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ABSTRACT Despite the growth in services, manufacturing remains an essential part of the nonmetropolitan South's economy, responsible for 25 percent of total personal earnings. But low-education nonmetropolitan areas, which gained more than their share of manufacturing jobs in the 1970s and 1980s, lost jobs in the 1990s. Their manufacturing base is threatened not only by low-wage competition from abroad, but also by the spread of new technologies, which is raising the demand for production worker skills. Data from the Economic Research Service Rural Manufacturing Survey (RMS) show that labor quality is a central problem for adopters, particularly in low-education areas. The silver cloud is that these "New Technology" manufacturers have a much greater interest in raising local education and skill levels than "Old Technology" manufacturers.

Employment in the nonmetropolitan South has expanded considerably over the past several decades. From at least 1960 through 1990, job growth in the nonmetropolitan South, while slower than in the metropolitan South, kept pace with other nonmetropolitan areas of the United States. Retirement and recreation were responsible for growth in selected areas, but the growth engine for much of the rural South was manufacturing and the rural South is the region most dependent on manufacturing. In 1995, nearly 20 percent of the jobs in the nonmetropolitan South were manufacturing jobs, far more than in the rest of nonmetropolitan United States (15 percent) or in the metropolitan South (10 percent) (U. S. Department of Commerce, Bureau of Economic Analysis (BEA) 2000).

These employment data actually underestimate the importance of manufacturing to the region. Manufacturing jobs generally pay higher wages than other jobs and are more often full-time, especially compared to service sector jobs. Thus, manufacturing was directly responsible for more than 25 percent of total earnings in the nonmetropolitan South in 1995. And it indirectly generated a substantial fraction of service sector earnings.

The central attraction of the rural South and other rural areas has been low-cost labor. The product cycle theory (and its variants) provided the geographic logic for understanding industrial relocation to the region through the 1980s. The essence of this model, summarized in Malecki (1991), is that as industries mature, production technology becomes routine, markets stabilize, price competition replaces product quality competition, access to ideas, information and skilled labor become less critical, and manufacturing in low-skill/low-wage areas becomes more competitive. The relocation process is facilitated by the organizational separation of manufacturing activities into headquarters and branch plants, which allows the location of more routine activities in peripheral locations while keeping more complex managerial and research activities in central locations.

In the past 10 years, spurred by globalization and the development of microprocessors, the product cycle has been turned on its head. Markets have become less certain, product competition has increased, and new technologies have evolved. The wave of innovation has involved most aspects of manufacturing, production, marketing, work organization, inter-firm relations, and inventory management and all types of manufacturing, if in varying degrees (Gale 1997b). It has permitted manufacturers to compete on the basis of quality and adaptation to particular customer needs rather than simply on the basis of cost. The greater uncertainty brought by the changing markets, new technologies, and overseas competition, suggests that skills have regained importance and that manufacturers adopting advanced technologies and marketing strategies based on quality may be shifting out of low-skill, low-education rural areas, toward more urban locations.

Globalization may also act to reduce the competitiveness of low skill/low wage areas in the United States for those manufacturers continuing to compete on the basis of cost. Many manufacturers continuing to pursue a low-skill/low-wage strategy are drawn now to countries whose wages are far below U.S. levels.

This scenario suggests a potential crisis for rural areas of the South. Rosenfeld (1992) argues forcefully that the continued pursuit of manufacturing using a low-wage/low-skill labor strategy is a dead-end street. Glasmeier and Leichenko (1998) raise similar concerns. Others, such as Dertouzos, Lester and Solow (1989) and the Cuomo Commission (1992), have argued this at the national level.

But how valid is this scenario? Rosenfeld's (1992) research suggests that at least through the 1980s, the low-wage/low-skill strategy was still effective as a means of attracting new manufacturing to rural areas. Indeed, southern manufacturing in the 1980s was growing significantly only in the most remote nonmetropolitan counties and major metropolitan areas. Killian and Parker (1991) found no negative effect of low education on rural job growth, once local industry mix was taken into account. McGranahan (1996) found nationally that manufacturing was as attracted by low local education levels in the 1980s as it had been in the 1970s. A recent study of Appalachia suggests that the strategy remains effective there and manufacturing was continuing to expand more rapidly than in other rural areas at least though 1992 (Jensen, 1998). These studies suggested that the new technology model outlined above may be largely irrelevant for rural areas. This anomaly between the apparent rising demand for skills and the continued shift of manufacturing to low-education areas was a major motivation for the development of the ERS Rural Manufacturing Survey (RMS) (Economic Research Service 1996), the basis for much of the analysis in this paper.

