

WOMEN'S WORK IN RURAL KOREA, 1980: LAND, LABOR, AND CAPITAL

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This study examines the relationship between women's labor force participation and the agricultural production system in rural Korea in 1980. Data are drawn from the 1980 Agricultural Census Report for Guns (rural administrative districts). Three dependent variables are considered; (1) the overall rate of women's labor force participation, (2) the labor force participation rate in agricultural work, (3) the multiple labor force participation rate both in agricultural and in non-agricultural work. The six independent variables utilized in the regression analyses represent the characteristics of land, labor, and capital in the agricultural system. The analyses show that the independent variables have quite different effects on each of the three dependent variables. With regard to the first two dependent variables listed above, the effects of the independent variables vary greatly by the areal sex ratio in Guns. The most important variable affecting women's participation in agricultural work is the ownership of farm machinery, whereas the most important variable affecting women's participation both in agricultural and in non-agricultural work is the size of family land which seems to represent proximity to urban areas.

This study examines women's labor force participation in rural Korea in 1980 in relation to other factors of the agricultural system such as land and capital. Korean women played an important role in the process of economic development by providing labor resources. Women constituted 34.9 percent of the total labor force in 1970 and 36.6 percent of the total labor force in 1980. The labor force participation rate among women 14 to 64 years of age increased dramatically from 28 percent in 1960 to 39.7 percent in 1970 when the government's second economic plan was in full force. Between 1970 and 1980 women's labor force participation rate remained almost the same, the participation rate of 1980 being 40.3 percent (Min, 1982, p. 238; EPB, 1973, Table 1; EPB, 1982, Table 1).

These overall figures mask differences in economic behavior of women in urban and rural areas. Women in rural areas participated in the labor force in greater proportion than women in urban areas. The difference in the labor force participation rates between the rural and urban women was more than twice as great in 1970 and 1980 as in 1960. In rural areas the labor force participation rates of women 14 to 64 years of age were 31 percent, 50.1 percent, and 54.1 percent in 1960, 1970, and 1980 respectively; the corresponding figures for urban areas were 20.7 percent, 27.2 percent, and 31.1 percent respectively (Min, 1982, p. 238).

The feminization of agricultural labor force has been observed in many parts of the world especially in European — both east and west — and African countries. In European countries agricultural work used to be men's work. But the collectivization of agriculture in east European countries and the rapid industrialization in both east and west European countries brought about changes in the distribution of agricultural workers by gender resulting in feminization of agricultural work force. As industrialization proceeded in urban areas massive male outmigration from rural areas ensued. The collectivization of agriculture weakened the traditional attachment of peasants to their former privately owned land. The mechanization of agriculture freed a significant portion of manual workers to look for urban jobs. With men leaving the family farms, the burden of agricultural work increasingly fell upon women's shoulders. In rural areas of Rumania, men represented 36.8 percent and women 63.2 percent of the total labor force employed in all Agricultural Producer

Cooperatives in 1974 (Cernea, 1978, p. 111). In rural Yugoslavia, women carried out between 60 to 70 percent of all farm work in the late 1960s (First-Dillić, 1980, p. 2). A similar phenomenon is also found in other parts of the European continent such as Hungary, Italy, Poland, U.S.S.R., and to a certain extent Federal Germany. In the orient, the People's Republic of China made it a part of the national development strategy in the late 1950s to encourage the participation of women in agricultural production in order to draw male labor into non-agricultural pursuits. Thus, the sexual division of labor between agriculture and non-agriculture is artificially created (Croll, 1979, p. 26). In Africa the agricultural labor force is predominantly female (Boserup, 1970, p. 21). In the early 1970s in Kenya, 60 percent of agricultural work was performed by women. Almost half the rural households in Ghana were headed by women and two-thirds of rural women were solely responsible for the daily living of their families (Savané, 1980, p. 27; Bukt, 1980, p. 18). In Korea the proportion of females in the agricultural labor force is not as high as in these countries, but is increasing. The female labor force constituted 40 percent of the total rural labor force (excluding Eups, i.e., small towns) in 1970 and 44.1 percent in 1980 (EPB, 1973, 1982, Table 1 respectively).

