Computer Services in the Rural Economy

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Rural Computer Services in a Global Economy

Rural communities often have the sense that their economies are buffeted by conditions beyond local control. Used to the vagaries of weather and its impact on rural incomes, manufacturing was to offer relief to rural instability. This hope dissolved with the recession of the early 1980s, when an overvalued U.S. dollar and a world wide recession resulted in massive rural manufacturing layoffs.

The growing internationalization of the economy further undermines rural aspirations for a permanent and pivotal role in a post-industrial economy. Theories of the international spatial division of labor suggest rural areas are merely way stations, as manufacturers move on to Third World Counties to take advantage of even cheaper labor abroad. Furthermore, the new models of flexible specialization argue for increasing centralization around urban manufacturing centers. Either way, rural labor markets are vacated or bypassed altogether. Can services fill the gap? This chapter examines the computer services industry and its present and anticipated role in rural development.

Computer services offers an interesting case for in depth examination because of its rapid national employment growth, its export potential, and its high quality jobs. Between 1982 and 1987, employment in this industry grew by an average of 16 percent per year. Revenues grew even faster, at an average of 30 percent per year, compared to 15 percent per year for all services.

Moreover, computer services is one of the service industries least dependent on domestic income for growth. As indicators of export potential, estimates are that 20 percent of United States' revenues from information and data processing services come from foreign purchases. Only about 5 percent of U.S. demand for electronic information services, in 1985, came from households (United States Congress, 1987). These numbers suggest computer services are not typical market driven services tightly linked to the location of customers.

Finally, computer related services (SIC 737) is, on the average, a high

paying industry. The average salary in all services was $18,053 in 1987. The average for computer related services in the same year was $32,734 (U.S. Department of Commerce, 1987).

The popular press, along with a number of other researchers highlight the potential of computer services as a source of rural development. These studies have emphasized jobs created by the entrepreneurial software programmer seeking the rural lifestyle (Drucker 1989, Worthington 1991). Is this popular image of the rural computer firms supported by the evidence from our six states?

In spite of the much touted decentralization of skilled software jobs, the large rural computer industry employers are data entry firms. While the data entry business is not a major employer in rural America, it is a major player in a number of rural communities. Firms in this industry select rural locations for economic reasons, and the rural industry is a successful competitor in the national market. Rural data entry operators currently enjoy a market niche for quick turnaround data entry (i.e. less than 1 week turnaround) from hand written documents. Will rural firms be able to hold onto this niche? Is this an activity other rural areas can duplicate? What government strategies would improve the competitiveness of these rural establishments vis a vis foreign competition? These are questions addressed in this chapter.

The first section of this chapter articulates provides an overview of the computer services industry in rural economies. The second section examines the importance of computer software development and programming services (SIC 7372) to rural development. The third and final portion delves deeply into the prospects for data entry and processing. The analysis is based on the Dun and Bradstreet data for 1980 and 1986 for six study states, California, Kansas, Maryland, Massachusetts, New York, and Virginia[1]; telephone interviews, and on-site interviews.

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[1]For a detailed discussion of the Dun and Bradstreet Data and the selection of the six study states see Howland, Marie "Using the Dun and Bradstreet Data for the Study of Rural Economies", unpublished paper, University of Maryland, College Park, October 1990.
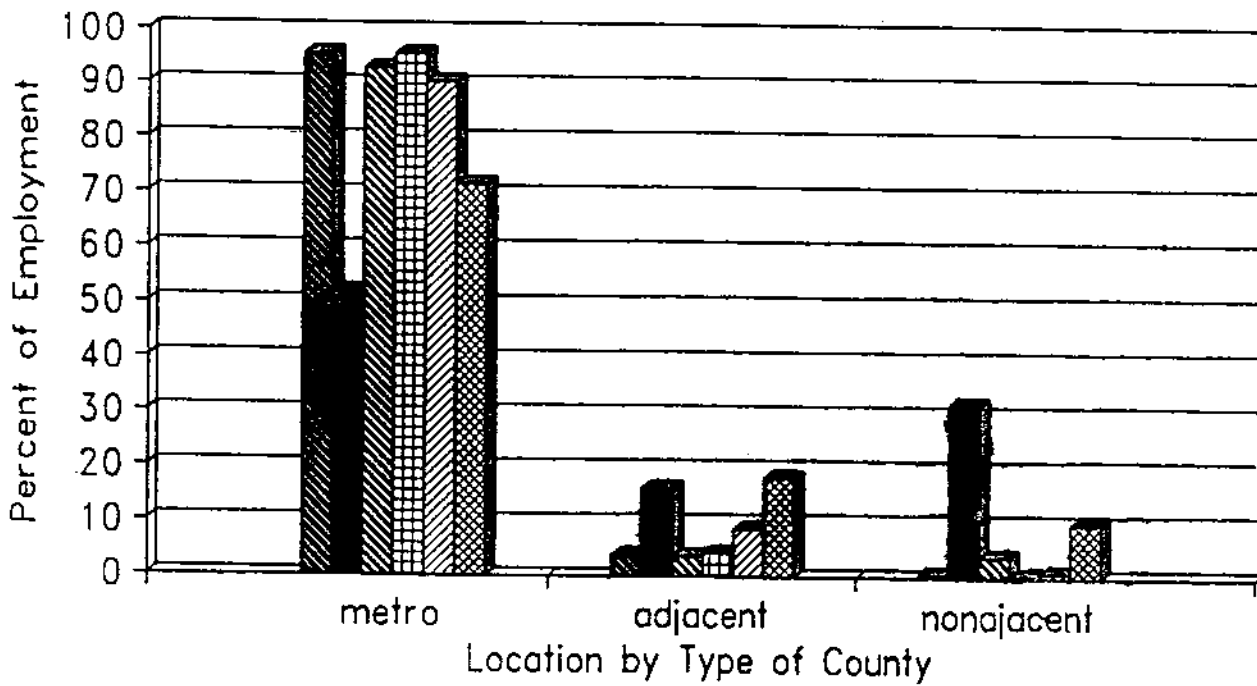
The Spatial Pattern of Computer Services

Until 1986, SIC 737 - computer services was divided into two distinct 4-digit industries, computer software development and programming (SIC 7372) and data preparation and processing (SIC 7374). Computer services not elsewhere classified (7379) is a third category including a heterogeneous mix of business lines.[2]

Establishments in SIC 7372 are small and primarily independently owned. As suggested by the preceding analysis, computer services are highly concentrated in urban centers, and more concentrated than population (see Graphs VII-1,2,3, and 4). Programming activities (SIC 7372) are even more concentrated than data preparation and processing services -SIC 7374 (see Graphs VII-1, 2, 3, and 4). This result is not surprising, since programming activities are more likely to be market oriented and to require higher skilled labor. As implied in the graphs and shown in Table VII-1, the absolute number, as well as the proportion of computer services establishments in adjacent and nonadjacent rural counties is small. In spite of newspaper reports celebrating the decentralization of computer firms these results show that decentralization is not a major trend.

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[2] The Standard Industrial Classifications were revised in 1987 to reflect emerging industry trends. There were major changes in SIC 737, with SIC 7372 - computer programming and software development SIC 7374 - Data Preparation and Processing services, and SIC 7379 -Computer Related Services, Not Elsewhere Classified each subdivided into three categories, resulting in a total of nine categories of 4-digit computer services. Here we retain the pre-1987 definition. See U.S. Census of Service Industries, 1987, Appendix H for a discussion of these changes.
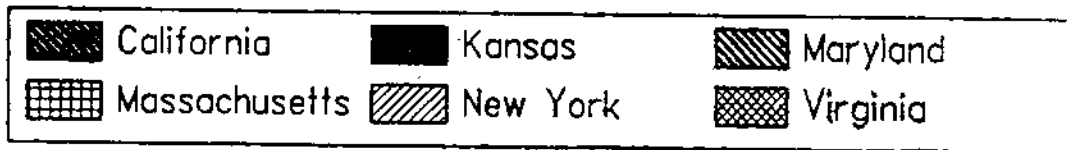
Employment Share by Location, 1986
Population

