. We may refer to them as problems of appropriability and scale economies, respectively. Taken together they are characteristic of public goods and, as is well known, market provision of public goods often falls short of the efficiency ideal. There are at least four major reasons that the social efficiency ideal may not be reached. First, inasmuch as the private incentive for the creation and dissemination of information is revenue or profit, private benefits may under- or overestimate social benefits both in the aggregate and on the margin. This discrepancy follows in part from the fact that investments in the creation and dissemination of information are, for the most part, fixed costs.

Second, when these fixed costs are "large", the resulting market structure is likely to be imperfectly competitive either at the level of the creation of information and knowledge or at the level of dissemination of the products that embody the fruits of these investments in the creation of information and knowledge, or both. Furthermore, there are no obvious limitations on scale economies when information is involved (low dissemination costs impart scale economies).[52]

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52 Also, we should not neglect the role of reputation in safeguarding the privacy of data. Reputation has the necessary characteristic of intra-firm

Third, imperfect appropriability and the presence of spillovers creates an additional wedge between social and private benefits, for at least the following reason. Given the total potential social benefit, the greater is the spillover the more closely is the potential benefit converted into an actual benefit. However, the more pervasive is the appropriability problem the weaker are the ex ante incentives to invest. On the other hand, restoration of appropriability through patent, copyright and trademark mechanisms, or through a first-mover advantage, while conducive to dynamic efficiency, disturbs static allocative efficiency. Furthermore, restoration of appropriability may overstimulate ex ante investment in the creation of information, as in patent races. On the other hand, insufficient appropriability may create incentives to repress such investment in anticipation that other firms will move first.[53]

Finally, for any given degree of appropriabilty, the buying and selling of information is subject to informational asymmetries: on one hand the seller does not know the value of information to the potential buyer; on the other hand, the buyer cannot assess the value of the information that is being offered for sale without knowing the content of the information. However, by revealing the content, the seller may diminish the likelihood of sale because much of the valuable information has already been transmitted.

To conclude, from the industrial organization perspective, markets in which information is created and/or exchanged tend to be susceptible to market failure, and may thereby warrant some form of government intervention. We may

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public input, which imparts economies of scale and more importantly of scope. However, given the large number of small firms both in data processing and software segments of the computer services industry, these economies do not appear to be overwhelming.

53 See Bliss and Nalebuff (1985) for an example of a game of timing with public goods.

as well call this type of intervention industrial policy. It is important to note that industrial policy of this type may be socially desirable even if the markets in which intervention is warranted are naturally closed to international trade.

Let us now survey briefly the international trade and policy issues raised by international trade in information and in information-related services.[54] From the international trade perspective, two queries are standard. The first is whether the pattern of trade can be explained by the usual forces of comparative advantage. Inasmuch as we are dealing here with trade in services, the explanatory power of comparative advantage remains undiminished for a variety of service categories.[55] Deardorff (1984) conducts his analysis of the determinants of trade in services under the assumption that the providers of services are perfect competitors. Krugman (1985) shows that the assumption of perfect competition is not necessary. However, when there are scale economies, at the industry or firm level, the link between comparative advantage and the pattern of trade becomes more tenuous. Two reasons can be identified. First, increasing returns can provide the reason for trade among identically endowed economies. Second, if increasing returns are large relative to the size of the "market", imperfect competition will result. This does not mean that participating firms will earn positive profits in equilibrium. Free entry (as in the Chamberlinian model) or market contestability can drive profits to zero. But if there are entry barriers, there arise other motives for trade: these are (i) international price

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54 Grossman and Shapiro (1984) contains an excellant discussion of normative issues raised by international trade in technology services.

55 As Stern (1984) summarizes and Deardorff (1984) rigorously demonstrates.

discrimination which manifests itself in cross-hauling of identical commodities,[56] and (ii) the differences in the degree of market concentration and market power across countries.