In what follows, I present evidence that the geography of manufacturing location has changed dramatically in the 1990s, consistent with the new technology-globalization scenario outlined above and in marked contrast to earlier decades. I then draw on the RMS to show that new technology is now making more demands on production worker skills and management/professional skills in both rural and urban areas and that the adoption of new technologies is impeded in rural low-education areas. A brief discussion of the implications for rural development policy concludes the paper.

Data and Measures

The data are from several sources. County level data come from U.S. Department of Commerce Bureau of Economic Analysis county data files and the 1990 Census of Population. Information on new technology and problems in adopting this technology come from the 1996 ERS Rural Manufacturing Survey (RMS) (Economic Research Service 1996), with a sample of 2,900 nonmetropolitan and 1,000 metropolitan manufacturers, and provides considerable information on technology adoption and new skill needs (see Gale, McGranahan,

Teixeira and Greenberg 1999). The population sampled included all manufacturers (except newspapers) who had at least ten employees at the time of the survey. The sample was stratified by establishment size, with larger establishments oversampled. It also included an oversampling of the nonmetro West. Within both the metropolitan and nonmetropolitan samples, the statistics reported below were weighted back to reflect the establishment population proportions, keeping the sample size the same. The sample for the nonmetropolitan South was 1,151 (unweighted) and 1,143 (weighted).

The RMS asked about the use of new technologies in three areas: production, management, and communications (Table 1). The items were drawn largely from other surveys, in consultation with researchers working in the technology area and several manufacturing associations. Our aim was to define a set of technologies that both captured recent innovations applicable to a wide range of manufacturers and reflected general plant adoption strategies. That is, plants using these technologies would also be likely to have adopted other new technologies relevant to their particular product. The items were all positively correlated with each other and scalable (using KR-20 as a criterion). In the present analysis, two indices are used, a production technology scale and an overall scale combining all three basic areas. Both were formed by summing the relevant items. To simplify the presentation, I focus on two groups. High adopters are those who scored in the top quarter of all plants in the combined index (more than nine of fifteen practices were used), while low adopters are those that scored in the bottom (four or fewer practices). I also assume that the latter are, by implication, users of old technologies.

The definition of South is that used by the U.S. Census Bureau of Population (U.S. Bureau of the Census 1992) and includes states as far West as Texas and as far north as Delaware.

The measure of county educational attainment used throughout this paper is the proportion of young adults (ages 25-44) who had not completed a high school degree, based on the 1990 Census of Population. It was felt that manufacturers look to young adults as the primary labor pool for hiring new production workers. Since the vast majority of nonmetropolitan production workers in the RMS survey either lacked a high school degree (20 percent) or had not continued their education beyond high school (70 percent), high school completion seemed a critical cutting point. Also, areas with a relatively high

Table 1. New Technology Scale Components

Production
Computer - assisted design or engineering
Computer - assisted machining
Numerically- or computer-controlled machines
Programmable controllers
LAN on factory floor
Management
Self-directed work teams
Job rotation
Employee problem-solving groups or quality circles
Statistical process control
Total quality management
Information
Modems
Satellite communications
Internet
Computer linkages outside firm
Computer linkages to other locations in firm (weighted ½)

Indices formed by summing uses; "overall" includes all three categories.
Source: Economic Research Service. 1996. *Rural Manufacturing Survey* (RMS).

proportion of young adult dropouts have poorer local school systems in general, at least according to survey responses relating to local schools (McGranahan 1998). For most of the analyses, the nonmetropolitan counties were grouped by high school completion quartiles (89.3, 82.6, and 74.2 percent, respectively), with statistics reported for the top and bottom quarters.