Employment Share by Location, 1986
Data Processing and Entry

Percent of Employment

100
90
80
70
60
50
40
30
20
10
0

metro   adjacent   nonadjacent

Location by Type of County

	California		Kansas		Maryland
	Massachusetts		New York		Virginia
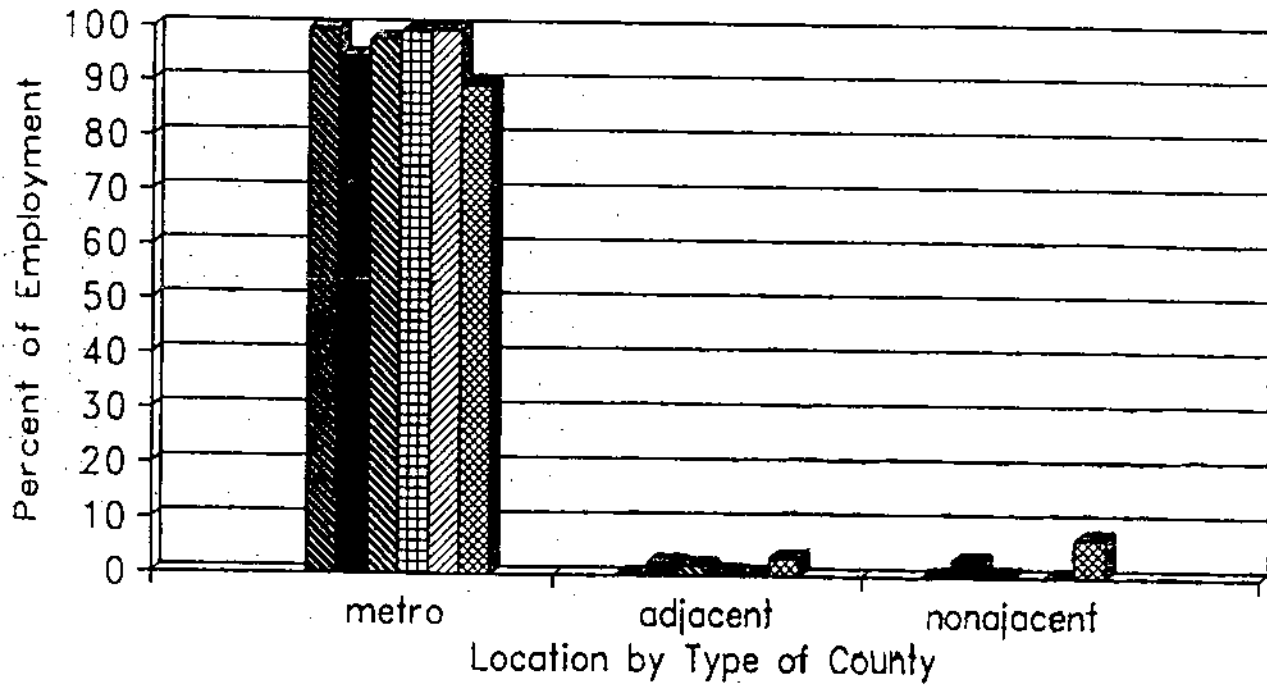
Employment Share by Location, 1986
Computer Services, NEC

Percent of Employment

100
90
80
70
60
50
40
30
20
10
0

metro   adjacent   nonadjacent

Location by Type of County

- California
- Kansas
- Maryland
- Massachusetts
- New York
- Virginia
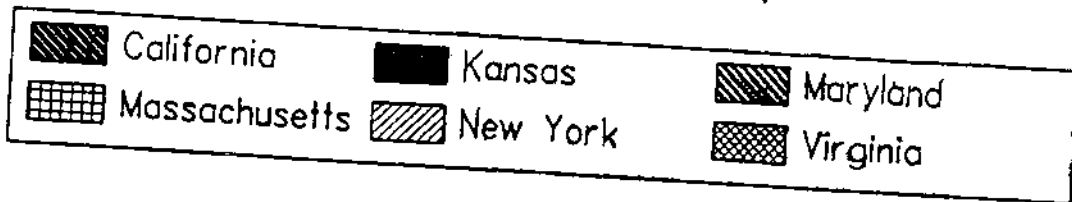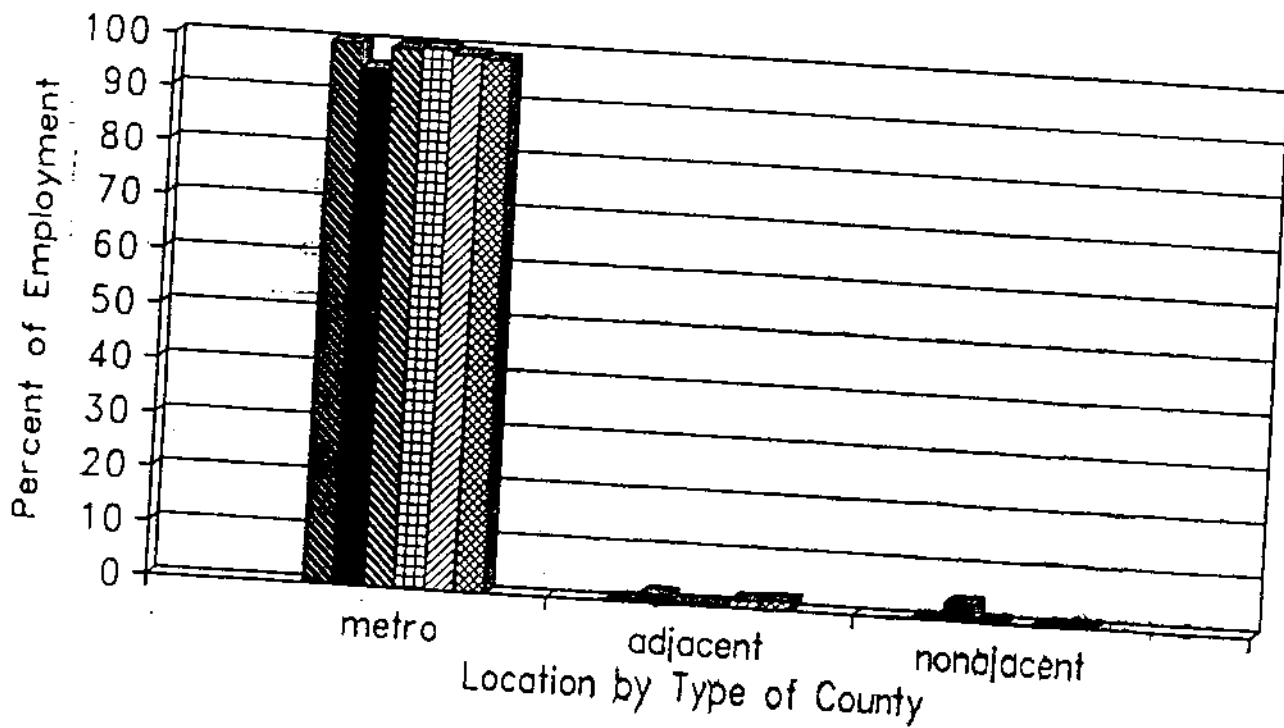
Characteristics of Rural Computer Establishments

Although SIC 7372 is dominated by independent establishments, rural businesses are more likely to be independently owned than urban establishments (see Table VII - 2). As shown in Table VII-2, there are exceptions, with rural and urban areas in Maryland having nearly equal shares of independent establishments.

While establishments in this industry are small, rural firms tend to be smaller than the state-wide average (see Table VII-3). Again, there are exceptions in the study states. In particular, rural establishments in Maryland and Virginia - the two states with large rural data entry operations - are larger. (see Table VII-3).

Table VII-1

Total Number of Establishments and Employment in Rural Counties, Computer Services, SIC 737, 1986

	California Est Emp	Kansas Est Emp	Maryland Est Emp	Massachu. Est Emp	New York Est Emp	Virginia Est Emp
Programming	3 165	18 198	9 326	14 110	34 221	29 483
Entry/Processing	8 38	15 106	3 263	5 57	13 87	8 447
Not Classified	13 46	9 20	8 35	5 26	23 569	16 88

Source: University of Maryland analysis of Dun and Bradstreet Data, 1986

Table VII-2

Percent of Establishments in Independents, Comparison of Rural and All Establishments, Computer Services - SIC 737, in 1986

	California Rural All	Kansas Rural All	Maryland Rural All	Massachu. Rural All	New York Rural All	Virginia Rural All
Programming	78.1 77.4	77.8 75.6	66.7 67.1	85.7 73.6	94.1 82.8	82.8 60.7
Entry/Processing	87.5 61.9	80.0 61.4	33.3 56.5	80.0 54.2	76.9 77.3	87.5 59.5
Not Classified	100.0 80.9	100.0 81.0	75.0 72.8	100.0 81.0	95.7 77.8	81.3 68.1

Source: University of Maryland analysis of Dun and Bradstreet data, 1986

Table VII-3

Mean Establishment Size in Rural Counties and All Counties
Computer Services, SIC 737, 1986

	California Rural All		Kansas Rural All		Maryland Rural All		Massachu. Rural All		New York Rural All*		Virginia Rural All	
Programming	5.2	16.4	11.0	21.2	36.2	23.7	7.8	21.2	14.9	6.5	16.7	35.5
Entry/Processing	4.8	37.1	7.1	28.6	87.7	73.1	11.4	38.9	6.7	49.0	55.9	46.2
Not Classified	3.5	14.1	2.2	7.6	4.4	15.7	5.2	20.5	24.7	24.7	5.5	13.4

Source: University of Maryland analysis of Dun and Bradstreet Data, 1986

Computer Programming in Rural Economies

To understand underlying trends in the location of computer programming firms, and in particular any nascent tendencies to decentralize, we undertook a telephone survey of 28 establishments in SIC 7372. The establishments were identified from the Dun and Bradstreet data, which provides information on line of business, exact address, and phone number.