The presence of scale economies and the consequent imperfect competitive market structure has some interesting policy implications. The key to these is that in imperfectly competitive markets, equilibrium outcomes are sensitve to the strategies pursued by the incumbent firms (and by potential entrants). There is no assurance, however, that non-cooperative equilibrium outcomes of these strategic interactions maximize nationalistic social welfare. And they surely do not maximize firms' global profits. This leaves room for government intervention whose purpose it may be to shift the equilibrium outcome in favor of domestic firms. Dixit (1985a) analyzes extensively the various rationales for strategic trade policy in markets populated by imperfectly competitive firms. His careful discussion suggests that the analytic foundations for new protectionism are still shaky, although less questionable than might have been surmised from reading traditional trade literature.

How do information services fit into the rich analytic framework employed by the students of the new industrial organization and trade theory? As we noted in the beginning, information services comprise an extremely diverse set of services. They range from low-tech, tourist information services to sophisticated large-scale data processing to complex software, not to mention technology services. For this reason, conclusions that may be appropriate for the whole aggregate are not readily forthcoming. However, to

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56 For example, see Brander and Krugman (1981) or Ordover and Willig (1986).

the extent that activities subsumed under the heading of information services involve producing, manipulating, and disseminating information, then such activities are potentially subject to inefficiencies stemming from market failure. Thus, government intervention through industrial or trade policy may, indeed, be welfare improving even in the absence of the strategic international trade considerations mentioned earlier.

The category of information services, computer information services, that we examined in some detail above, does not fit the oligopoly model too well. Entry (and also exit) occurs at dizzying speeds, and there is continuous downward pressure on profit margins. At the same time, however, a handful of data processing and software firms clearly control a substantial portion of the commercial market. Perhaps, then, in the U.S. and Canada data processing and software industries can be characterized as an oligopoly-cum-competitive fringe with substantial product differentiation. Thus, product differentiation is affected by copyright protection. In data processing, product differentiation occurs both along service type and geographical dimensions. Geography is important when proximity of the data processing operation to the entity generating the data is critical. It seems that proximity matters when there is a need for frequent interaction between data processing personnel and the personnel of the firm whose data is being processed. The actual location of the computing facilities is perhaps less relevant, unless data transport costs are prohibitive. It may be expensive for a data processing firm to maintain adequate personnel in the general proximity to the sources of data, unless the local geographic market is large and the firm can hold a sufficient market share. If these considerations are not met, local firms will predominate. Thus, in data processing, there is still substantial local market power.

We observe governmental interference with free trade in both data processing and software. For example, Mexico places a 20 percent duty on software, while Brazil applies a 50 percent duty. In addition, inadequate copyright protection further stymies trade in software. Inadequate privacy provision and other impediments impact trade in data processing services. Can these and other restrictions, together with the activist industrial policy, be easily explained using the strategic models that underlie new protectionism as a reputable trade policy? In our view, little justification can be found, for the following reasons: (i) the permanence of supracompetitive profits in either data processing services or software products is more an exception than a rule; (ii) scanty wage data indicates that, unlike in some declining smokestack industries, the workforce is not earning rents which would be lost by a flow of imports[57]; (iii) intensive competition among software manufacturers creates conditions under which the recipient country could obtain significant economic benefits from free trade. In particular,in this regard a persumption exists that the exporting country may benefit from export restrictions; [58] (iv) import restrictions can perhaps be mandated by the presence of a monopoly owner of an information service who can strategically play off one potential buyer against another. Conceivably, an owner of copyrighted software, for example, can start a bidding war in the importing country for the right to manufacture the software and thereby extract the monopoly rents which he then transfers abroad. We have not been able to

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57 See Lawrence (1984).

58 This is explained in Grossman and Shapiro (1984) who show that exporting firms impose a negative pecuniary externality on each other by over-competing in international markets where in fact they should be colluding in order to extract maximum surplus from foreign consumers.

provide examples of such strategic behavior by sellers of information services under scrutiny.

Why then the tariff and non-tariff-interference involving trade in information services? Some answers can be gleaned from the available literature and from political pronouncements. The first is that there is now a certain mystique about the nature of informatique. It is commonplace to speak of information as power and to refer to advanced economies as being information-based or being information creating and processing economies. What analytic insight comes from such labels is difficult to ascertain.[59] Nevertheless, these perceptions lead to industrial and trade policies designed to create or to strengthen local information industries.