It has been mentioned that the feminization of agriculture is only a temporary phenomenon occurring (1) in the early phases of industrialization, or (2) in regions undergoing rapid industrial change, or (3) where industrial development is accompanied by collectivization of agriculture (First-Dillić, 1980, p. 1; Cernea, 1978, p. 112). Perhaps the Korean experience of increasing women's involvement in agriculture falls into the second category. The implementation of several successive five-year economic plans has brought about rapid transformation of the economic structure. The proportion of the labor force employed in the primary sector decreased from 58.3 percent in 1966 to 38.5 percent in 1980, while that employed in the secondary sector increased from 12 percent to 22 percent during the same period (Min, 1986, p. 292).

A Review of the Literature

A review of the literature suggests that three groups of factors are involved in explaining women's labor force participation in rural areas: economic, social and demographic factors. The economic factors include ownership and size of land, mechanization and commercialization of agriculture. Boserup (1970, p. 31) argues that the private ownership of land in plough cultivation regions is the main factor explaining the less expensive involvement of women in agricultural production in these regions than in shifting cultivation regions. Families that own large land hire the landless rural proletariat to perform agricultural work rather than utilizing the labor of women in the family. Similarly, Anker and Knowles (1978) and Deere (1982) report that equal distribution of land is related to greater participation of women in the labor force than unequal distribution of land. An analysis of rural women's labor force participation in Korea in 1970 reports that the ownership of family land had a positive effect on women's participation in the labor force and that the effect was greater in areas where the sizes of land holdings were small than in areas where the sizes of land holdings were large (Min, 1985).

The size of the farm land owned by the family is another important economic factor determining whether or not women work on the farm (Min, 1985). Other things being equal, large farms require more labor than small farms and tend to hire wage labor. Small farms tend to maximize family labor (Coughenous and Swanson, 1983; Ahmed, 1983, p. 498). In Peru, Deere (1982) found that women in higher land-size strata tended to confine themselves to cooking for field workers, whereas women in the lower land-size strata tended to work in the fields.

The mechanization of agriculture has been discussed in the literature in terms of its contribution to productivity increase, of its impact on social class structure, and of its effect on women's labor force participation in agriculture. Of interest here are the latter two aspects of mechanization which are interrelated. There are three objectives of mechanization; (1) to increase labor productivity, (2) to increase land productivity, and (3) to decrease costs of production. In spite of these advantages

of mechanization, not all farmers in different social classes can equally afford to mechanize agricultural production. Mechanization requires considerable economies of scale, thus favors large farms, and facilitates the growth of large farms. Large farms have the financial resources to purchase the equipment and to pay high maintenance costs. Most equipment having been developed in western countries is designed for relatively large farms. Large farmers are better equipped with special skills to operate the machinery. The advantages of mechanization mentioned above make it profitable for large farmers to take over more farming operations or expand their farms by buying out small farmers. Small farmers and renter-tenants are driven into the ranks of the rural proletariat (Arnon, 1981, p. 373; Binswanger, 1986, p. 36; Lu, 1985, p. 1158; Rijk, 1984, p. 23). Ramsay (1985, p. 355) found mechanization to be the only significant explanatory factor for landlessness in Thailand. In Japan, if small farmers try to mechanize agricultural production, they incur "mechanization poverty." Income from the small scale of agricultural production is increasingly not enough even for household expenditures. The purchase of farm machinery puts an additional burden on the household budget. In order to meet these financial demands small farmers need to work off-farm (Oshiro, 1985, p. 327; Arnon, 1981, p. 366). Thus, the income distribution among different social classes within a region may become even more unequal as a consequence of mechanization of agriculture.

The relationship between mechanization and labor is rather complicated. In general, mechanization is said to have displacing effect on labor. However, this generalization has been criticized and modified in a variety of ways. Whether agricultural machines displace or replace labor depends upon the status of the regional economy. When there are off-farm jobs in the region, the machinery is not displacing but replacing labor. When the use of machinery makes it possible to expand cultivated land and double-crop, the demand for labor may remain constant. Also when machinery is used to change cropping patterns in favor of cash crops such as melons and vegetables, demand for hired labor increases. But in other circumstances reductions in the agricultural work force caused by mechanization can be substantial and those who lose their jobs may have to remain unemployed. (Ahmed, 1983, p. 495; Ahn, *et al.*, 1981, p. 705; Arnon, 1981, p. 364; Binswanger, 1986, p. 38; Ramsay, 1985, p. 355).