Changes in the Location of Manufacturing

Earlier research on manufacturing location generally did not extend into the 1990s and was often limited to particular regions. The present analysis includes both a national analysis and an analysis focusing on the rural South. At issue here is the extent to which locational shifts of manufacturing have changed over time, particularly with respect to the tendency to shift to low-education areas. For the national level analysis, local labor market areas (commuting zones) developed by Tolbert and Killian (1987) are the units of analysis. For the periods 1969-79, 1979-89, and 1990-97, I calculated "expected" manufacturing employment change for each labor market area based on the number of jobs it had in each of 21 different manufacturing industries in the base year and the national growth rates of these industries. The industry categorization follows the U.S. Department of Commerce, Bureau of Economic Analysis, the original source of the data. It is based on 2-digit Standard Industrial Classification codes, but with one category of the 20, "transportation," split into "auto" and "other."

The difference between the actual and expected growth represents the estimated "shift" in manufacturing jobs into (or out of) the area over the period in question. So an area with a loss in manufacturing may still have a positive shift in jobs if its manufacturing industries declined less than those same industries did in the nation as a whole.

The labor market areas were grouped based on education quartiles, based on the proportions of population aged 25-44 that lacked a high school diploma (or equivalent) in 1990. For each education quarter, we could then estimate the percent change in manufacturing employment due to shifts in employment to and from other education quarters.

The results of this analysis show considerable changes in the movement of manufacturing over time (Table 2). In 1969-79, a period when manufacturing employment was expanding nationally (by about 5 percent), the shift was out of the second-highest education areas (which tend to be in the "rust belt") to the highest and, particularly, lowest education areas. Overall, this pattern of shifts persisted in the 1980s, although somewhat reduced in intensity. While this was a period of restructuring due to intense competition from abroad and U.S. manufacturing employment declined during this decade, there is

Table 2. Aggregate Change in Manufacturing Jobs in U.S. Labor Market Areas, by Area Young Adult High School Completion Rates

Period and type of change	Area rank in high school completion rate (ages 25-44), 1990				Total
	Bottom quarter	2nd quarter	3rd quarter	Top quarter	
	Percent				
Change 1969-79					
1 Actual	20.7	3.0	-0.8	10.6	4.6
2 Expected[1]	2.1	3.9	6.1	4.4	4.6
3 Shift (1-2)	18.6	-0.9	-6.8	6.1	0.0
Change 1979-90					
1 Actual	1.8	-9.2	-13.4	-5.5	-8.8
2 Expected[1]	-8.7	-8.4	-9.3	-8.0	-8.8
3 Shift (1-2)	10.5	-0.8	-4.1	2.5	0.0
Change 1990-97					
1 Actual	-4.7	-1.5	-1.4	4.9	-1.1
2 Expected[1]	-2.5	-0.2	-1.1	-1.4	-1.1
3 Shift (1-2)	-2.2	-1.3	-0.3	6.4	0.0

[1]Expected change calculated by multiplying base-year labor market employment in each of 21 manufacturing industries by the industry national growth rates in the subsequent period. The sum is an estimate of the change that would have occurred absent any "shifts" in industry location.
Source: Unpublished data from U.S. Bureau of Economic Analysis. 2000, 1997.

no evidence of an overall change in locational strategy so far as local education levels are concerned. The predominate shift was to low-skill areas. These low-education areas were actually the only ones to gain in manufacturing jobs over the 1980s (2 percent).

The pattern of manufacturing employment shifts in 1990-97 was, however, markedly different. The shift into the highest-education areas intensified, but, more significantly, manufacturing shifted out of low-education areas for the first time. Given that the changes are due to shifts in manufacturing location and take into account national

Table 3. Nonmetropolitan Change in Manufacturing Jobs by Region and Country, 1990, Young Adult (ages 25-44) High School Completion Rates

Region and Country High School Completion	No. of counties	1969-1979	1979-1990	1990-1997
	No.		Percent	
South				
Below median (74%)	504	22.6	5.7	-2.4
Above median	504	21.5	-0.7	4.9
Non-South	1256	13.5	-2.3	9.0

Source: U.S. Bureau of Economic Analysis. 2000.

growth and decline in the various manufacturing industries (in textiles, for instance), the pattern of the 1990s cannot be ascribed simply to the different types of industries located in low- and high-education areas. Rather, I would argue, overseas competition has made low-education areas less viable as locations for low-wage/low-skill manufacturing strategies. Manufacturers pursuing these strategies can do better overseas. At the same time—and this is what the RMS data will strongly suggest — manufacturers adopting new technologies to compete on the basis of quality product and flexibility find high-education areas provide a more attractive setting.