The perception that information is power leads to policies that favor self-sufficiency as an insurance against exploitative practices of foreign governments and firms. Some such examples of exploitative behavior are adduced below. More apposite, however, is an example of selective U.S. restrictions on the transfer of technology to communist countries, which applies also to subsidiaries of U.S. firms. These types of U.S. interference creates problems for subsidiaries located abroad and causes unnecessary international tensions (as in the Dresser Industrie case). The other side of the coin is, of course, that countries that follow protectionist policies do not view them only as an insurance against foreign exploitation and abuse but also, as a route to rent-extraction from other countries, which have been endowed with less forsight.

On the insurance side we must also count insurance against the possibility that, for whatever reason, the country will not be able to obtain

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59 It leads to breathless and uninformative pronouncements such as those of Diebold (1983), for example.

the needed information services. Insofar as information services are indispensible to a smooth and efficient functioning economy, such cut-backs in availability may have devastating consequences on the whole economic life. This argument is reminiscent to that developed by Morgenstern and Thompson (1976) in their much neglected work on the core activities in the economy. We do not have a sound description of the possible matrix of linkages that would be affected if data processing or software services, ceased to be available to the importing countries, or if prices of these services were to be unexpectedly elevated. What we are left with, then, is a perception, both in the importing and exporting countries, that these linkages are important and that vital sectors of the economy would be affected by the disruption in information flows. This, then, justifies steps which ensure continued availability of critical information and information processing. Trade restrictions serve that purpose by (i) causing some types of data to be maintained in the home country when, in the absence of such restrictions, these data would be located elsewhere; and (ii) ensuring the presence of the necessary technical skills. Regarding the latter, the point is that it is not possible for a country to maintain an adequate supply of these skills in absolute: the technical personnel must find adequate employment which, in turn, is being generated by means of trade restrictions and stimulative trade policy.

Thus, we tentatively suggest that much of the trade policy pertaining to information services can be traced to (i) notions that in the information-age, domestic control over production, processing, and dissemination of information is necessary for long-run viability of the home economy; (ii) notions that these services render participants a potential for capturing of

supra-competitive profits and that this can be accompolished with policies whose shadow cost to the society is less than the potential monetary benefit. (We do not think that the benefits outweigh the costs for the category of information services examined in the previous sections); (iii) a nationalistic, but understandable, desire to protect local culture from pervasive foreign influences, as recently demonstrated in Canada (i.e. especially in publishing) or in the United Kingdom, where, for example, there were efforts to prevent "Dallas" from being shown on television, which have ultimately failed.

We should say that much of our conclusions here are rather tentative for a number of reasons. First, the analysis of international trade in information services has only recently begun and is being hampered by a total inadequacy of available data, in part because many of the transactions take place within firms. For this reason, the data problem is not likely to be resolved soon. Furthermore, unlike in the case of automobiles, lumber, or petroleum, it is not clear what are the correct real units in which transactions should be measured.

Second, modern trade theory has made great advances in extending the applicability of the comparative advantage viewpoint to markets characterized by scale economies, product differentiation, and imperfect competition. Yet even the most advanced and insightful presentations of that analytic viewpoint focus on static economies.[60] In such economies the number of available products is given: either it is fixed or, as in the Dixit-Stiglitz-Lancaster set-up, it can be infinitely extended from the well-known, generally available

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60 For example, Krugman (1985), Helpman and Krugman (1984).

metatechnology. Yet when it comes to information services, this static viewpoint is inadequate. International competition centers not only on who will be providing the already existing generation of information services (or the products that embody them) but also who will be providing the next generation. Now it cannot be said that theoretical industrial organization and trade literature suffers from an undersupply of models of research and development and technology transfer. But these models, partly because of their partial equilibrium nature, are not yet well equipped to answer the traditional comparative advantage questions.[61] And as long as it is the case (or it is believed to be the case) that tomorrow's success in imperfectly competitive markets depends on today's position, the incentives for strategic behavior are exacerbated. The result is that trade flows reflect these strategic interactions as well as the underlying factor endowments.

