WESTERN AGRICULTURAL ECONOMICS ASSOCIATION

PAPERS OF THE

1989 ANNUAL MEETING

WESTERN AGRICULTURAL ECONOMICS ASSOCIATION

COEUR D'ALENE, IDAHO

JULY 9-12, 1989

WOMEN'S EMPLOYMENT IN RURAL HIGH TECH MANUFACTURING

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As change continues to affect rural America, employment opportunities for women become more vital to family and community economic welfare. The recessionary impacts of the 1980s were felt primarily in male-dominated industries, which have become less labor intensive with economic recovery (U.S. Department of Labor, 1985). These events followed the general structural decline of employment in the male-dominated extractive industries -- agriculture, forestry, mining -- from the 1950s through the 1970s (Brown and O'Leary). Compounding the problem is the decline in low skilled manufacturing jobs, which had formed the core of many rural communities' diversification efforts. These circumstances have resulted in the dependence of a significant number of American families on the earnings of women (Norwood and Waldman). This is certainly evident among households headed by women, which comprise half the families in poverty (Brown). Even among two-parent families the wife's earnings increasingly determine the level of financial security. In agriculture, it is now recognized that the ability of many small and medium size family farms to stay in business often depends on the wife's off-farm earnings.

In response to the need for new, nontraditional employment sources, high technology manufacturing has become a focus for development efforts (U.S. Congress). The purpose of this paper is to examine the employment opportunities for women provided by high technology manufacturing in nonmetropolitan counties in the western United States. Differences among occupational categories and types of establishments (branch, single unit plants) will be examined, and comparisons made with low tech establishments. Two-limit tobit regression analysis will be used to estimate plant and community determinants of the percentage of women employed in selected occupations.

WOMEN IN THE RURAL LABOR FORCE

Women are responding to the changing rural economic environment. In the 1960s, nine out of ten jobs created in nonmetropolitan counties were occupied by women, with the pattern continuing through the 1970s (Brown and O'Leary). Women's total labor force participation rate surpassed 50 percent in the late 1970s, reaching 54 percent in the mid-1980s. The growth was similar in nonmetropolitan areas, although the average participation rate is still slightly less than 50 percent. Projections are that two-thirds of the labor force growth from 1975 to 1995 will be among women, regardless of assumptions behind the estimates (U.S. Department of Labor, 1986).

The types of employment opportunities for rural women, however, have tended to be concentrated in low wage, low skill occupations and industries. Moreover, these jobs frequently are part time, thus leading to overall inferior situations and opportunities for women (Brown and O'Leary; Sweet; Haney). One reason for this situation is the industries that often locate in rural areas are slow growing and declining, and labor intensive (Tweeten and Brinkman). Such industries tend to hire the less advantaged (less educated, less experienced) members of the labor force, which is the general characteristic of rural women workers (Gillis and Shaffer).

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The evidence concerning potential opportunities for women in high tech industries in inconclusive. On the one hand, women's opportunities for moving into traditionally male occupations are greatest in job sectors experiencing rapid growth. The demand for labor outstrips the primary source (males), and employers are forced to turn to other labor pools (Donato and Roos; Glenn and Tolbert). Moreover, many of the occupations, and tools to perform the work in high tech manufacturing did not exist before. Thus, the occupations in such industries have not been monopolized by entrenched groups of workers of a particular race or gender (Mellow). In addition, women are now becoming a significant part of the most recently trained scientific work force, occupations which account for a relatively high percentage of employment in high tech industries (U.S. Department of Labor, 1985; Hornig).

On the other hand, the machines in high tech industry are operated by a largely female labor force, while a largely male labor force controls what happens inside the machines. Access to high tech employment is especially difficult for women who may not have been exposed to the science and mathematics courses which lay a foundation for the skilled professional and technical occupations. Also, there is evidence that it is primarily the slow growth industries that are hiring women Ph.D.'s. The fast growth industries are hiring the fewest women scientists, and have the slowest growth of hiring women to do research (Mellow; Hornig).