Turning to the rural South in particular, a very similar pattern emerges when we look at simple changes in manufacturing employment in rural southern counties by educational attainment. For this analysis, the 1,008 counties in the rural South were split at their median percent with a high school diploma, 74 percent—which is well below the bottom quartile of the local labor market areas used for Table 3 (79 percent). In 1969-79, manufacturing grew rapidly in southern counties both above and below this median, at rates half again as large as in the rest of rural United States. In 1979-90, manufacturing expanded only in the bottom half of the southern counties, suggesting that the low-road strategy was the first one emphasized in the face of international competition. However, the pattern was reversed in 1990-97, when the high-education group in the

South were the ones that expanded manufacturing employment while the low-education counties lost manufacturing jobs. Overall, however, the gain in manufacturing jobs in 1990-97 was considerably greater outside the South, where education levels are generally higher. Again the pattern is consistent with the thesis that new technologies are raising the skill needs of rural manufacturers.

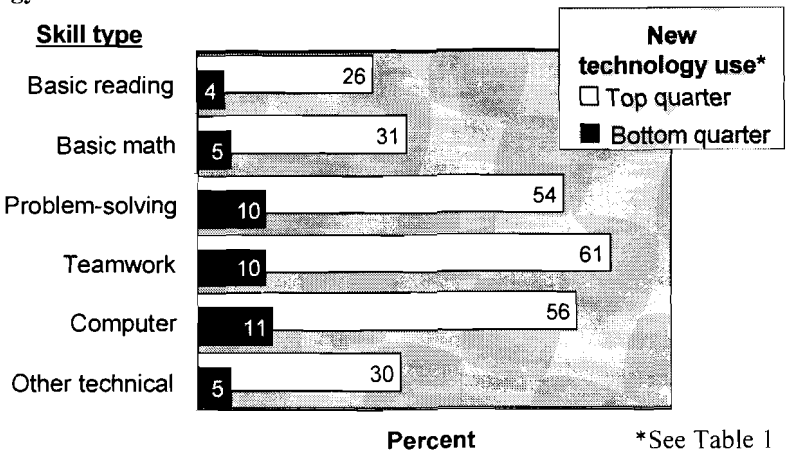
Unfortunately, county level data for shift-share analysis are not available to me at the county level before 1990. An analysis of the 1990-97 change suggests that the loss in the low-education counties in 1990-97 could largely be ascribed to the presence of declining industries (primarily textiles and apparel). Based on their industry mixes, both the higher-education counties in the rural South and the rural counties outside the South would have had virtually no growth in 1990-97 without manufacturing shifts into these areas.

Overall, manufacturing has shown an abrupt change in locational patterns. The shifts to low-education areas which marked the 1970s and 1980s disappeared in the 1990s and even reversed. Some of this change may be ascribed directly to globalization of production, as plants which at one time may have moved to low-education areas to reduce labor costs are now finding locations abroad. But more is involved, since rural areas with higher education levels appear to have been more competitive in the 1990s than in the 1980s. Much of this may have to do with the spread of new technology. The results of the ERS rural manufacturing survey shed more light on this issue.

Skill Needs and New Technology

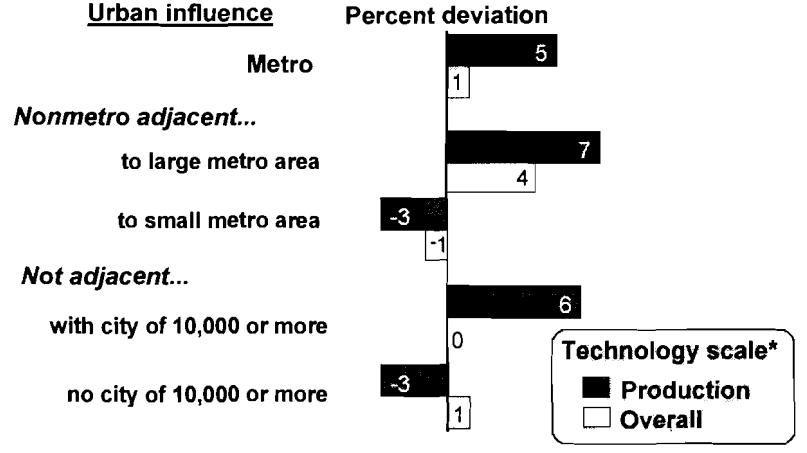
Skill needs for production workers appear to have increased considerably with the spread of new technology. The 1996 survey asked manufacturers about the extent that various skill requirements had changed in the past three years, with possible answers including decreased, stayed the same, increased a little, and increased a lot. Among nonmetropolitan manufacturers, those in the bottom quarter in technology use (low adopters) rarely reported that skill needs had increased a lot (Fig. 1). But those in the top quarter (high adopters) often reported such increases. Problem-solving, teamwork, and computer skills were cited by about half of the high adopters, while basic reading and math and "other technical" skills were reported by over a fourth. A similar pattern was found for metropolitan