The modern trade and industrial organization literature has brought us much closer to an understanding of the economic and policy issues in information services. Further advances will come from additional empirical scrutiny of these industries.

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61 See Grossman and Shapiro (1984).

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Table 2.1

U.S. Computer Services Industry

	Computer Services		Processing Ser.		Software Services		Prof. Services		Integrated Syste	
Year	Number of Firms	Revenue ($mil)	Number of firms	Revenue ($mil)	Number of Firms	Revenue ($mil)	Number of Firms	Revenue ($mil)	Number of Firms	Revenue ($mil)
1970	1400	1900								
1971	1500	2350 (24)								
1972	1600	2760 (17)								
1973	1700	3330 (21)								
1974	1900	4410 (32)								
1975	2550	4580 (4)	1557	3290	993	1290				
1976	2584	5325 (16)	1556	3605 (10)	1028	1720 (33)				
1977	2977	6300 (18)	1942	4700 (30)	618	600 (-65)	417	1000		
1978	3391	7750 (23)	2089	5580 (19)	752	940 (57)	550	1250 (23)		
1979	4055	9446 (22)	2140	6706 (20)	1095	1210 (29)	820	1550 (26)		
1980	4376	14903(58)	2132	8800 (31)	1225	2631(117)	978	3472(124)		
1981	6178	22311(50)	2259	11220(28)	1605	3765 (43)	1284	4570 (32)	1030	2756
1982	6470	26430(18)	2130	12484(11)	1879	5295 (41)	1348	5329 (17)	1113	3322 (21)
1983	7000	32600(23)	2150	14600(17)	2250	7500 (42)	1400	6400 (20)	1200	4100 (21)
1984	-	39900(22)		15000 (3)	-	10400(39)		-8600 (34)		-5900 (44)

Source: OECD (1985); U.S. Dept. of Commerce (1984a)
Financial Times 12/04/84; 10/04/85.

Note: Numbers in parentheses represent annual growth rates (as a percentage).

Table 2.2

Distribution of Computer Services Industry Revenues
(By type of service)
(%)

Year	Processing Services	Software Products	Professional Services	Integrated Systems
1975	72	28		
1976	68	32		
1977	75	10	16	
1978	72	12	16	
1979	71	13	16	
1980	59	18	23	
1981	50	17	21	12
1982	47	20	20	13
1983	45	23	20	12
1984	37	26	22	15

Source: Table 2.1

Table 2.3

Data Processing Services Sector
(By mode of delivery)
($ millions)

Year	Batch Computing	Remote Computing	Facilities Management	VAN's	Total Processing Services *
1980	3332 (38)	4374 (50)	989 (12)		8698 (100)
1981	3822 (38)	5117 (51)	1116 (11)		10055 (100)
1982	3939 (35)	5935 (52)	1289 (11)	180 (2)	11343 (100)
1983	4353 (34)	6764 (53)	1439 (11)	253 (2)	12809 (100)
Annual Rates of Growth					
80/81	15%	17%	13%		15%
81/82	3%	16%	15%		11%
82/83	11%	14%	12%	41%	13%

Source: INPUT/U.S. Dept. of Commerce, 1984.

Note: Numbers in parentheses are the percentage that each mode of delivery contributes to total processing services revenue.

* Revenues for data processing services will differ from those in Table 1. since they are adjusted here for inflation.

Table 2.4

Profitability of U.S. Computer Services Companies

Type of Company	Number of Companies 82	83	Non-Captive U.S. Revenues 82	83	Public Companies Pretax 1982 Profit Margins	Public Companies Aftertax 1983 Profit Margins
Processing Services	2130	2150	12484	14600	13.2%	5.3%
Software Products	1879	2250	5295	7500	18.3%	7.8%
Professional Ser.	1348	1400	5329	6400	5.7%	3.6%
Integrated Systems	1113	1200	3322	4100	12.9%	7.5%
Total	6470	7500	26431	32600	11.8%	5.6%

Source: OECD, (October, 1985).
Financial Times, 12/04/84.