Recall from Table Vll-1, above, the total population of rural computer programming businesses in the six study states was only 107 in 1986, thus we achieved a coverage rate of approximately 25 percent. The sample is biased towards survivor firms, those in existence in 1986 and still operating in early 1991. The dissolution rate for these operations is high, with more than 50 percent of the contacted establishments out of business in 1991. The profile then is of successful rural computer software businesses.

The interview questions centered on the reasons for the choice of business location, advantages and disadvantages of a rural site, and the location of markets. The underlying theoretical framework was that (1) computer services are export oriented services that can provide an independent source of income growth for rural communities and (2) improvements in telecommunications technologies, desire for the rural lifestyle, and the growth in military spending which benefits rural communities and stimulates market demand for computer software would accelerate the decentralization of computer programming services.

Results

Our research shows the activities of these firms include the writing of software programs for sale to manufacturers, government, utilities, and banks. A number of the establishments subcontract to larger firms, such as IBM and Data General. For example, one rural firm acts as a subcontractor providing computer graphics for other software developers. Client - rural firm interaction can be taken care of by telephone, facsimile, or a single meeting. With one exception, the tasks were high skilled. The one low-skilled operation involved the copying and packaging of software programs, developed in the firm's Atlanta branch.

The results, presented in Graphs VII-5 through VII-10, indicate the importance of noneconomic factors. The majority (nearly 75 percent) of the entrepreneurs selected rural areas because it was their hometown or because the area offered a high quality of life. Proximity to a university and to market were other draws for software development and programming firms. The markets referenced here were, in all three cases, military bases. The reason in the "other" category included proximity to a high quality printing company. This was the business, mentioned above, that packaged or "manufactured" rather than developed software.

The view that quality of life issues are important for rural entrepreneurs are reinforced. Nearly 61 percent of the respondents stated an improved quality of life was the single most important advantage of their location. Several respondents, one as far away as California, reported moving from away New York City, seeking a cleaner and quieter atmosphere. One quarter of the respondents felt a captive local market or lack of competition was the single most important advantage. Firms noting a captive market were either serving the military or local businesses. For example, one entrepreneur appreciating the uncompetitive local market was the only businesses helping local firms implement and adapt specialized accounting and inventory software.

While 46 percent of the firms interviewed reported no disadvantages associated with their location, 32 percent described isolation from both industry
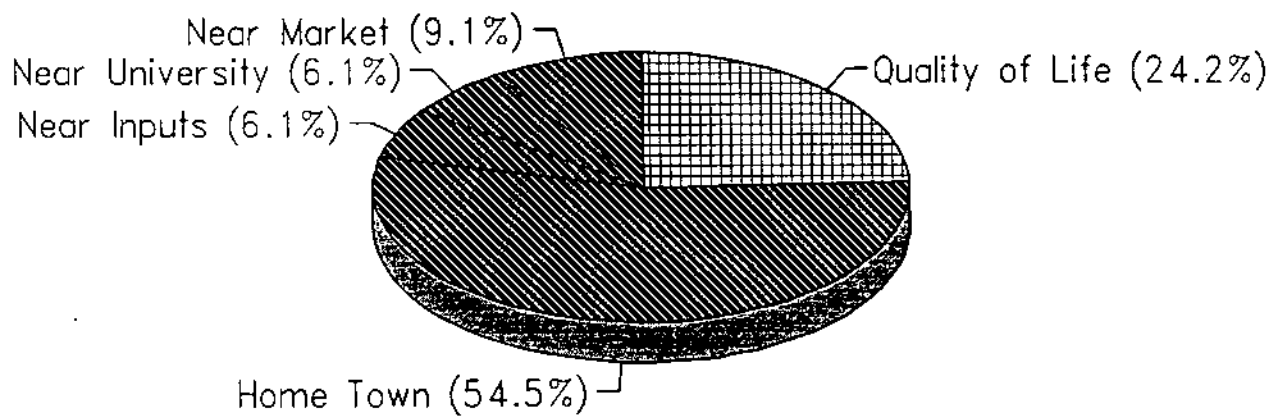
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innovations and airports as handicaps. Only 7 percent cited lack of skilled labor, a commonly assumed shortcoming of rural locations. The lack of importance to access to skilled labor can be explained by the fact the firms are small and do not hire many additional technical workers. Eleven of the twenty-eight establishments had 4 or fewer employees. Secondly the firm that did hire a larger workforce (20 employees) was the one "manufacturing" rather than development software mentioned above. This workforce carried out relatively routine tasks.

As expected, the majority of firms in this industry are export oriented. More than 75 percent of our sample served markets outside of the local region. The business supplying local markets fell into two categories: computer firms serving local military installations or small firms providing computer sales, installation, consulting, and software development for local small businesses. Interestingly, several of the firms in the later category talked of having to create a local market for computer services.

Although we suspect export oriented firms are more likely to note disadvantages to a rural location, this was not the case. Nearly the same percentage, 46 percent, claimed there were no disadvantages associated with a remote location.

Reason for Selecting This Location
Interview with 28 Establishments

Near Market (9.1%) —

Near University (6.1%) —

Near Inputs (6.1%) —

— Quality of Life (24.2%)

Home Town (54.5%) —

Location of Markets
20 percent sample

International (32.1%) —
Local (21.4%)
State (14.3%)
National (32.1%)

Disadvantages of Location
20 percent sample

Isolation (32.1%) ⎯

Limited Market (14.3%) ⎯

⎯None (46.4%)

⎤Lack of Skilled Labor (7.1%)
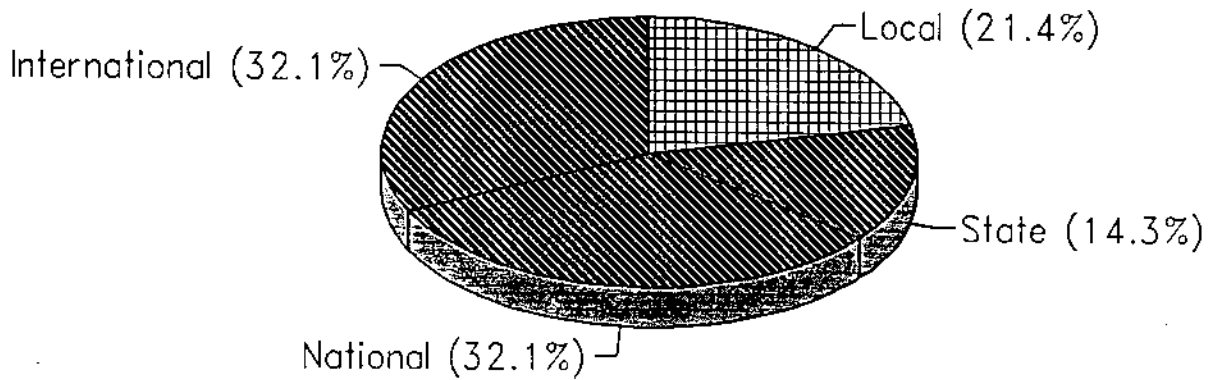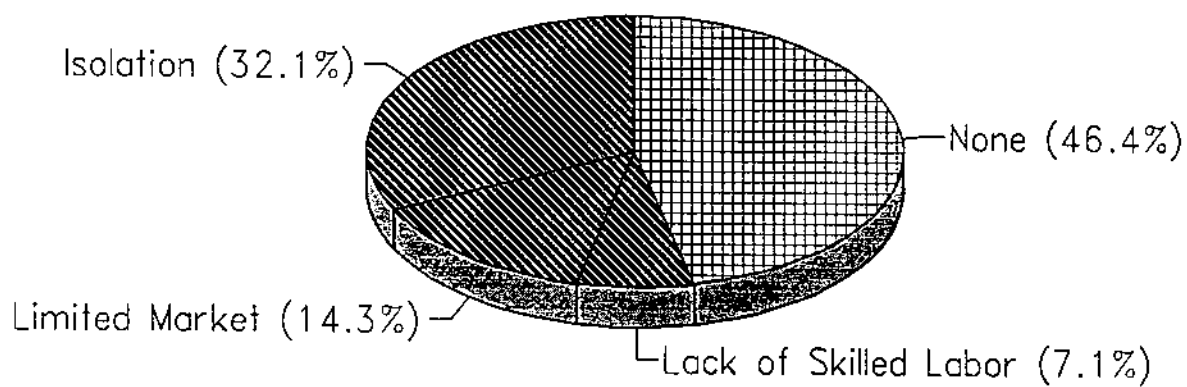
Disadvantages of Location
Export Oriented Firms Only