While the relationship between mechanization and the absolute demand for labor in agriculture is not clear and depends upon the status of the regional economies, what is clear is that mechanization does have a serious impact on the kind of labor demanded and on the sexual division of labor in the farm families. First of all, mechanization reduces family labor and increases hired labor. As mentioned above, with the advantages of mechanization large farms tend to increase the scale of production by buying up small farms. Thus, women and other family members who hitherto have been working on the small family farms lose their work and work as hired laborers on the large farms. The expansion of mechanization may further displace hired labor. The large farm families on the other hand may reduce their own labor supply and prefer to hire labor as their incomes increase and as the scale of farm operation increases. Women in these wealthy households may engage in more lucrative trading ventures (Bandarage, 1984, p. 501) Thus, mechanization reinforces the effect of ownership and size of land on women's involvement in agriculture.

Secondly, when small farms are mechanized, the farmers face "mechanical poverty" and may divide the family labor resources into on-farm and off-farm jobs in order to cover the household expenditure and farm operation. At the same time mechanization makes it possible to release family labor to off-farm jobs. The extent of women's participation in agricultural production in this case depends upon who takes up the off-farm work. Thirdly, mechanization is selective in terms of the tasks to be mechanized. In general, the machinery is applied to tasks which are done by men. When traditional women's tasks are mechanized men tend to take over the operation. Therefore, women are relegated to do unmechanized works and confined to a marginal role or unskilled labor (Abdullah, 1980, p. 36; Savané, 1980, p. 31). Oshiro reports a change in the composition of the core group of workers in the farm household in Japan (1985, p. 329). The core group used to consist of the housewives and elderly. After the mechanization of production, it consists of younger

males in the family. In most developing countries the social status of agriculture has been enhanced by mechanization of production and younger generation of workers tends to take over the management of the farm (Arnon, 1981, p. 365). However, the overall male labor force is reduced because mechaization frees men hitherto engaged in manual work and allows them to leave for permanent non-agricultural work leaving the bulk of agricultural work behind to be done by women (Cernea 1978, p. 110).

Fourthly, when the subsistence agriculture is transformed into commercial agriculture through mechanization, women's work load may increase, because women are expected to help men in cultivating cash crops in addition to performing their traditional tasks of growing food crops for family consumption (Ahmed, 1983, p. 495). In plantation Africa, the sexual division of labor is clear. Men work on commercial farms and women on subsistence farming (Savané, 1980, p. 28) In rural Poland, Tryfan reports changes in the division of labor by sex due to male outmigration to urban areas. The range of women's activity has been enlarged including activities which used to be in men's domain. At the same time more men have become involved in activities that were traditionally performed by women such as cow milking and cattle breeding (Savaé, 1980, pp. 16-17).

Educational status of women is one of the social factors affecting women's labor force participation. According to Human Capital theory, the higher the level of education and training, the greater the worker's productivity and therefore, the greater the returns for the individual in a free and competitive labor market. This means that a person with a high level of education has better access to employment opportunities and at the same time, has higher opportunity cost of being out of the labor market than a person with lower level of education. In addition, higher levels of education weaken the constraints of the traditional culture, tend to alter women's preference with respect to household activities, and thus motivate women to pursue professional achievement, economic independence, and improvement of her family's level of consumption (Pecht, 1978, p. 36; Peek, 1978, p. 63; Sheehan, 1978a, p. 256). Therefore, one would normally expect a positive relationship between the level of education and labor force participation.

On the other hand, a woman with higher education will usually be married to someone with an equal or higher level of education and relatively higher income. So it will be less necessary for her to contribute to household income.

The effect of women's educational status varies also by cultural factors and the development stage of the economy. When the culture strongly prescribe women not to participate in the labor force and attaches a stigma to working women, the attainment of education would not have any effect on women's labor force participation. In rural areas and in the traditional sector of urban economy there will not be many jobs which require higher level of education.