Table 2.5

Independent Computer Services Companies Share of the U.S. Software Market
($ millions)

	1981		1983		% Growth
	Revenue	% of Total	Revenue	% of Total	
Systems Software					
Hardware Manufacturers	2025	49.3	3660	45.6	80.7
Independents	820	20	1854	23.1	126.1
Subtotal	2845	69.3	5514	68.7	93.8
Applications Software					
Hardware Manufacturers	295	7.2	455	5.7	54.2
Independents	965	23.5	2060	25.6	113.5
Subtotal	1260	30.7	2515	31.3	100
Total	4105	100	8029	100	95.6

Source: IDC/U.S. Dept. of Commerce, December 1984.

Table 2.6

Top 25 U.S. Data Processing Companies
Revenue ($ millions)

	Company	1981	1982
1	Control Data	622	840
2	Automatic Data Processing	588	669
3	GE Information Systems Co.	427	455
4	Electronic Data Systems *	205	255
5	Tymshare **	237	220
6	Computer Sciences	145	171
7	Shared Medical Systems	115	156
8	McDonnell Douglas Automation	129	148
9	NCR Data Center	110	120
10	Quotron Systems	79	121
11	Computax	92	115
12	Boeing Computer Services	91	119
13	National Data Corp.	71	103
14	United Information Systems	117	99
15	National CSS	92	95
16	Interactive Data/Case	95	92
17	Bradford National Corp.	76	91
18	Xerox Computer Services	79	85
19	TRW	67	75
20	Comshare	79	72
21	BunkerRamo	55	63
22	American Express	38	60
23	Mead Data Control	28	51
24	Computer Language Research	37	50
25	Reynolds & Reynolds	42	43

Source: IDC/U.S. Industrial Outlook, 1985.
* Acquired by General Motors Co. in 1984.
** Acquired by McDonnell Douglas in 1983.

Table 2.7

Concentration Ratios in the U.S. Computer Services Industry
(1972 - 1982) Sales/Total Sales of Industry

	1972	1977	1982
4 largest firms	18.4%	13.0%	12.3%
8 largest frims	26.9%	19.7%	21.3%
20 largest firms	39.4%	29.9%	30.4%
50 largest firms	51.0%	41.3%	42.0%

Source: OECD, (October 1985).
1982 Census of Service Industries, Industry Series: Establishments and Firm Sizes, U.S. Dept. of Commerce, Bureau of Census, May 1985.

* Includes only those firms that have payrolls.

Table 2.8

Software and Service Revenues of the major U.S. Hardware Vendor (1983)

Company	A Total Corporate Revenue ($ millions)	B Total Software and Service Revenue ($ millions)	B/A (%)
IBM	40180	2813	7
Digital Equipment Co.	4272	1404	33
Control Data	4500	1260	28
Burroughs	4390	830	19
NCR	3731	805	22
TRW	5493	790	14
Hewlett-Packard	4710	461	10
Harris	1423	250	18
Honeywell	5753	229	4
Perkin-Elmer	1015	214	21
General Instrument	974	213	22
Sperry	2810	146	5
Data General	829	133	16
Tandy	2475	76	3
Apple	983	69	7
Prime Computer	517	65	13
Commodore	681	62	9
Four-Phase Systems	541	60	11
MDS Qantel	170	9	5
Altos Computer	75	6	8

Source: ICP/OECD, October 1985.

Table 2.9
Top 25 Software and Service Companies in the U.S.
(1983)

Company	Services Offered	Software & Services Revenue
		($ millions)
1 IBM	abceijlm	2813
2 Digital Equipment	abcdefghijklm	1404
3 Control Data	abcdeghijklm	1260
4 Burroughs	abce	830
5 NCR	abcdeghijklm	805
6 TRW	abk	790
7 Automatic Data Processing	ghi	753
8 Computer Sciences	ghijklm	695
9 Electronic Data Systems/GM	abcghijklm	630
10 Hewlett-Packard	abce	462
11 General Electric Info. Services	abceghikm	450
12 Computervision	e	400
13 McDonnell Douglas Automation	aehikl	376
14 Tymshare/McDonnell Douglas	agikl	289
15 Harris	bcde	250
16 Boeing Computer Services	ajlm	250
17 Honeywell	abcem	229
18 Perkin-Elmer	abcejklm	214
19 General Instrument	abceghi	213
20 Shared Medical Systems	ehij	211
21 Dun & Bradstreet	abceik	210
22 Informatics General	abcik	198
23 Cap Gemini Dasd	bcklm	173
24 First Data Resources	ai	158
25 Martin Marietta	abcehijklm	154