It is not clear, then, in which areas or to what degree rural women will benefit from the promise of high tech employment. For rural areas trying to target employment development efforts, or estimate impacts of high tech manufacturing, this information is important. The question that needs to be answered is whether or not the growing opportunities in high tech manufacturing, and the accompanying professional, technical and skilled jobs, will extend to women in rural areas. The remainder of the paper addresses this question.

DATA AND GENERAL CHARACTERISTICS OF THE SAMPLE

The definition of high technology industries used in this study was developed in 1983 by Armington, Harris and Odle of The Brookings Institute. This definition classified an industry as high technology if (1) more than 8 percent of its employees were in scientific, engineering and technical occupations and at least 5 percent of industry employment was in the more narrow class of scientific and engineering occupations, or (2) the proportion of expenditures for research and development relative to product sales exceeded the national average.[1]

The data on nonmetropolitan manufacturers are from a mail survey (following Dillman's method) of 927 high technology and low technology manufacturing firms located in nonmetropolitan counties in eleven Western states -- Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The sample frame was the manufacturing directory for each state for 1985 or 1985/86. All nonmetropolitan counties in each state were identified, and all high tech establishments listed in the directories for those counties were selected for the survey. A 10 percent stratified random sample of listed low tech establishments was selected. The total

number of responses was 638, for an overall response rate of 68.8 percent. The usable response rate was 62.7 percent, with 280 high tech and 301 low tech establishments.

The average size of the high tech establishments was 52 employees, vs. 31.6 employees for the low tech establishments. For size categories of less than 10 and 10 or more employees, the average size was 4.8 and 68.7 employees, respectively. Within the category of 10 or more employees, the high tech establishments averaged 78.3 employees, vs. 57.1 employees for the low tech (these differences are all statistically significant at least at the .05 level). In the smaller category, the high and low tech establishments were virtually the same size, at 4.9 and 4.7 employees.

The establishments in the sample were divided into two ownership types -- single unit plants (including headquarters) and branch plants. Over 80 percent of the sample was in the first category, and 19 percent in the second. These percentages were about the same for both high and low technology categories. For establishments in the 10 or more category, branch plants averaged 143 employees vs. 42 for the single unit/headquarters plants.

Overall, the high tech establishments sampled employed a slightly higher percentage of women, 31 vs. 28 percent. For the larger size establishments, the difference widens to 32.5 vs. 26 percent, which is statistically significant at the .05 level. Although high tech establishments employed a larger percentage of women overall, the difference appears to arise primarily in the low skilled production occupations of operators/fabricators and laborers (Table 1). Women have over 31 percent of the operator/fabricator jobs in the high tech vs. 18 percent in low tech establishments, for the sample as a whole. This gap widens to 34 percent vs. 16 percent for establishments with 10 or more employees. At the high end of the skill spectrum, women make up 26 percent of the professional and technical employees in low tech establishments, but only 15 percent for high tech. Again, the gap widens among larger plants, to 28 percent vs. 14 percent, respectively. All these differences are statistically significant at the .01 level.

Table 2 provides further detail. Between the high and low technology categories the statistically significant differences are in the professional and the higher and lower skilled production categories. Significantly lower percentages of women were employed in the professional occupations by high tech establishments, regardless of type and size of establishment. In the skilled production occupations (precision production), high tech branch plants also employed a statistically significant lower percentage of women. On the other hand, in the lower skilled operator/fabricator occupations, both high tech branch and single unit plants employed considerably higher percentages of women than did similar low tech plants.

