The High-Tech Rural Renaissance?:
Information Technology, Firm Size and Rural Employment Growth

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Advances in information technology have held out the possibility of a rural renaissance. If firms can communicate over the internet with customers, suppliers, and each other electronically, perhaps they can locate anywhere. And if they can locate anywhere, why should they put up with the high rents, long commutes, crime, and pollution of big cities when small towns and rural areas are ready to welcome these businesses?

The promise of electronic communication has indeed lured some firms, large and small, away from big cities. Larger firms, like Citibank and American Express, have moved back-office functions away from big-city headquarters to smaller towns. Numerous small firms and self-employed workers have set up shop in Florida, the Southwest, and in resort towns across the country – some stockbrokers are known to work primarily from their boats off Nantucket.

Are these examples part of a larger trend? If they were, the future for rural areas would look rosy indeed. An influx of firms using information technology would mean new jobs for local residents and new customers for local businesses. These new jobs would include high-skilled positions that might attract skilled workers from larger cities, or at least keep educated residents from leaving. These jobs, at high salaries, would create a consumer base that could revive existing retail and bring in new stores.

However, this research offers no evidence of this rural renaissance. In the aggregate, employment in information technology-intensive industries is overwhelmingly urban and is becoming more so. High-tech employment growth was faster in urban areas than in rural areas over the period 1988-1995 and shows no sign of slowing. The examples of high-tech firms moving to (or starting in) rural areas and small towns are exceptions to the trend. While employment growth in rural areas has been strong, high-tech industry is not driving this growth.

"FORTY ACRES AND A MODEM"

The idea that information technology could loosen the ties that bind businesses to cities has captured the public imagination. Observers like George Gilder have predicted that new information technology – the internet in particular – could cause the "death of cities."[1] A recent New York Times article argued that many firms, particular small businesses, now need only "forty acres and a modem," the modem providing the connection to the crowded world of far-away customers and suppliers.[2]

Two features of new information technology change the calculation firms make when thinking about location. First, advances in information technology have facilitated data manipulation and storage, allowing firms to create and maintain large, centralized

[1]George Gilder, *Forbes ASAP*, February 27, 1995. Quoted in Mitchell Moss, "Technology and Cities," *Cityscape 3:3*.
[2] Joel Kotkin, "Why Wall Street is Losing Out to Forty Acres and a Modem," New York Times, December 27, 1998.

databases and improve record-keeping. Second, advances in information technology have introduced new methods of data transmission on private networks within a firm, on private networks between firms, and on the public network – the internet.

Taken together, these two features lower the cost of communications. Data-manipulation and storage technology compresses a given amount of information into less and less electronic space, and the data-transmission technology allows a given amount of electronic data to be sent more quickly and cheaply. Firms communicate with customers, suppliers, and other firms in their own industries; firms also depend on communication among its own divisions and employees. Advances in information technology reduce all of these communications costs.

Firms base their location decisions, in part, on the cost of communication. Many firms locate in large cities in order to keep their communications costs low. For instance, the advertising industry is concentrated in New York, Chicago, and a handful of other large cities. Advertising firms depend on face-to-face contact with their clients, which are often large corporations headquartered in big cities. An advertising firm located in the same big cities can meet with clients easily and spontaneously; in contrast, an advertising firm located in a rural area might find itself spending a considerable sum on airfares and on hotel rooms in order to meet with their faraway clients.

Of course, not all industries rely as heavily on face-to-face communication as advertising does. Many manufacturing industries ship their products and require little face-to-face contact. For these industries, the advantages of locating in cities are slim, and many manufacturing industries are disproportionately located in smaller towns and rural areas. But most industries do require face-to-face contact and therefore reap benefits from locating in cities.

New information technology fulfills much the same role that cities do. Just as the density of cities facilitates face-to-face communication, new information technology facilitates electronic communication. When electronic communication is a good substitute for face-to-face communication, the benefits of an urban location are reduced. Some firms will find it cheaper to relocate to a smaller city or rural area, where rents and wages are lower. Even firms that stay put are affected. If the benefits of an urban location are reduced, then the profits of rural firms will grow faster relative to urban firms, raising employment in rural areas relative to urban areas.

Smaller firms should be most affected by information technology, and their employment patterns should change most dramatically. Small firms have less physical capital and therefore have lower moving costs than larger firms. Also, because small firms use less labor, they are better able to relocate or begin in rural areas. Larger firms have more difficulty meeting their demand for skilled labor in rural areas.