Legend

a Applications Software
b Systems Software
c Utilities Software
d OEM Distributor
e Turnkey Systems Operator
f Software Product Retailor
g Batch Processing
h Remote Processing
i Interactive Processing
j On-Site Processing
k Custom Programming
l DP Consulting
m Education/Training

Source: OECD (1985).

Table 2.10

Top 25 Independent Software Suppliers in the U.S.

		Software Revenue ($millions)	Software Rev as % of Total Rev
1	MSA	145	100
2	Informatics General	101	51
3	Softsel	88	100
4	Applied Data Research	82	92
5	Cullinet Software	79	100
6	Cincom Systems	71	100
7	SEI	68	100
8	Computer Associates Int.	58	100
9	Lotus	53	100
10	Alpha Microsystems	52	100
11	Microsoft	50	100
12	MicroPro Int.	45	100
13	Pansophic Systems	43	100
14	Visicorp	42	100
15	Digital Research	38	100
16	SAS Institute	30	93
17	Candle	30	100
18	Information Builders	28	98
19	Software AG of N.A.	29	95
20	Policy Management Systems	27	43
21	Integrated Software Systems	24	100
22	Softeam	22	80
23	American Software	21	100
24	Boole & Babbage	20	93
25	The Continuum Company	20	98

Source: ICP/OECD, October 1985.

Table 2.11

Number of Firms in the U.S. Computer Services Industry
By Type of Service

Year	Total		Processing Services		Software Products		Professional Services		Integrated Systems	
1975	2550		1557		993					
1976	2584	0.01	1556	-0.00	1028	0.04				
1977	2977	0.15	1942	0.25	618	-0.39	417			
1978	3391	0.14	2089	0.08	752	0.22	550	0.32		
1979	4055	0.2	2140	0.02	1095	0.46	820	0.49		
1980	4376	0.08	2132	-0.00	1225	0.12	978	0.19		
1981	6178	0.41	2259	0.06	1605	0.31	1284	0.31	1030	
1982	6470	0.05	2130	-0.05	1879	0.17	1348	0.05	1113	0.08
1983	7000	0.08	2150	0.01	2250	0.2	1400	0.04	1200	0.08

Source: Table 2.1

Table 2.12

Sources of Revenue in the Canadian Computer Services Industry
C$ millions

Type of Service	1974	1975	1976	1977	1978	1979	1980	1981	1982
Processing Services	124	173	211.5	255.3	313.8	357	433.3	547.3	648.3
		(40)	(22)	(21)	(23)	(14)	(21)	(26)	(18)
Input Preparation	15.8	19.3	25.6	32.4	36.8	39.9	44.8	48.3	46.6
		(22)	(33)	(27)	(14)	(8)	(12)	(8)	(-4)
Software and Software Services	50.6	52	59.6	77.4	112.2	135.8	207.9	291.1	456
		(3)	(15)	(30)	(45)	(21)	(53)	(40)	(57)
Other Computer Services	12.8	5.3	10.6	19.6	28.5	37.2	49.8	100.4	37.3
		(-60)	(100)	(85)	(45)	(31)	(34)	(102)	(-63)
Sale & Rental of EDP Equipment	6.7	23.3	12.4	21.2	31.3	40.5	62.3	86.9	105.1
		(247)	(-47)	(71)	(47)	(30)	(54)	(40)	(21)
Maintenance Services	-	6.4	0.6	-	-	4.4	7	13.2	29
		-		-	-	-	(59)	(89)	(120)
Total Revenue	210.9	285.7	327.5	416	531.8	630.9	819.8	1102	1347.7
		(35)	(15)	(27)	(28)	(20)	(29)	(34)	(23)

Source: P.K. Neogi, May 1983.
Statistics Canada, Census Data on the Computer Services Industry, 63-222,

Note: Numbers in parentheses represent annual growth rates (%).