Figure 1. Proportion of Nonmetropolitan Manufacturers Reporting that Skill Needs had Increased "a lot" in Past Three Years, 1996, by Technology Use



Source: Economic Research Service, 1996. *Rural Manufacturing Survey* (RMS).

Figure 2. New Technology Adoption Relative to Nonmetropolitan Average, 1996, by County Urban Influence



Source: Economic Research Service, 1996. *Rural Manufacturing Survey* (RMS).

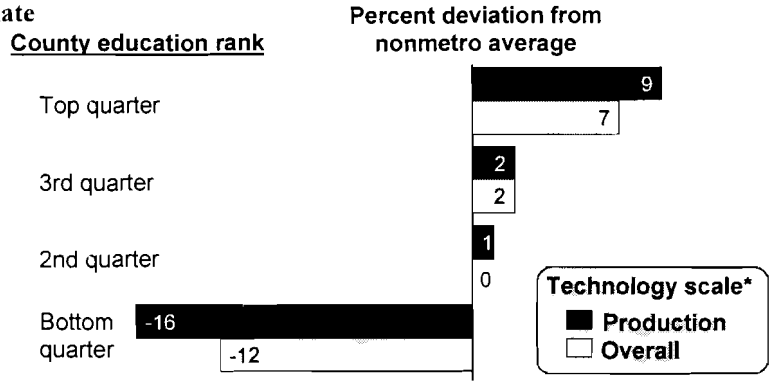
manufacturers. While the three year time frame was probably loosely interpreted by the respondents, the results do suggest that many of these technologies have been adopted relatively recently in the 1990s rather than in the 1980s.

Given the rise in skills associated with new technologies and the general need for more access to information and technical expertise, we expected that manufacturers in more rural areas would be less likely to have adopted new technologies. But, we found little rural deficit in the adoption of new technologies. Regressions of technology measures on dummy variables for 20 industry types, plant employment size, branch/nonbranch status, and dummy variables reflecting a county rural-urban continuum (see Gehlfi and Parker 1997) showed little net effects of location on technology adoption. The differences, shown in Figure 2, are statistically significant only for production technology, and even then only barely (the F-test for change in R^2 is significant at $p<.05$). Similar results were obtained with data from the U.S. Bureau of the Census's earlier Technology Survey, which had a narrow range of industries but a greater number of production technologies (Gale 1997a).

Apparently, there is no longer any substantial rural disadvantage in access to information and specialized knowledge, at least insofar as technology adoption in manufacturing is concerned. One possible explanation may be the extensive organization of manufacturing into multi-unit firms. According to the RMS, two-thirds of rural manufacturing employment is in firms with plants in multiple locations. In the rural South, three quarters of employment is in these plants. However, the results are quite similar when the analysis is repeated excluding branch plants, so this is not the explanation.

This is not to say that rurality no longer makes any difference. Consistent with Glasmeier (1991) and Glasmeier, Kays and Thompson (1995), rural-urban differences were substantial for the typical measure of "high technology," the proportion of establishment employees who were professional or technical workers. High technology, which involves the development of new products through research and development, is quite different from new technology, which involves the organization of production. Thus, while the product cycle model is relevant for contrasting high and low technologies, it does not appear to apply, at least at present, to the distinction between new and old technologies, the focus of the present analysis.

Figure 3. New Technology Adoption by Nonmetropolitan Manufacturers, 1996, by County Young Adult (ages 25-44) High School Completion Rate



*See Table 1

Source: Economic Research Service, 1996. *Rural Manufacturing Survey* (RMS).