DATA AND METHODOLOGY

A new dataset, the Longitudinal Enterprise and Establishment Microdata (LEEM) file, provides detailed information on firm size and location. The LEEM tracks the

employment of every private-sector establishment with at least one employee.[3] For each establishment, the dataset includes employment, location by county, industry, ownership, and payroll, for each year during 1989-1995.

A second dataset, the Current Population Survey (CPS), reports on individual workers' demographic and economic characteristics. Questions include items on employee computer usage at work; workers reporting computer usage also describe the tasks they use computers to perform. By aggregating responses of workers in the same industry, a measure of industry-level technology usage is obtained. This study uses the fraction of an industry's workers that use a computer for electronic mail or other communications as the measure of IT-intensity. Industries are classified into high-IT, medium-IT, and low-IT industries for the analysis.

The IT classification from the CPS is added to the LEEM file, and the individual establishment data are tabulated to create an overall picture of IT and employment change between 1989 and 1995. Employment growth rates are compared across different IT intensities, across firm size, and across locations. Again, there are three levels of IT intensity. Examples of high-IT industries are computer manufacturing, software and data processing, scientific research, and securities/investment companies. Examples of low-IT industries are apparel manufacturing, beauty shops, auto repair shops, furniture manufacturing, and nursing homes.

Four categories of firm size are examined: smallest firms (0-19 employees), smaller firms (20-99 employees), medium-size firms (100-499 employees), and large firms (500 or more employees).[4] Two kinds of places are compared: counties that are in metropolitan areas ("urban areas"), and counties that are outside metropolitan areas ("rural areas").[5]

MAIN FINDINGS

Rural employment growth is strong and is indeed driven by small business. Rural employment growth over the period 1989-1995 was 2.4% annually, while urban employment growth was 1.4%. In part, this higher growth rate in rural areas was due to the presence of the smallest firms – those with fewer than 20 employees – in rural areas. Though only 15% of national employment is in rural areas, 19% of smallest-firm employment is in rural areas. Employment in these smallest firms grew fast, at almost 4% annually in both urban and rural areas. This accounts for part of rural employment growth.

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[3] An establishment is a single location where business is conducted or where services or industrial operations are performed. A firm consists of one or more establishments. Establishments belonging to the same firm may be located in the same or different counties. Over time, new establishments come into existence, others cease operation, and still others change ownership.

[4] The firm size categorization refers to FIRM, not establishment, size. If a firm has 50 employees in a New York establishment, 75 employees in a Chicago establishment, and 1000 employees in a Los Angeles establishment, then its employment is included in the large-firm employment total for each city. The firm size categorization is based on employment in 1989.

[5] Counties in MSA's will be called "urban," and counties outside MSA's will be called "rural." Metropolitan area designation is based on the Census Bureau's 1995 MSA/NECMA definitions.

Larger firms are less well represented in rural areas, and their growth rates were slower than the smallest firms' growth. But employment in firms with 20 or more employees grew considerably faster in rural areas than in urban areas. The employment growth rate in firms with 20-99 and 100-499 employees was over three times as high in rural areas as in urban areas. Even employment in large firms – those with 500 or more employees – grew almost twice as fast in rural areas as in urban areas. (See table 1.)

In 1989, at the start of the time period under consideration, high-IT employment was disproportionately located in urban areas. Only 7% of high-IT employment was in rural areas, while 18% of low-IT employment was in rural areas. The difference between these two numbers is the "rural technology gap." The rural technology gap was 11% in 1989. If high-IT and low-IT firms were equally likely to locate in rural areas, then the gap would be zero.

This rural technology gap existed across all firm sizes, but was least pronounced for the smaller and smallest firms. The gap was 5% for employment in firms with 20-99 employees and only 4% for the smallest firms. The view from 1989, then, suggested that if the rural technology gap were closing, it would close first for the smallest firms. (See table 2.)

The rural technology gap did not close; instead, it grew. By 1995, the gap widened to 13%. The fraction of high-IT employment in rural areas stayed constant at 7%, while the fraction low-IT employment in rural areas increased to 19%. The gap grew most for the smaller and smallest firms. For smaller firms, the gap grew from 5% in 1989 to 8% in 1995; for the smallest firms, the gap grew from 4% to 8%. In other words, small high-IT firms were even more disproportionately located in urban areas in 1995 than in 1989. (See table 3.)