Lack of Skilled Labor (9.1%)

Limited Market (13.6%)

none (45.5%)

Isolation (31.8%)

n: 2
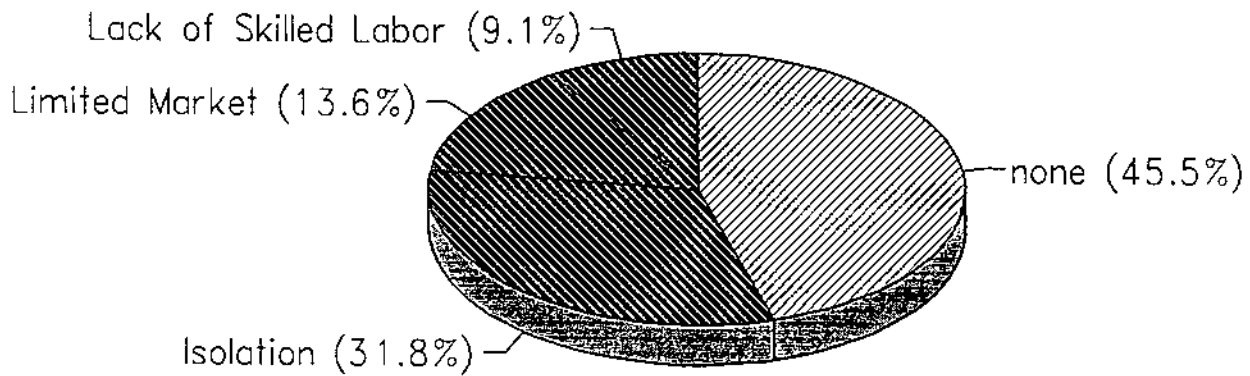
Advantage of Location
20 percent sample

Labor Force (14.3%)
No Answer (0.0%)

Captive Market (25.0%)

Quality of Life (60.7%)
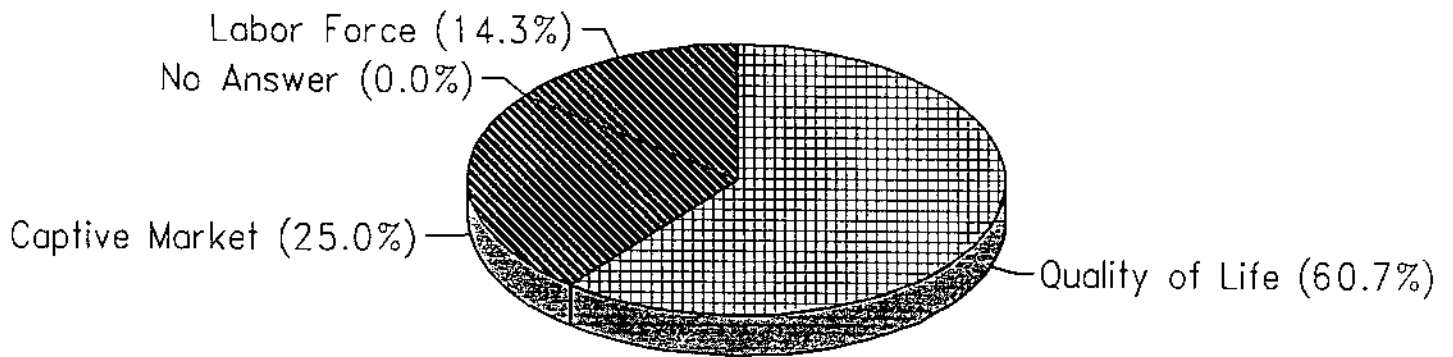
Plans to Relocate
20 percent sample

Yes (3.6%) ⌐

No (96.4%)
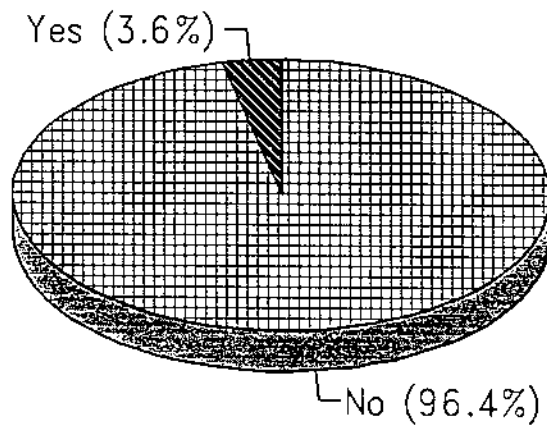
Implications for Rural Development Policy

These results offer little encouragement to rural counties already experiencing the large employment losses, particularly agriculture, mining, and poverty counties. The counties most likely to attract high technology services are those hosting a military base or university, or those possessing natural amenities and already capable of attracting tourists and retirement populations.

Rural development and telecommunications scholars (Parker et. al.) debate the extent to which telecommunications is a facilitator of rural job growth. These interviews indicate that telecommunications technology is not capable of leading growth, but when a rural site is desirable for other reasons - a home town or a high quality of life - the revolution in communications technologies makes a distant site feasible.

Data Entry and Processing in Rural Economies

Firms in the data entry and processing industry are the larger rural employers and provide an important source of employment in a number of remote rural counties. In fact, with 1800 rural workers, the rural based Appalachian Computer Services is the largest American employer of data entry workers. Industry location decisions are, for the most part, motivated by the calculus of economic rationality, and at present rural firms have a sold market niche in quick turnaround jobs, especially those keyed from handwritten documents.

In spite of current market strength, the long run prospects for rural data entry jobs are in question. Near term technological change will facilitate the offshore transmission of documents to be entered into machine readable form and telecommunications investments by a number of low wage countries will speed the return of completed jobs. Both of these changes will reduce the competitive advantage of rural firms. Furthermore, rural data entry firms tend to be undiversified and located in rural areas for one reason, a low wage - hard working labor force. As the industry continues to reduce its labor input, the rural advantage will deteriorate.

The analysis of this industry is based on on-site and telephone interviews with rural, urban and suburban data entry and processing firms in six states; offshore data processing facilities in Barbados and Europe; telephone interviews with data entry and data processing firms; telephone interviews with producers of telecommunications, optical scanning and imaging equipment; and secondary source material[3].

Barbados was selected as an offshore case study site because of its successful and active government program to attract data entry operations. As of December 1989, the Barbados Industrial Development Corporation had subsidized ten foreign data entry firms with a total of 1,200 employees. I interviewed producers of telecommunications, optimal scanning, and imaging equipment, to understand the current and near future state-of-art technologies relevant to this industry.

Rural Data Entry and Processing Firms a National Context

Differences between the activities of rural and urban establishments, in this industry, highlight the role rural economies play in the national economy. The spatial division of labor model is a useful point of departure (Lipietz 1982, Storper and Walker 1986, Scott 1988). Urban firms in this industry provide non-routine, knowledge-intensive services. Although most of these high level computer services are labor intensive, the need for face to face contact with clients and highly trained labor necessitates an urban location. Rural firms tend to conduct the low end functions, labor-intensive but low-skilled data entry. Unlike the traditional spatial division of labor model, there is no evidence of industry deskilling and decentralization. Instead, firms within this industry are moving towards vertical specialization, or the offering of new and more specialized services which require more intense company - client interaction. Not only are jobs in this industry unlikely to vacate urban centers, but offshore firms are making inroads into the traditional rural data entry business. As a consequence, there is no evidence this industry will be a

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[3]For a list of the on-site and telephone interviews, see the appendix.

major source of rural jobs in the coming decade.

The rural establishments in SIC 7374 dominate the data entry portion of the business and are relatively undiversified, with their products limited almost solely to data entry services. Where an urban establishment employed data entry workers, this activity is supplementary to other lines of business or was a declining proportion of the operation over time. Urban establishments are simply not competitive in most of the data entry business, due to the labor intensive nature of data entry and higher urban than rural labor costs. Urban firms with data entry operations complain about the difficulty of retaining urban workers. Data entry work is tedious and stressful, requiring long hours at a video display terminal (VDT). Consequently, urban turnover rates are high. Rural locations circumvent this problem. Managers of the rural firms noted a lack of competition from urban data operations.