DETERMINANTS OF THE PERCENTAGE OF WOMEN EMPLOYEES

It is hypothesized that the percentage of women employed in selected occupations (professional/technical, precision production, operator/fabricator, laborer) is a function of establishment and community characteristics. The establishment characteristics are high or low tech, the

percentage of employees who are part time, employment size of the establishment, and whether the establishment is a single unit (including headquarters) or branch plant. The community characteristics are the population of the town in which the plant is located, location in a county adjacent to a metropolitan county, the 1980 county labor force participation rate for women, average county unemployment rate (1976-1985), percent county employment in service industries, and the percentage of county population that is minority.

The model is estimated with a two-limit tobit procedure (Maddala). This is more appropriate than OLS estimation, as the dependent variable is a percentage with limits at 0 and 100, thus giving a censored regression. Estimation with OLS leads to biased and inefficient estimators when a number of values of the dependent variable are at the limits, as is the case here.

The model underlying tobit is expressed as follows:

$$Y_i = \begin{cases} 0, \text{ if } \beta X_i + \epsilon_i \leq 0 \\ \beta X_i + \epsilon_i, \text{ if } 0 < \beta X_i + \epsilon_i < 100 \\ 100, \text{ if } \beta X_i + \epsilon_i \geq 100, \end{cases}$$

where 0 and 100 are the lower and upper limits on the dependent variable Y_i, β the vector of coefficients, X_i the vector of dependent variables, and ϵ_i the independently normally distributed error with zero mean and constant variance. The assumption is that $\beta X_i + \epsilon_i$ is a latent variable, observed only when it falls between the limits.

The results are in Table 3 for all plants with 10 or more employees[2], using a dummy variable to distinguish between plant type (1 for branch, 0 for single unit/headquarters). The Chi-square statistics show that the model explains the percentage of women's employment much better for the less skilled occupations (operators/fabricators and laborers) than for the skilled occupations (professional/technical and precision production). There also are few differences between high and low tech plants in the variables explaining employment of women. Apparently, after considering each occupation separately and controlling for other factors, the key factors determining women's employment are not technology and type of plant, but other plant and community characteristics.

The coefficients for plant characteristics are significant only for the lower skilled occupations. The percentage of part time employees is positively related to women's employment as laborers in low tech plants, but negatively related to operators/fabricator employment in high tech plants. Plant size has a consistently positive effect on the percentage of women employed in each occupation. The effect is particularly strong and statistically significant in the high tech plants and lower skilled occupations, and also is marginally significant in the high tech precision production occupation.

The community characteristics provide a mix of expected and unexpected results. The population of the town is mainly negatively related to the percentage of women employed, particularly in the lower skilled occupations. Thus, plants in smaller towns provide relatively more opportunities for women.

Location in a county adjacent to a metropolitan county has a consistently positive effect on the percentage of women employed, and is statistically significant for all but the professional/technical category. The effects of the women's labor force participation rate are inconsistent across occupations. The negative coefficients are somewhat unexpected, however. Previous research has shown a positive relationship between women's labor force participation and generalized manufacturing activity (Brown and O'Leary). The percentage of county population that is minority is positively related to the percentage of women employees. The stronger and statistically significant relationships are for low tech production occupations, and also for low skill production jobs in high tech plants. Average county unemployment rate and percent service employment do not contribute to the explanation.

CONCLUSIONS

Previous research had suggested that high tech manufacturing might provide greater opportunities for women. The results of the survey show that high tech plants employed higher percentages of women than low tech plants. They did so, however, only in the lower skilled occupations. The low tech industries, on the other hand, provided considerably higher percentages of jobs for women in the professional and technical and more highly skilled production occupations. When controlling for other influences, however, the analysis showed that technology and type of plant did not explain the percentage of women employed as well as other plant and community characteristics.

The similarity of community influences on both high and low tech plants implies that rural areas are not at a disadvantage in gaining the former. Moreover, it appears that larger high tech plants provide more opportunities for women. And since high tech plants were larger, on average, larger numbers of jobs also would be available.