How could the gap have increased even though rural employment grew faster than urban employment? The growth in rural employment was confined almost exclusively to medium-IT and low-IT industries. While rural growth in all industries was 2.4% annually, rural high-IT growth was only .5%. In contrast, high-IT employment in urban areas grew three times faster, at 1.5%. Low-IT employment grew faster in rural areas than in urban areas across all firm size categories; medium-IT employment grew faster in rural areas than in urban areas among all but the smallest firms.

In fact, it was high-IT employment in small firms – which was supposed to be driving the rural renaissance – that favored urban areas most. Employment growth in the smallest high-IT firms was an impressive 7% annually in urban areas, compared to 2.6% in rural areas. For smaller high-IT firms, growth was 2.4% in urban areas and only .1% in rural areas.

DISCUSSION

Contrary to popular prediction, advances in information technology have not fostered rural growth at the expense of cities. Instead, high-IT industries are driving urban employment growth. There are several explanations for this.

First, high-IT industries base their location decisions on many factors, not the just cost of communication. Even if electronic communication reduces the advantage of an urban location because of communication costs, cities offer other advantages to high-IT industries. High-IT industries depend on skilled labor, and urban areas have more educated workforces than rural areas. High-IT industries also depend on telecommunications infrastructure, which is more developed in urban areas than in rural areas. The superior infrastructure in urban areas includes both physical infrastructure, like fiber-optic cables and the computers that direct internet traffic, as well as internet service providers, consultants, and other firms that provide high-tech support.[6] Finally, most high-IT industries are new industries, and nearly all new industries – whether high-tech or not – tend to develop first in larger cities. Larger cities provide proximity to venture capital, intermediate inputs, and other services that start-up industries need; they also offer a wealth of other employment in case start-ups fail. Over time, as high-IT industries mature, these initial advantages of urban areas will fade, but for now the dynamism of urban areas is a strong pull on new high-IT industries.

Second, electronic communication is only a partial substitute for face-to-face communication. Not all kinds of communication work well electronically. While an accounting database can be sent electronically without losing any information, electronic communication misses much of the nuance involved in closing a business deal with an important client. Thus, even if back-office divisions running routine operations can be relocated to smaller towns or rural areas, corporate headquarters – where most of the communication with clients and suppliers happens – still benefit from urban locations.

Third, in some situations, electronic communication complements face-to-face communications.[7] Many relationships, business as well as personal, have both face-to-face and electronic components. The boss of a used-motor business might learn of a difficult-to-find motor over the internet and then wish to see the motor in person. Here, electronic communication creates a demand for new face-to-face communication. For this technologically savvy used-motor business, the internet raises the advantages of an urban location – just the opposite effect of that implied by the "forty acres and a modem" story.

Some evidence for this complementarity between electronic and face-to-face communication is that businesses in larger cities are much more likely to have internet domains than businesses in smaller cities and rural areas are.[8] This holds true even after controlling for the more skilled labor and better infrastructure found in larger cities. This complementarity implies that employment growth in high-IT industries might continue to

[6] Tom Downes and Shane Greenstein, "Universal Access and Local Commercial Internet Markets," 1998, draft. Shane Greenstein, Mercedes Lizardo, and Pablo Spiller, "The Evolution of Advanced Large Scale Information Infrastructure in the United States," *NBER Working Paper #5929*, 1997.

[7] Jess Gaspar and Edward Glaeser, "Information Technology and the Future of Cities," *Journal of Urban Economics 43*, 1998.

[8] A domain is the address that identifies an internet presence. A domain is the "amazon" in www.amazon.com or the "msnbc" in myfriend@msnbc.com.

favor urban areas over rural areas and exacerbate the existing differences between urban areas and rural areas in skill level, infrastructure, and income.[9]

It is risky to forecast the future, especially when predicting the effects on new technologies. While the future might look like the recent past, the future might instead still hold the rural renaissance that many have predicted. High-IT industries, as they mature, might start to move to smaller cities and rural areas. As the infrastructure gap continues to close, the disadvantages of rural areas for high-IT firms might shrink. Electronic communication will surely improve and – with tools like video conferencing – will become a better and better substitute for face-to-face communication. What is clear, though, is that these effects have not yet begun to make their mark. Over the past decade, information technology has played no part in rural employment growth.

[9] Jed Kolko, "The Death of Cities? The Death of Distance? Evidence from the Geography of Commercial Internet Usage," 1999, draft.