Saztec, is a data entry firm, with an urban presence in Dayton, Ohio and Kansas City, Missouri. The company has additional facilities in Manila, Philippines; and Adrossan, Scotland. The Dayton facility hires only 5 data entry workers for jobs too small to send overseas. The Kansas City facility hires 180 workers to do complex keying tasks requiring close contact with clients to check specifications or questionable data. This facility also handles tasks requiring 24 hour turnaround. However, the major share of Saztec's data entry work goes off-shore (Hamilton 1990).

Urban firms, in this SIC code, are more likely to earn the major share of their revenues from data processing and computer related software development. While software development would usually be classified under SIC 7372, all firms classified under SIC 7374 had either data processing as its main line of business or started as time sharing or data entry/processing establishments and had recently branched into new lines of business.

Critical for understanding the current role and future of rural economies in the computer services industry is the limited number of functions performed by rural firms. While rural establishments tended to be almost solely dependent on data entry activities, urban establishments generally operated several lines of

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business. For example, one small suburban firm started as a data entry business, but now earns the largest proportion of its revenues from a contract to maintain computers in a local school system. Automated Data Processing (ADP) is the second largest data processing company in the U.S. with $1.4 billion in sales in 1987. ADP's traditional line of business is payroll and tax processing. However, ADP is moving away from simply processing payrolls into the provision into more specialized services, such as tax consulting combined with payroll processing. Other firms in this Standard Industrial Code, such as CSC and General Electric began as time-sharing companies. With the introduction of personal computers in the early 1980s, time sharing companies branched out to offer other specialized software and computer systems development services. The industry journals confirm that these patterns are typical across the industry. Data processing firms are moving towards vertical specialization, or the offering of new and often more specialized services to existing clients (Fersko-Weiss 1987; U.S. Congress 1987).

Will Urban Establishment Decentralize?

As telecommunications technologies improve, data processing, at first glance, may appear to be an industry ready to disperse. Our results indicate this is not the case. The trend towards more specialized services, increasing skill requirements, and diversification is anchoring these firms to urban areas even more than in the past. Specialized services require close proximity to customers and a highly trained labor force. Both factors imply a continued and increasingly strong attachment to urban areas. ADP provides a good example of a business that could conceivably move some of its operations to rural areas. An ADP client delivers payroll time sheets by courier to the ADP plant or the information is sent over telephone lines into the ADP computers. ADP processes the information and prints the employee paychecks, which are then delivered by courier to large and small customers. Therefore, at present proximity to markets is crucial. The equipment for printing checks is still too expensive for individual employers to purchase. However, as the price of this technology

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drops, the printing could eventually be done at the customer's site, further reducing the need for spatial proximity between the data processing firm and its customers.

However, recent changes suggest firms like ADP will not be free to decentralize. Because ADP is moving away from simple data processing and towards developing solutions to specific client needs, proximity to clients is more important than ever. Moreover, since data processing is not a labor intensive, low skilled operation, the company is not disadvantaged by its urban location. Again, secondary sources confirm an industry-wide movement away from routine services towards more specialized jobs, and thus a greater need to be located in urban areas. For example, in February 1990, Nippon Telephone and Telegraph Corporation announced plans to open its first overseas data center in Jersey City, New Jersey. "Locating in Jersey City makes excellent business sense," said Mr. Tamura, noting that it gives the company "unbeatable access to the largest potential clients" (Armbruster 1990).

In short, these urban firms tend to be highly client oriented and clients are concentrated in urban markets. As a reason for an urban location, client orientation was ranked above access to a skilled labor force. In fact, for large contracts, computer services companies will open a new branch and pay to move highly skilled employees to remote areas in order to be near a prominent customer. This is not an unusual scenario when the client is a remote military base. As the industry moves towards more specialized software solutions, this industry is likely to be more anchored in urban areas, rather than less.

How do Data Entry Firms Operate in Rural Areas?

While there is variation across firms, for the most part information to be translated into machine readable form is delivered in hard copy by the U.S. Mail, Federal Express, or courier. All of the firms run their own courier service from the major surrounding metropolitan areas and airports. The data is entered into machine readable form, by a mostly female labor force. The data are keyed in and verified manually at computer work stations. The completed jobs are then

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returned by telephone line to the client or in tape form or disk via courier, U.S. Mail, or Federal Express. ACS the largest company transmits 99% of their final product through the phone lines. The smaller companies are more likely to ship the tape. Some examples of work carried out by these firms include the keying of publisher mailing lists, doctors' patient records, appliance warrantee information, medical claim forms, credit card receipts, data bases, and book manuscripts.

The Location Decision

Rural data entry firms are located in remote rural locations; ACS is a two hour drive out of Lexington, Kentucky; TDEC is situated in Oakland, Maryland approximately three and one-half hours outside of Washington, D.C. Highland Data is in Blue Grass, Virginia, approximately two and one-half hours outside of Roanoke in the Allegheny Mountains.

Moreover, these are not small operations. ACS is the largest data entry firm in the U.S., with approximately 1800 workers. All of the above firms employed more than 50 workers in each of their rural facilities.

In all instances, sites were selected for their labor force characteristics, low wages and labor availability. Remote sites not only offer a hard-working low cost labor force, but distance from manufacturing. Proximity to manufacturing, which is higher paying but cyclically sensitive, can lead to high quit rates during upswing of business cycle.

Three examples illustrate the process by which a rural location is chosen. Highland Data was started by a women whose husband worked in the data processing industry, and who, through this connection assessed demand for data entry services. She was familiar with Blue Grass, Virginia as a vacation spot. The recent closure of a nearby sewing factory suggested an available labor force and the closure of a public school provided a potential facility.

ACS, began providing data management and processing for a local county's tax bills. After years of struggle and an insufficient market for data management and processing services, the company backed into the area for which there was

great demand and the company was particularly competitive - data entry.

A third example is a siting of a firm's back office function in a remote rural location. The owner of Rosenbluth Travel Agency, Inc. a large Philadelphia based travel firm saw a feature on the evening news in 1988 about the hardships of North Dakota farm families. He was facing difficulties in hiring data entry workers in Philadelphia, and he asked his staff to make inquiries in North Dakota about placing a temporary data entry facility there. With the help of the local development officials, Linton was selected because of its economic need and the availability of a facility. The arrangement has turned out to be so profitable for the company that, what was originally intended as a temporary arrangement has evolved into the permanent hiring of approximately 50 data entry workers (Leistritz and Ekstrom 1989).

None of these companies were started by individuals seeking a rural lifestyle. In fact, most owners do not live in the rural community, but in the metropolitan areas. Managers and industry observers claim demand for data entry services is strong, and all of these firms have recently expanded and/or are currently considering expansions.

Advantages of a Rural Location

Although, wage rate differences between rural and suburban areas are important, the key to a rural location is reliability of the workforce. Labor quality and not simply low wage levels is the major reason firms are attracted to rural locations. Data entry jobs rarely have long running contracts. Rather each job is fixed in length and must be done correctly and on-time or clients will go elsewhere for their next job. This means that labor force reliability is key. According to one manager, "We don't get a second chance to do the job right."

In Virginia, hourly wages for low-skilled workers are the same in rural and urban Virginia. Rural workers are considered more dependable. Reinforcing the importance of a captive and reliable work force, one manager argued unions pose a threat primarily because of the increased potential for walkouts and strikes.

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Higher wages accompanying unionization were considered secondary concerns.

Most data entry jobs begin at the minimum wage. Salaries begin at the minimum wage of $3.80 an hour in Kentucky and Virginia, but are higher in Maryland. In April of 1991, the minimum wage will increase to $4.25 per hour. Overtime, management anticipates adjusting to the higher wage bills by replacing labor with technology or by shifting more of their work offshore.

Wage rates are determined by worker productivity, measured by keying stroke speed and accuracy. For example, in one firm the average wage is $5.80 an hour with a few workers earning as high as $16.00 an hour. Fringe benefits include paid holidays, vacations, and health insurance. Since the job centers on rapid and accurate key boarding, it is not surprising, the labor force is primarily female. Many work part-time with the part-time full-time split varying by firm. Part-time work serves both the needs of the firm and in some cases, the needs of the employee. Since contracts are generally short term, but require rapid turn around, labor demand can vary substantially. Part time workers give the firm flexibility in meeting fluctuations in contracts. While many workers prefer full-time work, others claim part-time work better meshes with the demands of a family. Shift work is not uncommon, since night work permits faster turnaround. A job can be delivered in the evening and be returned to the client the next day.