The results also imply that specific information on the women's labor market in a rural community would be valuable in recruiting both high and low tech industry. A relatively low women's labor force participation rate may imply a latent labor supply for larger branch plants, particularly high tech. The number of women willing to work outside the home, who are not currently doing so, could be an important piece of information for job creation efforts. This should be combined with other characteristics, such as number of small children at home, to gain an idea of women's availability for full time work. This is important because high tech employment of women in the less skilled production occupations does not appear to be part time. Thus, if the effort is made to target high tech employment for women, efforts also may have to be made to enable them to work full time.

Footnotes

1. Industries classified as high-technology are: industrial inorganic chemicals (SIC 281); plastic materials; synthetics (SIC 282); drugs (SIC 283); industrial organic chemicals (SIC 286); miscellaneous chemical products (SIC 289); petroleum refining (SIC 291); ordnance and accessories (SIC 348); engines and turbines (SIC 351); construction machinery (SIC 353); general industrial machinery (SIC 356); office and computing machines (SIC 357); electrical industrial apparatus (SIC 362); radio and TV receiving equipment (SIC 365); communication equipment (SIC 366); electronic components (SIC 367); aircraft and parts (SIC 372); guided missiles (SIC 376); engineering, scientific instruments (SIC 381); measuring and control devices (SIC 382); optical instruments and lenses (SIC 383); medical instruments and supplies (SIC 384); ophthalmic goods (SIC 385); photographic equipment (SIC 386); watches and clocks (SIC 387).

2. As many of the respondents were small establishments with few employees, a break point of 10 employees was arbitrarily chosen to focus attention on establishments that might generate more noticeable local economic impacts (321 of the 581 establishments).

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Table 1. Percentage of Women Employed in Occupational Categories in the Rural West Nonmetro Manufacturing Sample, 1985.

	Entire Sample		10 or more Employees	
	High Tech	Low Tech	High Tech	Low Tech
Executives	22.1	23.6	22.5	21.6
Professional	15.3	26.1	14.0	28.1
Sales	16.0	21.2	17.0	18.0
Clerical	81.9	86.4	81.5	89.0
Precision Production	10.8	12.1	10.6	8.9
Operators; Fabricators	31.4	18.0	33.9	16.2
Laborers	18.7	16.0	17.4	14.1

Table 2. Percentage of Women Employed in Each Occupation by Type of Establishment and Technology

	Type of Establishment			
	Entire Sample		10 or More Employees	
	Branch	Single Unit	Branch	Single Unit
Executives				
High Tech	16.6	23.4	15.9	25.1
Low Tech	16.9	25.0	14.5	23.9
Professionals				
High Tech	13.5	15.8	11.8	14.9
Low Tech	27.9	25.4	29.4	27.5
Sales				
High Tech	13.0	16.7	15.6	17.4
Low Tech	19.9	22.1	18.0	18.3
Clerical				
High Tech	86.8	80.8	87.9	78.9
Low Tech	80.6	88.1	81.4	91.8
Precision Production				
High Tech	4.6	12.3	4.8	13.1
Low Tech	12.6	12.1	9.2	8.9
Operators; Fabricators				
High Tech	27.6	32.7	31.7	35.1
Low Tech	19.7	17.7	18.5	15.5
Laborers				
High Tech	13.0	21.3	14.8	18.8
Low Tech	10.0	17.9	11.1	15.3

Table 3. Determinants of Percentage of Women Employees by Occupation and Technology: Establishments With 10 or More Employees[a]