While rural-urban differences in new technology adoption are small, there is considerable variation among nonmetropolitan manufacturers, depending on local education levels. The above regression analyses were repeated for nonmetropolitan manufacturers with the addition of dummy variables representing county education quarter (based on young adult high school completion). Manufacturers in nonmetropolitan low- education counties (counties where more than 25 percent of the young adults (ages 25-44) had not completed high school in 1990) averaged 16 percent below the nonmetropolitan average in the use of new production technologies and 12 percent below the nonmetropolitan average in the overall index (Figure 3).

In contrast, manufacturers in high education counties (where 10 percent or fewer of the young adults lacked high school diplomas) had above-average technology use according to both measures. These differences are not stark, but they are strong enough to suggest that it may be more difficult for manufacturers in low-education counties to adopt new technologies. Other results from the survey tend to support a conclusion that poor labor skills are an impediment to technology adoption. For instance, asked directly about problems associated with

the adoption of new technologies, manufacturers in both rural and urban areas cited inadequate worker skills more than twice as often as obtaining capital or technical assistance.

At the same time, the low adoption rates in low-education counties probably also reflect a self-selection on the part of the manufacturers. That is, manufacturers pursuing low-skill/low-wage (low road) competitive strategies have tended to locate in low-education counties, while high road manufacturers have tended to locate in areas with better-educated labor forces.

Virtually all of the low-education counties are in the South, but this is not simply a South/nonSouth phenomenon. Manufacturers in southern rural counties with greater levels of education have levels of adoption only somewhat lower than manufacturers in the rest of the country.

Nor does this appear to have a separate racial dimension. Once education is taken into account, manufacturers are no less likely to use new technologies in counties where blacks comprise a third or more of the population than in other counties. Within the South, the simple correlations between percent of the population black and the two technology measures were virtually nonexistent ($r = .03$ in each case).

Further insight into the skills issue is provided by a set of questions from the RMS that asked about problems the manufacturers have finding skilled applicants for production jobs. Whether they are located in low-education areas or high, low adopters users of old technology report few major problems finding applicants with appropriate skills (Fig. 4a). Skill problems in basic math, problem-solving, computer skills, and other technical areas are reported as major by only 10 to 15 percent of the old-technology manufacturers. The most serious problem, cited as a major one by nearly 30 percent of these manufacturers, is not what one usually considers a skill at all credibility and work attitude. But this problem, also, was cited no less often in high-education counties than low by old-technology firms. Labor costs have historically been a major motivation for manufacturing relocation. Given that wages are generally lower in low-education areas, these manufacturers may be expected to gravitate toward those areas. I have labeled this group old-technology manufacturers as I want to suggest that their situation broadly represents that of rural manufacturers in earlier decades.

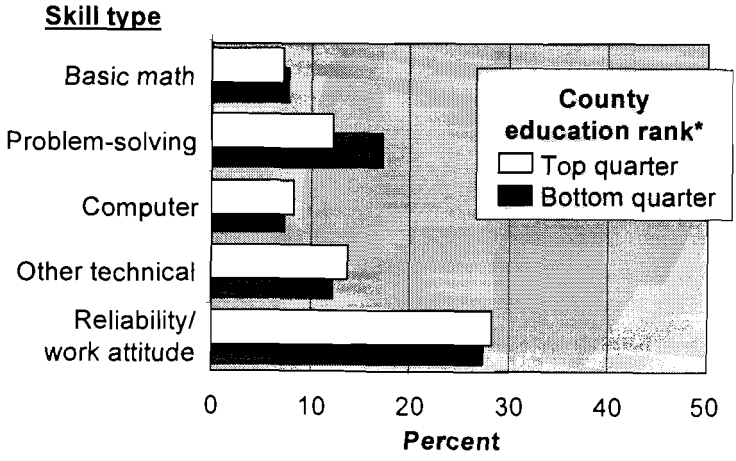
The situation for high adopters of new technology is markedly different (Fig. 4b). First, consistent with their reported increases in skill needs, these manufacturers cite major problems finding qualified applicants across a number of skill areas more than twice as often as the old-technology manufacturers. Moreover, local education levels make a difference. These skill problems are consistently cited more often in low-education counties than high. Despite the small sample size, these differences are statistically significant for basic math, problem solving, and computer skills. These results suggest that new-technology manufacturers may be less drawn to low-education areas than old-technology manufacturers.