Disadvantages of a Rural Location

Managers mentioned a number of disadvantages to a rural location. An initially surprising disadvantage mentioned by all firms was the difficulty of acquiring additional labor after start-up. All firm managers indicated that the rural labor pool was rapidly tapped; expansions had to be satisfied through the opening of branch operations in nearby towns. Three of the four companies opened one or more branches to meet additional demand. A fourth company operated a sister establishment off-shore.

Another disadvantage mentioned often is distance from clients. Sales and marketing functions require frequent face to face contact with current and potential clients. Two of the four companies have dealt with this problem by

having sales offices in metropolitan areas. However, even in these cases managers mentioned the difficulty of bringing a prospective client to the site to see the facility. For a third, the smallest firm, a sales representative makes frequent calls on firms located in the metropolitan area.

Distance from other professionals in the field was also mentioned as a disadvantage. Keeping up with the latest competition, changes in technology, and changes in the market are more problematic when contacts with others in the industry are limited to a once-a-year professional meeting. Remoteness is more serious than some managers recognize, as many were unaware of new technologies pertinent to the data entry and transmission business.

The absence of broad band telecommunications technology was *not* considered a major disadvantage by the interviewed rural firms. While rural data entry firms shipped the major share of their data on tape or diskettes, all but one transmitted some information by telephone lines back to clients. Traditional telephone service with copper wiring is the norm in these communities. The largest rural company was an exception, with one dedicated fiber optic link-up from their rural headquarters. These findings contradict claims that fiber optic cables and digital switching are a necessity for rural participation in the new information economy. Enhanced telecommunications infrastructure permit the faster and clearer transmission of voice, video and data information. And while these advances are mostly likely critical to the future competitiveness of rural computer services firms, they are not key to the current day to day operations. We discuss this issue in more detail below.

The Future of Data Entry Work in Rural Areas

Rural areas existing competitive advantage lies in the data entry business. However, in-house data entry, optical scanning, point of transaction data entry, and off-shore data entry all pose massive change for the industry and potential threats to the competitiveness of rural data entry operations.

In-House Data Entry

Industry wide trends suggest the outsourcing of data entry is becoming

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increasingly common as data users are faced with cost cutting pressures as a result of increased foreign competition and the current economic downturn. According to one manager, a client recently began outsourcing to reduce costs associated with fringe benefits paid to in-house data entry workers. The company offered a generous benefit package to the high skilled workforce in order to attract them to the firm. This same generous benefit package filtered down to low wage and low skilled data entry workers. In a move to cut costs, the company found it cheaper to eliminate their own data entry workers and outsource to a rural data entry company.

Insurance companies, medical institutions, and manufacturers are increasingly looking outside their companies for specialty computing needs. Recent trends indicate banks, in particular, are abandoning their in-house data processing operations and turning to outsourcing. Insurance companies and the medical industry are expected to follow suit. One bank reports savings of $1 million a year in computer related costs after outsourcing their data processing tasks (Fersko-Weiss 1987). A slowing economy is expected to accelerate the trend towards outsourcing of both data entry and data processing facilities.

Barcoding and Optical Scanning

The development of optical scanning is sidestepping manual data entry entirely. Innovation in bar coding technology has eliminated the need for vast numbers of manual data entry workers. Nonetheless there are an immense number of tasks that do not lend themselves to bar scanning.

Optical Character Recognition technologies permit the mechanical translation of documents into machine readable form. However, the technology, as it is currently configured has limitations. First, scanning documents with font changes results in error rates above 10 percent. One rural firm claimed that it can key in a document and verify it faster and cheaper than it can be mechanically scanned, edited, and corrected. Although this company purchased costly scanning equipment, the machinery sits idle.

Second, scanning technologies are limited in their ability to read hand

written entries. Machines with Intelligent Character Recognition (ICR) have been designed to read hand written documents, but error rates currently run about 50%. This error rate is too high to make ICR use economically feasible. Experts suggest, barring an unforeseen technological break through, the accurate machine scanning of handwritten documents is still more than ten years away.

Third, scanning technology is expensive and in many cases must be designed specifically to read the document being entered. Because most data entry jobs are short term contracts, rarely does one job justify the cost of a specially designed scanner. Estimates are that most commercial scanning equipment costs in excess of $25,000 for both hardware and software. One of the firms interviewed does use scanning technology. This company has a long running contract with a number of banks to translate credit card receipts into machine readable form. The scanner reads customers credit card numbers, but the amount of purchase and date, which are handwritten, are key punched manually. For the foreseeable future, as long as optical character recognition technologies are limited to type set documents and even then not all type script documents, there will continue to be a market niche for manual data entry.

Finally, data entry companies are now finding that the scanning equipment cannot be adopted as easily as anticipated because its implementation requires a complementary high-skilled labor input. Firms adopting scanning technologies have found the equipment cannot be successfully operated in regions of the world lacking a highly trained computer literate labor force. Scanning operations require programmers to set up the scanning process; programmers to write the software specific to each job; and technicians who can handle equipment maintenance and breakdowns. According to one firm, future data entry work will be limited to regions of the world with a skilled labor force, which will not necessarily exclude all Third World countries. For example, Saztec has found the skills necessary in the Philippine labor force, although not without some difficulty.

Point of Transaction Data Entry

Increasingly, information is entered into machine readable form at the point of transaction, displacing the demand for key entry workers. For example, merchants are moving to credit card transactions where the information is entered into the computer at the point of sale.[4] Doctors are submitting medical insurance claims on computer disks, and many courts have switched to recording legal cases directly into computer readable form. These changes reduce demand for manual key entry. At the same time, the demand for data in machine readable form is growing as information flows between industries intensify and computers are applied to new situations and problem solutions. Industry observers have yet to quantify the net impact of these two contradictory trends. Nonetheless, in the longer run most predict the need for data entry workers will decline.

Off Shore Data Entry

The most immediate danger to rural data entry firms is off-shore data entry. This threat captured national attention when American Airlines closed its data processing facility in Tulsa, Oklahoma in 1984 and moved to Barbados. Barbados, Jamaica, Ireland, Philippines, Taiwan, Sri Lanka, and China are all now attracting data entry jobs from the U.S. Estimates are that between 1980 and 1985, 40 companies in the U.S., Japan, and England have sent their data entry work overseas. Barbados alone has attracted eleven data entry operations in the last decade.

Rural Data Entry in the International Market

A primary attraction of offshore data entry is labor availability and low wages. The Office of Technology Assessment estimates off-shore wages range from one-fourth to one-fifth of U.S. wages, with the lowest wages found in Asia. This ratio holds true when comparing foreign wages with rural labor as well. Barbadian data entry operators, for example, earn an average of $2.55 an hour, compared to a current minimum of $4.25 in rural areas of the United States. In

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[4] Sales slips that look like a cash register receipt rather than a credit card receipt are generally point of sale data capture.

the case of American Airlines, approximately 900 pounds of used airline tickets are delivered daily by air to Caribbean Data Services, an American Airlines Subsidiary in Barbados. Employees sort the tickets and enter information into computer terminals. American Airlines estimates that, with all costs included, salaries are about $6.00 an hour less in Barbados than in the U.S.

Another equally important advantage of off-shore operations over a rural American location is the availability of labor. Barbados, as well as other Third World countries, offer large pools of unemployed and underemployed labor. Therefore a single plant is not constrained from achieving technological economies to scale. One American firm operating in Barbados claimed they opened a branch in this Caribbean country not only for the lower cost of labor but for the larger qualified labor pool. The company operates in several rural communities in the United States. In recent years, attempts to expand in those rural locations resulted in the tapping of a poorly educated, less reliable labor pool.

As noted above, even allowing for the wider commuting sheds for rural workers, managers of data entry facilities in rural areas of the U.S. find that the labor pool is tapped relatively quickly. Expansions then require a new facility in another town, with all of the inherent expenses of duplicating infrastructure.

Most observers agree foreign workers are as reliable and accurate as rural workers in the U.S. While competitors in the data entry industry are not limited to English speaking countries, the major competitors remain in the Caribbean, with Barbados and Jamaica attracting the greatest numbers of jobs. In addition, to being native English speakers, Barbados and Jamaica have high literacy rates. The illiteracy rate in Barbados is only .7 percent, lower than that of the U.S. The illiteracy rate in Jamaica is only 3.9 percent (Pelzman and Schoepfle 1988). All of the off-shore firms interviewed reiterated satisfaction with the skills and work ethic of the local labor force.