	LABORERS		OPERATORS/FABRICATORS		PRECISION PRODUCTION		PROFESSIONAL/TECHNICAL	
	High Tech	Low Tech	High Tech	Low Tech	High Tech	Low Tech	High Tech	Low Tech
Branch vs. Unit Plant	-12.674	-24.154	7.783	3.154	-5.591	17.713	12.105	32.658
	(-.56)	(-.84)	(.60)	(.63)	(-.33)	(.80)	(.95)	(1.09)
% Part Time Employees	.630	1.009	-.746	-.0379	.473	.470	.091	.325
	(1.10)	(1.73)*	(-2.41)**	(-.47)	(1.29)	(1.25)	(.29)	(.47)
Plant Size	.225	.321	.091	-.0002	.101	.024	.066	.124
	(2.48)**	(1.82)*	(1.74)*	(-.01)	(1.54)+	(.18)	(1.04)	(.46)
Town Population	-.00148	-.00070	-.00087	-.00111	-.00008	.00036	-.00006	.00000
	(-1.74)*	(-.53)	(-1.92)*	(-4.98)***	(-.14)	(.38)	(-.14)	(.00)
Adjacent to SMSA County	35.705	48.553	30.707	7.013	30.568	28.71	-1.306	.328
	(1.88)*	(2.06)**	(2.84)***	(1.70)*	(2.16)**	(1.37)	(.12)	(.01)
Average % Unemployment	-6.560	.882	-.904	.154	1.246	2.390	4.246	1.781
	(-1.86)*	(.21)	(-.43)	(.20)	(.48)	(.68)	(1.82)*	(.30)
Women's Labor Force Participation Rate	-2.030	-1.649	2.230	.436	-.050	2.825	.205	-2.903
	(-1.62)*	(-.62)	(2.29)**	(.95)	(-.05)	(1.52)+	(.26)	(-1.10)
% Service Employment	5.462	-76.936	-8.396	-3.96	-1.567	-19.992	5.931	23.94
	(.53)	(-.68)	(-.89)	(-.26)	(-.16)	(-.25)	(.81)	(.18)
% Minority Population	.411	.478	.696	.543	.459	1.001	-.127	-.303
	(.82)	(.96)	(2.34)**	(5.90)***	(1.07)	(2.04)**	(-.38)	(-.40)
χ^2	16.37	15.27	30.78	21.67	7.30	15.19	4.27	3.09
Significance Level	.059	.084	.000	.010	.606	.086	.893	.961

[a]Numbers in parentheses are t-ratios.

+; *; **; *** - statistically significant at the .15, .10, .05, and .01 levels, respectively.

INDUCED AGRICULTURAL DEVELOPMENT IN TOURISM-BASED ECONOMIES

by

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INTRODUCTION

A declining agricultural sector is not the preordained outcome of increased tourism because new agricultural-based goods and services induced by tourism may more than offset decreases in traditional agricultural activities. However, the academic literature in general reinforces the perception of the agriculture and visitor industries as being independent sectors in competition with each other for the scare resources of the economy (Belisle).

This paper argues that increases in tourism change the structure of the agricultural sector, but do not necessarily lead to its demise. It contains a discussion of how tourism may stimulate the demand for food and agricultural services and increase the positive externalities received by society from farmland. The concluding section includes a discussion of the need for a comprehensive research program to investigate all the direct, indirect, and non-market aspects that make up the linkages between the agriculture and tourism sectors.

FOOD PRODUCTION AND THE VISITOR INDUSTRY

The perception that an increase in tourism causes a decline in agriculture stems from evidence that as tourism grows, a larger proportion of food is imported (Latimer). Hope's study of the decline in trade balances for agricultural products and agricultural's share of exports in the CARICOM countries of Barbados, Guyana, Jamaica, and Trinidad and Tobago also supports these conclusions.

This focus on agriculture's share of trade in light of increases in tourism has painted an overly pessimistic picture. The data used by Hope and Latimer show, or in some cases suggest, that while agricultural imports increased, domestic production also increased. A relative decline in the agricultural sector is well accepted by development professionals to be an inevitable part of modernization; it is an indicator of economy's progress rather its decline. Looking at the role of agriculture on its own terms is more revealing and provides a more realistic assessment of agriculture's performance.

Recent research indicates that agriculture will respond to an increase in tourism, albeit with difficulty (Latimer). Imported agricultural products may have a competitive advantage. However,