Thus, the relationship between women's educational status and their labor force participation is not as simple as it appears to be. Many studies show a positive relationship (de Graft Johnson, 1978; Fong, 1978; Macke, *et al.*, 1977; Pecht, 1978; Peek, 1978; Rasević, 1978; Sheehan, 1978a, 1978b; Standing, 1978; Standing and Sheehan, 1978a and 1978b; Uthoff and González, 1978), but other studies show a negative or no relationship (Angulo and de Rodriguez, 1978; Anker and Knowles, 1978; Morgenstern and Hamovitch, 1976; Standing and Sheehan, 1978b; Shapiro and Shaw, 1983). Some studies report secondary education to be a critical level positively affecting women's labor force participation (Pecht, 1978; Standing and Sheehan, 1978b; Uthoff and González, 1978). In rural Korea in 1970 it was found that women's education had a negligible but positive effect on women's labor force participation in areas where the sizes of land holdings were small, but it had a negative effect in areas where the sizes of land holdings were large (Min, 1985).

Demographic factors affecting rural women's participation in the labor force include family size and sex ratio. The role conflict hypothesis suggests an inverse relation between the level of fertility and women's participation in economic activities. The child care role is hypothesized to be in conflict with the worker role as both roles demand women's time and attention. In general, this hypothesis is supported in industrialized economies but in less industrialized economies the rela-

tionship is less conclusive. In most rural areas and in the traditional sector of urban economy women can perform both roles at the same time. In many subsistence rural economies the large family means more people to feed and therefore, tends to have a positive effect on women's labor force participation (Min, 1983, 1985). Sex ratio is another important demographic variable affecting rural women's labor force participation. As mentioned above, when men folks go to town for non-agricultural employment women have to work on the farm. In rural Korea in 1970 the areal sex ratio was negatively related with women's labor force participation (Min, 1985).

This study examines women's participation in economic activities in rural Korea in 1980 in relation to these economic, social, and demographic variables and thereby purports to understand the interrelationship among the three elements of the agricultural system, i.e., land, labor, and capital.

Data and Methods

The 1980 Agricultural Census Report provides the data for this study. The unit of analysis is not individuals but Guns which are rural administrative districts. In the agricultural census, the population 14 years old and over is classified into the following categories: (1) those who worked only in agriculture in the previous year and those who worked, in addition to agricultural work, in non-agricultural jobs less than 30 days in the previous year, (2) those who worked, in addition to agricultural work, in non-agricultural jobs more than 30 days in the previous year, (3) housewives, (4) students, and (5) others (sick or without a job). In this study the labor force participation rates are calculated for women 14 years old and over.

Our dependent variable, WLF1 is the proportion of women who fall into categories (1) and (2) of the total women. This is an overall measure of women's labor force participation. There are two other dependent variables, WLF2 and WLF3. WLF2 is the proportion of women who fall into the category (1) of the total women, i.e., the proportion of women who worked mainly in agriculture of the total women. WLF3 is the proportion of women who fall into the category (2) of the total women, i.e., the proportion of women who worked both in agricultural and in non-agricultural sectors of the total women.

Six independent variables were selected. The characteristics of land are represented by variables, SMLAND and SMLPDY. SMLAND is the proportion of households with less than or equal to 0.3 ha of land of the total households. SMLPDY is the proportion of households with less than or equal to 0.3 ha of paddy field of the total households. The social and demographic characteristics of labor is represented by SEXRATIO, WED7UP, and MEANSIZE. SEXRATIO is the ratio of men to women 14 years old and over. WED7UP is the proportion of women with 7 or more years of education of the total women. MEANSIZE refers to the average size of households in number of persons. The element of capital in the agricultural production system is represented by CAP which is an index of ownership of farm machinery. The index indicates the abundance of farm machinery relative to the national average (see Appendix for index formulation).

We used regression analyses to determine the independent effects of each of our six independent variables on the dependent variables. We found significant interactions between two independent variables (SEXRATIO and CAP) with respect to two of our dependent variables (WLF1 and WLF2). Therefore, the total 139 Guns were divided into two groups using the mean sex ratio of 139 Guns as the criterion: (1) high sex ratio group (69 Guns) and (2) low sex ratio group (70 Guns). Regression analyses for WLF1 and WLF2 were run separately for these two groups of Guns. Regression analysis for WLF3 was run for total 139 Guns as there was no significant interactions among the independent variables.