Although English speaking counties have an advantage, China is also providing data entry services. For example, Pier 1 Imports uses Chinese labor to input catalogue lists.

The lack of minimum wage laws and stringent worker safety restrictions are additional attractions for firms moving overseas. The more lenient environmental regulations are not as much an issue for the "cleaner" service industries as for manufacturing. Health benefits are socialized, further reducing costs to business.

Rural Market Niche

While labor costs in third world countries are substantially lower than rural wages in the U.S., rural data entry firms still hold a competitive market niche. The turnaround times for off-shore jobs is longer, usually about one week. While estimates on the turnaround time from foreign data entry sites vary, most off-shore data entry falls into what is called "retrospective work", work that can wait for two weeks (Myers 1986). The quickest turnaround possible from Asia is five days. The quickest turnaround currently possible from the Caribbean is 48 hours. Rural sites can return data in 24 hours when necessary.

Fortunately for rural firms, at present the market for quick turnaround jobs is robust and growing. For example, Nexus/Lexus a major user of data entry work in the creation of their on-line legal data base now requires quicker job turnaround than in the past. When Lexus had a monopoly in the legal data base business, delays in putting court decisions on-line were not a problem, and much of their work went to the Philippines. Competition from other providers, now requires that Lexus have legal decisions on-line within 24 hours. Consequently, data entry jobs no longer are sent off-shore. For quicker turnaround, rural domestic firms are more competitive. In a second example of the strength of domestic relative to foreign production, one rural headquartered company, ACS, recently closed its Jamaica branch because it lacked a sufficient volume of work permitting more than a 24 hour turn-around time. While the present market for domestic manual data entry is strong, the best predictions are that off shore data entry poses a serious threat in the 1990s.

Foreign Competition in the 1990s

In the longer run, innovations in imaging technology and massive investments in state-of-art telecommunications technologies threaten rural America's data capture market niche. The deficiencies of rural telecommunications technologies have been discussed in earlier chapters and elsewhere (Parker et. al. 1989). Using current copper cable lines, data transmission is slow and relatively costly. While the smaller rural firms primarily rely on Federal Express, couriers, and the U.S. Mail service to deliver the data, some smaller firms also use telephone lines. These communication linkages were not considered barriers to developing new markets or expansion. However, as more sophisticated linkages become common, these rural firms could be put at a technological disadvantage.

At present, the cost of installing points of presences[5], satellites, or fiber optic cables that bypass local telephone lines are beyond the budget of all but the very largest private firms. At the same time rural areas are lagging in telecommunications investments. Foreign governments, particularly in Barbados and Jamaica, are undertaking massive investments in telecommunications technologies in an aggressive attempt to attract U.S. data entry firms and orders.

Over the next decades, companies operating abroad will be increasingly competitive in the data entry business for jobs requiring short turnaround time. The speed with which off-shore data entry dominates the market depends on improvements in imaging equipment. When data can be imaged by satellite or telephone line across long distances, off-shore sites will offer as quick turnaround as rural areas in the United States.

Document Imaging

Imaging technologies permit the scanning of pictures which can then be transmitted by cable or satellite, over long distances. Facsimile machines are

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[5]A point of presence is a privately provided tie in to the international fiber optic network.

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the most common example. Data entry workers in remote sites can then read the material directly off of a computer screen or hard copy and enter it manually into machine readable form. At present, the delays and costs of transferring hard copy information to overseas data entry sites curbs the off-shore movement of data entry work. Imaging technology that enables the quick, accurate, and inexpensive transmission of pictures will shrink delays to the hours required to send an image, key punch the data, and return the data on-line. High speed imaging would also dramatically reduce document transport costs.

Rapid transfer of documents through telecommunication channels will eliminate the "quick turnaround" advantage of rural firms and displace jobs in rural America. At present imaging technology is expensive and slow, and most data entry firms still transfer the hard copy. However, several firms are experimenting with scanning and the on-line transmission of images. One alternative currently being tested by some U.S. firms is to transfer document images to computer tape in the U.S. and ship the tape abroad, thereby saving the mailing or document transit costs. The larger firms are also retooling domestic sites to become centers for collecting documents and imaging them to tape or over dedicated high speed lines to branch operations in the Caribbean. The keyed documents are then returned directly to the client. If this technique spreads, rural data entry would become uncompetitive. Smaller rural data entry firms that cannot afford the technology or a Caribbean facility could be put out of business, along with U.S. workers.

At present high speed imaging technology is too costly for all but the largest of data entry firms. One firm manager estimates that the cost of purchasing document scanning, sending, and receiving equipment to the Caribbean is $85,000. However, industry researchers believe imaging equipment will follow the path of all computer technologies, enhanced speed and quality accompanied by falling price. Projections are that within the decade, high speed document imaging will be feasible on a large scale. Once this occurs, the market niche for rural firms - quick turnaround - will disappear.

Investments in Telecommunications

A number of Caribbean countries are making massive investments in telecommunications technologies in order to attract the more routine U.S. services, such as data entry and telemarketing. In 1988, a joint venture between ATT, Cable and Wireless PLC of the United Kingdom, and Telecommunications of Jamaica invested $8 million to install image transmitters and satellite transmission at Montego Bay (Thurston 1990). The station now offers digital international long-distance, 800 number services, and switched and dedicated high-speed data circuits up to 1.5 megabytes. Barbados External Telecommunications (BET) provides direct access to the global space communications system via earth station to satellite and a microwave link to communications networks to the U.S. and the Atlantic underwater cables. BET also leases fiber optic dedicated lines with digital switching to companies that required continuously available circuits, such as data entry companies. While only a few of the local companies currently take advantage of returning data by telecommunications, lack of telecommunications access is not a barrier to further growth. These communications links are quickly surpassing the links available between urban and rural regions of the United States and further threaten the ability of rural areas to hold onto these jobs.

The Rural Response to Changing Markets

Several firms are already adjusting to the changing market. One firm is moving into ancillary lines of business, such as document management and storage, and simple data processing. One example is in the credit card operations of one of the interviewed firms. Credit card sales are increasingly being entered into machine readable form at the point of sale. This company now provides a document storage and retrieval system for all of these transactions. A record of all transactions are stored on microfilm and originals are stored on-site for 120 days. For these bank clients, the records of the transactions are supplied, when a purchase is challenged by the purchaser. The company also provides clients, who purchase data entry services, simple data processing and editing

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services. For example, the company matches entry and exit data on all foreign travelers to the U.S. and has edited applications for citizenship under the Immigration and Naturalization Reform Act of 1987.

Several of these firms are adjusting by purchasing branch operations in the Caribbean. In one case, documents will be imaged at the domestic rural site and mailed off-shore for key punching. A second firm is purchasing imaging technology that will transmit 18,000 pages every 24 hours to a branch in Jamaica. According to the Vice President of this firm, the domestic operation could eventually become an document receiving and transmitting center - with the major share of key punching carried out in Jamaica.

Summary

Similar to the pattern in manufacturing, rural areas have attracted the low-skilled, labor intensive portion of the computer services industry - data entry. There is little evidence that the urban firms in the data entry/ processing industry will decentralize in the foreseeable future. A trend towards vertical specialization and the offering of more advanced, client-specific, complex services limits the prospects of spatial filtering. The capital intensive nature of data processing further limits dispersal. At the same time, advances in scanning technologies and bar coding reduce the importance of labor availability, reliability, and cost altogether. In these cases the advantages of leaving the high cost urban markets are negligible.

At the same time, rural firms are threatened by offshore data entry in countries with lower wages and solid educational systems. When information can be imaged over long distances at high speeds, rural economies will lose their market niche in this industry - less than 48 hour turnaround.

Furthermore, the one dimensional function of most rural data entry establishments makes them and their communities, vulnerable to changes in the market. Rural data processing firms are in rural areas for one reason, the labor force. Intensified foreign competition or changes in technology could easily weaken demand for the data entry services of these rural firms. Because of the

isolated nature of most of these firms and the lack of alternative job prospects, the losses will be severe for residents of the surrounding communities.

In contrast, urban establishments are more likely to operate several lines of business, thus changes in any one line are less devastating. Moreover, urban firms are centered in metropolitan markets for numerous reasons, including access to clients, the ease of acquiring skilled labor, and access to specialized inputs. Thus market adjustments are much less likely to result in a change in optimal location. In the next section we examine policies for rural communities currently dependent on data entry jobs.

Public Policies for Keeping and Attracting Data Entry Jobs in Rural Areas.