While this analysis has focused on production worker skills, new technologies also call on new management and professional skills. While this is most obvious in the adoption of new management practices such as total quality management, the need is pervasive, extending, for instance, to the use of computers in sales, production, inventory, and communications and to marketing on the basis of quality rather than (only) price.

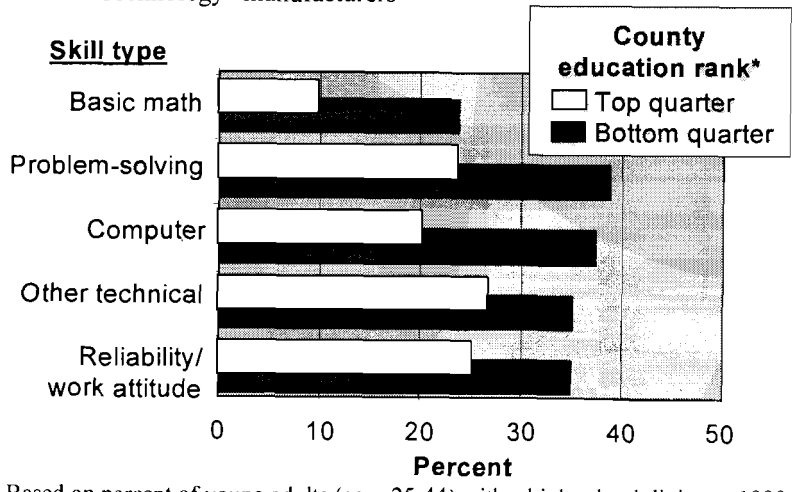
The RMS did not focus on management and professional skills, since presumably the labor market for these employees is not local but regional or national. However, the respondents were asked whether the attractiveness of the area to managers and professionals was a problem for their ability to compete. The responses to this question follow much the same pattern as for production worker skills (Fig.5). Old-technology managers cited attractiveness of the area as a major problem only about 12 percent of the time and local education levels had no bearing on their responses. New-technology manufacturers cited this problem about as often in high-education counties. However, in low-education counties, more than a third of the new-technology manufacturers cited area attractiveness to managers and professionals as a major problem. The reporting of the quality of local schools as a major problem followed much the same pattern. Apparently, poor school systems with high dropout rates create an environment amenable to old technology, but for new-technology users, poor schools mean both an underskilled labor pool and an environment unattractive to young managers and professionals.

Figure 4. Proportion of Nonmetropolitan Manufactures Reporting Major Problems Finding Skilled Applicants for Production Jobs, 1996, by Technology Use and County Education Rank

A. "Old Technology" manufacturers**



B. "New Technology" manufacturers**

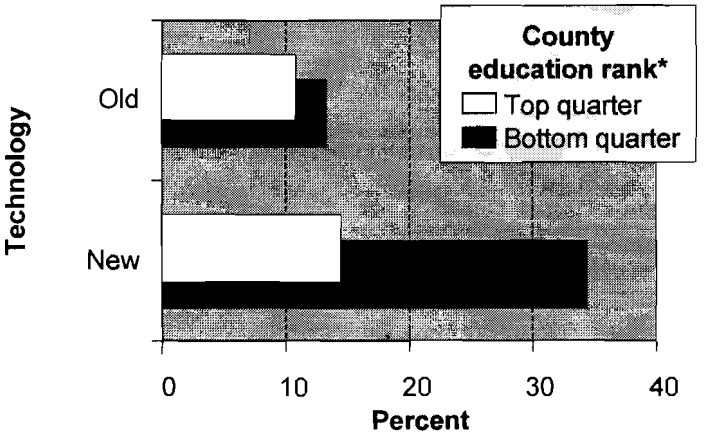


* Based on percent of young adults (ages 25-44) with a high school diploma, 1990

** Based on New Technology scale (see Table 1). Manufacturers ranked in the bottom quarter are "Old Technology" users, while those in the top quarter are "New Technology" users.

Source: Economic Research Service, 1996. *Rural Manufacturing Survey* (RMS).