Table 2.13
Top 34 Canadian Service Bureaux
($C millions)

	Country of Origin	1979	1980	1981
1 Canada Systems Group	Canada	62.3	77.9	101.5
2 Datacrown	Canada	60.2	68.6	86.2
3 B.C. Systems	Canada	40.2	49.1	57.9
4 I.P. Sharp	Canada	24.7	35.3	42
5 Computel Systems **	Canada	31	38.4	41.3
6 IBM Canada	U.S.	30	33.6	37.7
7 L'Industrielle Services Technique	Canada	19.5	20.4	23.8
8 Control Data Canada	U.S.		14.5	20.3
9 Automatic Data Processing	U.S.	12	16.7	20
10 Sask. Comp.	Canada	9.9	12.8	16.8
11 Manitoba Data Services	Canada	11.5	13	15.5
12 Canadian GEISCO	U.S.		14	15
13 Computer Sciences Canada	U.S.	9.3	11.2	12.2
14 Comshare	Canada	6.5	7.6	10.2
15 Dataline	Canada	7	8.2	9.9
16 Digitech	Canada	7.8	7.9	9
17 Nfld.&Labrador Computer Services	Canada	6.2	7.3	8.4
18 ACT Computer Services	U.S.	4.9	6.8	7.5
19 NCR Canada	U.S.		7	7
20 Real Time Datapro	Canada	4.3	5.1	6.4
21 National Datacentres	Canada	4.7	5.2	6.3
22 Comtech Group Int.	Canada	5.7	5.7	5.8
23 Riley's Datashare Int.	Canada	4.2	5.1	5.6
24 Alphatext	Canada	5.2	4.7	4.9
25 Comcheq Services	Canada	2.2	3.6	4.8
26 Cybershare	Canada	2	4.3	4.6
27 Polycom Systems	Canada	2.8	3.3	4.5
28 Boeing Computer Services Canada	U.S.	3.6	4.2	4.2
29 Coverall Computer Services	Canada	1.5	2.6	4.2
30 MICR Systems	Canada	4	4.2	4.2
31 Automation Centres of Ottawa	Canada	3.7	3	4
32 Computrex Centres	Canada	3.4	3.8	3.5
33 Cableshare	Canada		1.5	2.4
34 University Computing Co. Canada	U.S.	1.8	1.3	1.9
Total		392.1	507.9	609.5

Source: Evans Research Corp./Neogchi, 1983.

** Acquired by Canada Systems Group in 1982.

Table 2.14

Distribution of Canadian Computer Services Industry Revenues
(C$ millions)

	1981	1982
Processing Sevices	655	735
	(50)	(47)
Consulting and Education	170	230
	(13)	(15)
Software Products	475	598
	(37)	(38)
Total	1300	1563
	(100)	(100)

Source: Evans Research Corp. EDP In-Depth Reports, Dec. 1984.

Table 3.1

Software and Services Market: Western Europe
(1983)

	Revenues ($ millions)	Share of Total (%)
Packaged Software	3365	28
Custom Software	3492	29
Software Total	6857	56
Training	528	4
Facilities Management	87	1
Processing Services	4728	39
Total	12200	100

Source: IDC/ECSA/OECD, Oct. 1985.

Table 3.2

Software and Services Markets in Selected European Countries

	France		Germany		Italy		United Kingdom	
	(Revenue in $millions)							
	1983	1984	1983	1984	1983	1984	1983	1984
Packaged Software	591	674	810	966	369	433	659	794
Custom Software	1011	1077	592	626	396	417	535	557
Total Software	1602	1751	1402	1592	765	850	1194	1351
Training	95	100	112	120	50	54	96	106
Facilities Management	16	16	9	9	10	9	12	11
Processing Services	1076	1033	728	708	464	442	633	612
Total	2789	2900	2251	2429	1289	1355	1935	2080
	(Percentage Shares)							
Packaged Software	21	23	36	40	29	32	34	38
Custom Software	36	37	26	26	31	31	28	27
Total Software	57	60	63	66	59	62	62	65
Training	3	3	5	5	4	4	5	5
Facilities Management	1	1	-	-	1	1	1	1
Processing Services	39	36	32	29	36	33	33	29
Total	100	100	100	100	100	100	100	100

Source: IDC/ECSA/OECD, 1985.
Financial Times, 10/04/85.