No doubt, some American firms will continue to use domestic manual data entry services, in spite of higher costs, because of a reluctance to send confidential material offshore, the small size of their data entry job, or lack of familiarity with operating overseas. Nonetheless, continued dependence on data entry is a precarious strategy for rural communities.

What action can rural communities and states dependent on this source of income take, while there is time? Rural economies will continue to hold an advantage relative to urban areas in labor intensive tasks with in activities with weak linkages to suppliers and markets. In relation to Third World countries, rural America can offer proximity to markets and a higher skilled workforce. The best alternative for rural firms is to build on the current computer skills base acquired from the data entry business and to move their labor force up the skill ladder and provide more specialized services to existing and new customers. Possibilities include editing combined with lower level data processing, mechanical scanning combined with editing, and data base management.

Reaching this new market niche will require technical assistance to the smaller data entry firms, education and training assistance, capital subsidies for the purchase of new equipment, and an investment in telecommunications linkages.

Technical Assistance

Limited technical and financial resources and distance from competitors make it difficult for rural firms, particularly the smaller ones, to keep abreast of new markets and technological change in the industry. In particular, managers of the smaller firms were occupied with delivering a quality product on-time. They did not have the staff to scope out new markets and assess new technologies. Although the manager of the smallest firm traveled to the annual professional meetings, he often felt isolated from industry innovations. When this firm's assessment of new technologies and future industry trends were compared with that of the larger companies, his sense of isolation was found justified.

Training Assistance

One commonly cited barrier to upgrading the technological base of rural areas are long standing deficiencies in the technical education levels of the rural workforce. New technologies and markets will require an upgrade in workforce skills along with production and organization changes. Hardware and software vendors generally do a poor job of providing training for managers and workers. Profit margins are modest and consequently, small and medium sized firms are unable to take on wholesale training in-house. While most studies examining the impact of education on rural development find the relationship tenuous at best, most all agree that training linked with specific jobs is a successful development strategy.

Subsidized training is not new to the majority of rural data entry firms. Most of the interviewed firms made use of federal, state, and regional training assistance during the initial phases of operation. The experience of the firms that have done some upskilling of their workforce is encouraging. ACS is particularly noteworthy here. ACS, the largest rural based data entry firm, has moved in the direction of offering editing and simple data processing services, and manual key operators have been successfully trained to master these new responsibilities.

Capital Subsidies

Low interest government loans, such as those offered by the Urban Development Action Grant (UDAG) Program in rural areas, is a proven successful means to assist firms in the purchase of capital equipment when new adoptions are cost effective. A study of the now defunct UDAG program found that for the most part rural firms used the program to obtain financing not accessible in private markets and to pay lower financing costs. While the outcome may be biased because only the successful firms were available for interview, the new equipment purchased with the capital subsidies improved business competitiveness and were critical to enterprise survival (Howland and Miller 1990, Howland 1990).

Telecommunications

The value of integrating rural communities into urban and international networks via improved telecommunications technologies is not an issue. All agree that the quality of rural education, health care, and employment could improve with better communication (Hudson and Parker 1990, Parker et. al. 1989). The issue is whether the costs of supplying each rural location with fiber optic cables and digital switching are justified by the benefits, and the answer for many communities is no.

One option suggested by Rowley and Porterfield (1991) is a demonstration project based on the Nordic telecottages, where selected communities receive enhanced telecommunications linkages. These initial experiments could be carried out in communities with a track record in computer based industries, such as those examined in this study. Access to fiber optic cables, digital switching, or satellite links will not insure jobs remain in rural areas, nonetheless rural data entry operations cannot remain competitive in the face of antiquated telephone lines and electronic switching. Moreover, these are communities with exposure to and experience with computers, and thus are likely to be the most receptive to technological innovations.

Implications for Models of the Spatial Division of Labor

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A model of the international division of labor offered a starting point for analysis. Yet this case study highlights the model's deficiencies. In the spatial division of labor model, international labor costs drive location decisions, with management capabilities and industrial structure influencing the scope of locations under consideration. Here we find technology plays a more critical role than recognized by the proponents of a spatial division of labor model. For example, the limits in imaging technology constrain distance from the market. As long as work has to be shipped in hard copy, there is a limit to the speed with which offshore work can be returned and a constraint on the type of work going overseas. Furthermore, we find in some instances technology renders labor costs irrelevant. Instead a more appropriate model is one where technology plays the central role, and influences location decisions by either freeing firms to minimize labor costs or, on the other hand, rendering labor irrelevant altogether. As the technology becomes more sophisticated, the spatial division of labor model becomes less relevant.

Secondly, the spatial division of labor model places rural America in the position of being a way station between urban America and offshore production. This characterization is too narrowly focused in time and space. In other words, as this case study highlights everyplace is a way station at some point in time for some industry. Technological change is constantly repositioning geographical locations as the optimal location for jobs. For example, urban centers lost manual data entry employment as communications permitted the movement of these jobs to lower wage rural areas. Unskilled urban workers are increasingly at a disadvantage in the competition for these jobs. Rural communities may also lose data entry jobs to offshore sites as imaging technologies improve over the next five years. Nonetheless, within the next decade, breakthroughs in scanning will permit the mechanical entry of hand written documents, displacing manual data entry altogether. Offshore sites may well lose these jobs as they return full circle to the urban areas of the industrialized countries. In this broader sweep of the changing location of jobs, rural areas are not a way station any more than other locations.

In part, the spatial division of labor model was developed with manufacturing in mind and there are essential differences between the services and manufacturing sectors. For example, face to face contacts continue to play an important role in the provision of services. Data entry is an exception and most service firms that have located in low wage locations are more often taking advantage of markets than producing low cost services for first world consumption.

More importantly, service firms are more sensitive to technological change in the telecommunications industry than is the case for manufacturing. As long as inputs have to be shipped to the production site and manufactured goods moved to markets, manufacturing will be pulled by factors other than labor costs. Data services that can be transmitted across telephone lines, by satellite, or microwave are freer than manufacturing to take advantage of far flung locations.

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Firms Interviews Include:

Domestic On-site Interviews

TDEC headquartered in Washington, D.C. with plants in rural Maryland and West Virginia. Interviews held with J. Timothy Mann, Director, in Washington, D.C. headquarters and with Wanda Dawson, Vice President, in Oakland Maryland.

Highland Data headquartered in Blue Grass, Virginia and a branch in West Virginia. Interview held with Edward Hevener, Manager in Blue Grass.

Appalachian Computer Services (ACS) headquartered in London, Kentucky, with branches in Berea, Bateyville, and Montecello, Kentucky and Mount Vernon, Illinois. Interview held in London, Kentucky with Ed Miller,

Computer Science Corporation (CSC), headquartered in El Segundo, California and offices in a number of cities in the U.S. Interviews held in Falls Church, Virginia with Howard Chambers, Vice President and Floyd H. Jean, Vice President.

C C and H headquartered in Los Angeles and branches throughout cities in the U.S. Interview held in Walnut Creek, California with Hank Klor, Assistant Director.

Automated Data Processing, headquartered in Roseland, New Jersey with offices in urban centers across the U.S. Interview with Tom Ryan in Towson, Maryland.

General Electric in Rockville, Maryland. Interview with William McGowen, Manager.

ABS in Hyattsville, Maryland

Telephone Interviews

Lexis/Nexus, a large data entry user, based in Dayton, Ohio. Interview with Michelle Love, Public Relations.

ILM headquartered in Fredricksburg, Virginia, an independent firm with a sister operation in Jamaica. Interview with James Griggs, Vice President in Fredricksburg.

Saztec, headquartered in Kansas City, with branches in the Philippines and Ardrossan, Scotland. Interview with Scott Francher in Kansas City.

Offshore Interviews

Donnelly & Sons, headquartered in Chicago, interview held in Barbados branch with Ronald Wolfe.

American Demographics, headquartered in Denver, interview held in Barbados branch with Enid Blackman.

Southwest, headquartered in Dallas, interview held in Barbados branch with Cynthia Chandler.

Data Research LTD, a Barbadian owned firm, interview with Ms. Sharpe.

Compudata Business Bureau, a Barbadian owned firm, interview with Jean Alleyne.

The Barbados External Telecommunications (BET) Agency, interview with Mr. Seale.

The Barbados Industrial Development Corporation, the agency responsible for economic development. Interview held with Reginald Farley, Business Development Officer in Barbados and John Mills in New York, N.Y.

Saztec Europe, Ardrossan Scotland facility.

Producers of Telecommunications, Optical Scanning, and Imaging Technologies

International Business Machines, interview with Mark House and Jeff Hamilton, Arlington, Virginia branch.

Xerox.

Microfax.