Table 1: Location of Employment and Annual Growth Rates, by Firm Size

	location of employment, 1995		employment growth rate, 1989-1995	
	urban	rural	urban	rural
0-19	81.0%	19.0%	3.85%	3.68%
20-99	84.0%	16.0%	0.41%	1.55%
100-499	84.1%	15.9%	0.30%	2.59%
500 up	87.4%	12.6%	1.01%	1.84%
ALL FIRMS	84.9%	15.1%	1.38%	2.41%
all firms, cumulative growth rate			8.55%	15.35%

Table 2: Location of Employment, by IT-Intensity and Firm Size, 1989

	high IT		medium IT		low IT	
	urban	rural	urban	rural	urban	rural
0-19	83.7%	16.3%	81.3%	18.7%	79.4%	20.6%
20-99	88.8%	11.2%	85.4%	14.6%	83.6%	16.4%
100-499	93.7%	6.3%	86.5%	13.5%	82.8%	17.2%
500 up	95.6%	4.4%	88.5%	11.5%	81.2%	18.8%
ALL FIRMS	92.8%	7.2%	86.3%	13.7%	81.6%	18.4%

Table 3: Location of Employment, by IT-Intensity and Firm Size, 1995

	high IT		medium IT		low IT	
	urban	rural	urban	rural	urban	rural
0-19	86.9%	13.1%	81.8%	18.2%	78.7%	21.3%
20-99	90.1%	9.9%	84.5%	15.5%	82.4%	17.6%
100-499	93.2%	6.8%	84.1%	15.9%	81.6%	18.4%
500 up	96.0%	4.0%	88.0%	12.0%	80.6%	19.4%
ALL FIRMS	93.2%	6.8%	85.5%	14.5%	80.6%	19.4%

Table 4: Annual Employment Growth Rates, by Location, IT-Intensity, and Firm Size, 1989-1995

	high IT		medium IT		low IT	
	urban	rural	urban	rural	urban	rural
0-19	7.19%	2.63%	4.31%	3.78%	3.50%	4.26%
20-99	2.44%	0.10%	0.98%	2.17%	-0.33%	1.19%
100-499	0.42%	1.93%	0.93%	4.14%	-0.66%	0.71%
500 up	0.08%	-1.70%	1.40%	2.22%	1.03%	1.69%
ALL FIRMS	1.46%	0.54%	1.81%	2.90%	1.07%	2.20%

note: urban and rural growth rates, for all industries, are shown in table 1

TECHNICAL APPENDIX

The two datasets used in this analysis are the Longitudinal Enterprise and Establishment Microdata (LEEM) file and the Current Population Survey (CPS).

The LEEM tracks the employment of every private-sector establishment with at least one employee. For each establishment, the dataset includes employment, location by county, industry, ownership, and payroll, for each year during 1989-1995. The dataset is longitudinal, so that one can track the employment changes at a given establishment over time. With the LEEM, employment was tabulated for each county, industry, and firm size in 1989 and 1995.

The firm size for each establishment was based on the size of the firm that the establishment belonged to in 1989. New establishments born during the period were assigned the size of the firm they belonged to in 1995. Thus, every establishment that existed in both 1989 and 1995 remained in the same firm size category, avoiding the bias inherent with looking at firm size data from published tabulations. Four categories of firm size are examined: smallest firms (0-19 employees), smaller firms (20-99 employees), medium-size firms (100-499 employees), and large firms (500 or more employees).

A second dataset, the October 1989 Current Population Survey (CPS), reports on individual workers' demographic and economic characteristics. Questions include items on employee computer usage at work; workers reporting computer usage also describe the tasks they use computers to perform. By aggregating responses of workers in the same industry, a measure of industry-level technology usage is obtained. This study uses the fraction of an industry's workers that use a computer for electronic mail or other communications as the measure of IT-intensity.

Industries are classified into high-IT, medium-IT, and low-IT industries for the analysis, according to the fraction of their employees using a computer for electronic mail or other communications in 1989. In high-IT industries, this fraction was over 25%; in medium-IT industries, this fraction was between 5% and 25%; in low-IT industries, this fraction was under 5%. The industry classification in the CPS follows the Census 3-digit coding, which differs from the Standard Industrial Classification (SIC) coding used in the LEEM. Using a crosswalk linking the Census and SIC codes, the LEEM industries were classified into IT categories. This crosswalk allowed 99% of establishments to be assigned an IT category.