Table 3.3

Top 30 Computer Service Companies in Western Europe
(1983)

Company	Country of Origin	Packaged Software	Custom Software & Consulting	Systems House	Processing Services	W. European Revenues ($ millions)
IBM	U.S.				X	279.0
SG2	France	X	X	X	X	144.7
Cap Gemini Sogetti	France	X	X			139.1
Gsi	France	X	X	X	X	128.8
GEISCO	U.S.				X	112.9
Scicon Int.	U.K.	X	X	X	X	110.4
Datev	Germany				X	108.9
CiSi	France		X	X	X	98.0
CCMC	France	X			X	83.9
Telesystemes	France		X	X	X	77.3
Sligos	France	X	X	X	X	74.9
Sema	France	X	X	X	X	71.9
Kommunedata	Denmark		X		X	66.8
Thorn EMI	U.K.	X	X	X	X	62.4
Datema	Sweden	X	X	X	X	62.2
SESA	France	X	X	X		61.3
Datacentralen	Denmark		X		X	59.4
Kommunedata	Norway				X	55.8
Steria	France	X	X	X		51.6
CDC	U.S.	X	X	X	X	51.2
ADP	U.S.				X	50.8
ACI/UCC	Switz/U.S.	X		X	X	48.6
Kommunedata	Sweden	X	X	X	X	48.5
NCR	U.S.			X	X	44.9
CIG	Belgium		X	X	X	42.8
Volmac	Volmac		X			42.3
Hoskyns	U.S./U.K.	X	X	X	X	38.9
Logica	U.K.	X	X	X		38.5
IDA	Norway		X		X	36.7
CMG	U.K.		X		X	36.5

Source: ECSA/IDC/OECD, October 1985.

Table 3.4

U.S. Versus Foreign Computer Services Revenue Distribution and Growth
(By Type of Service)

Type of Service	Noncaptive Revenues		Noncaptive Revenue Growth (1982 - 1983)	
	Foreign	U.S.	Foreign	U.S.
Processing Ser.	(%)	(%)	(%)	(%)
1982	9	91		
1983	8	92	5	14
Software Products				
1982	24	76		
1983	23	77	25	39
Prof. Services				
1982	11	89		
1983	12	88	31	21
Turnkey Systems				
1982	16	84		
1983	15	85	13	24
Total				
1982	14	86		
1983	14	86	19	22

Source: INPUT, 1984.

Table 3.5

Foreign Sales of U.S. Computer Services Companies

Type of Service	Year	Foreign Sales (%)	U.S. Sales (%)	Captive Sales (%)
Processing Services	1981	7	85	8
	1982	7	83	10
Software Products	1981	31	69	0
	1982	28	72	0
Professional Services	1981	7	93	0
	1982	12	88	0
Integrated Systems	1981	12	88	0
	1982	12	88	0
Total	1981	13	83	4
	1982	12	83	5

Source: Price Waterhouse/OECD, October 1985.

Table 3.6

Measures to Promote and Protect Software Industries
in Selected Developed and Developing Countries

Country	Mandatory Registration/Licensing	Market Reserve	Procurement Preference	Government Subsidies/Incentives Domestic Firms	Foreign Firms
France	No	No	Yes	Yes	No
Japan	Proposed	No	Yes	Yes	No
United Kingdom	No	No	No	Yes	Yes
Brazil	Reg./Lic Proposed	Yes	Yes	Yes	No
India	No	Yes	Yes	Yes	Yes
Ireland	No	No	No	Yes	Yes
Mexico	Registration	No	No	Yes	Yes
Singapore	No	No	No	Yes	Yes
South Korea	No	Proposed	Proposed	Yes	No
Taiwan	No	No	No	Yes	Yes

Source: U.S. Dept. of Commerce, December 1984.