Figure 5. Proportion of Nonmetropolitan Manufacturers Reporting that Attractiveness of Area to Managers and Professionals is a Major Problem, 1996, by Technology Use and County Education Rank.



*Based on percent of young adults (ages 25-44) with a high school diploma, 1990.
Source: Economic Research Service, 1996. *Rural Manufacturing Survey* (RMS).

Implications for Policy

In the past, manufacturing shifted to the rural South and other rural areas as well largely in a search for low-cost labor, with labor skills a very secondary issue. However they may have felt as local residents, manufacturers as business owners and managers had little to gain from improvements in local schools and training institutions. Indeed, given that even now a large part of production labor consists of people lacking high school degrees, it is arguable that some manufacturers may even have benefited from ineffective school systems, where few went beyond high school and many did not complete it, and where local property taxes were low. Ineffective school systems may have resulted in a larger labor pool, as school-leavers have few alternative employment opportunities.

The analysis presented in this paper suggests that this era is now largely over. While there may be some areas where the low-skill/low-wage strategy is still predominate (see Jensen 1998), the opportunities to thrive or even survive on this strategy have clearly become more limited. The globalization of production has seen substantial movement of low-skill industry (most notably apparel) move off-shore.

New technology has weakened if not eliminated this low-skill/low-wage logic for an increasing proportion of remaining manufacturers, creating both risks and opportunities for rural localities.

The central risk is that manufacturers will avoid rural areas with extremely low education levels or, if they are already there, move away, thus depriving these areas of a long-term source of new jobs and exacerbating inequality between rich and poor regions. The 1990s saw at least a temporary cessation in the shift of manufacturing to low-education areas. This could create long-run problems for these areas. Manufacturing jobs in low-education counties, although paying less than manufacturing jobs in other areas, are still relatively good jobs in these counties and generate income and other jobs in the community.

The spread of new technologies also creates new opportunities. To the extent that manufacturers in low-education areas move to adopt new technologies, they develop a greater stake in the effectiveness of local schools and training systems, both to produce a more skilled supply of labor and to improve the community as a place for their employees to live. This is not a trivial concern for these manufacturers. The quality of local primary and secondary schools was cited as a major problem for the plants' ability to compete by more than a third of the new-technology manufacturers located in low-education counties. The quality of local labor and the attractiveness of the area to managers and professionals were cited as major problems no less often. The next most frequently cited problem, access to training, was cited by only half as many of the respondents. In contrast, no infrastructure or access (e.g., to financial institutions, major customers, business services) was cited by more than 15 percent of these manufacturers. This concern for schools and training creates incentives for local public-private partnerships that were almost totally lacking in the past. Within limits, these manufacturers may also be favorable to higher local taxes, if the increase was devoted to local school systems.

This education and training strategy seems especially possible in the present context of very low employment nationwide, when the pull of the relative labor surplus in low-education areas in the rural South is most likely to outweigh disadvantages of low labor skills.

This analysis is based on the 1990s. The extent to which the trends of the 1990s are going to continue over the next decade is not clear. New technology is a new paradigm for plant and industry

organization, but not one that is equally applicable across all types of manufacturing and all settings and the reorganization is bound to have temporal limits. Nevertheless, it seems likely that the trends will continue in the near future. The survey results suggest that, for most advanced technology plants, the adoption has been fairly recent within this decade and it seems likely that adoption will spread further as new plants are opened and older ones refurbished. Applebaum and Batt (1994) found in their case study research that firms were still feeling their way in the adoption of new management practices. Trade impacts from GATT and NAFTA agreements are still being phased in and are likely to create continued pressures (Glasmeier and Leichenko 1998). Also, the decline in manufacturing jobs in low-education areas was more marked in 1995-97 than in previous years, suggesting that the period of adjustment may not yet have reached its peak.

Finally, while the focus here has been on education, it is not clear that this is the only drawback to manufacturing in the rural South in the current economic environment. Much of the current literature on manufacturing points to the importance of industrial clusters or districts composed of small- and medium-sized producers linked at least in part through supplier/customer relations (see, e.g., Porter 1998; Storper 1997). Although there are many small, independent producers in the rural South, the organizing force has been the large branch plant. Many of the smaller independent plants may be relatively isolated and slow to take advantage of technological change.

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