Findings

Table 1 shows very interesting results. With one exception (WED7UP) the effect of each indepen-

Table 1. Regressions of Women's Labor Force Participation Rates, Rural Korea, 1980

Indep. Var.	Regression of WLF1		Regression of WLF2	
	HSRA(69) beta	LSRA(70) beta	HSRA(69) beta	LSRA(70) beta
SMLPDY	.02	.24	-.01	.13
WED7UP	.07	.05	-.11	.04
MEANSIZE	.23	.14	.22	.02
CAP	-.04	-.43	.00	-.52
R ²	.06	.34	.07	.31
<u>Regression of WLF3 (139 Guns)</u>				
				<u>beta</u>
SMLAND				.53
WED7UP				.30
SEXRATIO				.13
MEANSIZE				.14
CAP				.15
R ²				.44

Source: Data were drawn from Ministry of Agriculture and Fisheries, *1980 Agricultural Census* Vol. 10 (National Edition), Republic of Korea, 1982.

Note: HSRA refers to High Sex Ratio Areas and LSRA refers to Low Sex Ratio Areas. The numbers in parentheses refer to the number of Guns in each area. The means, standard deviations, and correlation matrix of the variables are shown in Appendix Tables A and B.

dent variable on the proportion of total working women (WLF1) in high sex ratio areas is quite different from that in low sex ratio areas. The effect of SMLPDY (the proportion of farm households with less than or equal to 0.3 ha of paddy field of the total households) is positive but very weak in high sex ratio areas, and it is positive and substantial in low sex ratio areas. The effects of women's education (WED7UP) are positive but negligible in both areas. The family size variable (MEANSIZE) has positive effects in both areas, but the effect is stronger in high sex ratio areas than in low sex ratio areas. Farm machines (CAP) have negative effects in both areas but the effect is greater in low sex ratio areas than in high sex ratio areas. These four independent variables explain very little of the variation in women's labor force participation rates in high sex ratio areas but they explain one third (0.34) of the variation in women's labor force participation rates in low sex ratio areas.

We have to be cautious in interpreting these results because WLF1 is the overall measure of women's labor force participation. We would expect that the effect of independent variables on women's participation in farm work to be different from those on women's involvement in multiple jobs both in farm and in non-farm work. The separate runs of regressions of WLF2 (the proportion of women engaged only in farm work of the total women) and WLF3 (the proportion of women engaged both in farm and in non-farm work of the total women) show this difference.

When we use the dependent variable, WLF2, the differences between the effects of independent variables on women's economic activity rate in high sex ratio areas and those in low sex ratio areas are clearly pronounced. In high sex ratio areas there is no relationship (-0.01) between the proportion of households with less than or equal to 0.3 ha of paddy field of the total households and the proportion of women engaged in agricultural work of the total women. In low sex ratio areas, there is a positive relationship between the two phenomena. It seems that when the size of paddy field is small and men are around, there might not be enough work for women to do; but when fewer men are around to work on the farm, women must work on the small paddy field.

The variable of education, WED7UP, also has different effects on WLF2 in the two areas. In high sex ratio areas, the higher the proportion of women with 7 or more years of education of the total women, the lower the proportion of women engaged in agricultural work of the total women. In low

sex ratio areas the two variables have a mild positive relationship. In other words, when more men are around to tend the farm, educated women tend not to work on the farm, whereas when there are fewer men in the area, even women with education tend to be drawn to work on the farm. The family size variable, MEANSIZE, has positive effects in both areas but the effect is substantially greater in high sex ratio areas than in low sex ratio areas. In low sex ratio areas women must work on the farm anyway and having large family does not affect very much on whether or not they work on the farm. But in high sex ratio areas where men are available for farm work, family size may have a greater impact on whether or not women work on the farm.

The effect of the ownership of farm machines (CAP) on women's participation in farm work is nil in high sex ratio areas and it is very strong and negative (-0.52) in low sex ratio areas. It seems that when male labor is available for farm work, farm machines affect male labor rather than female labor. But in a situation where there is a shortage of male labor and women must assume most of the labor requirement in agricultural production, farm machinery will directly affect women's participation in farm work by releasing women from the burden of farm work.

The most important explanatory variable for WLF2 in high sex ratio areas is family size, and that in low sex ratio areas is farm machinery. The four independent variables together explain only 7 percent of the variation in women's participation in agriculture in high sex ratio areas, whereas they explain 31 percent of the variation in women's participation in agriculture in low sex ratio areas.

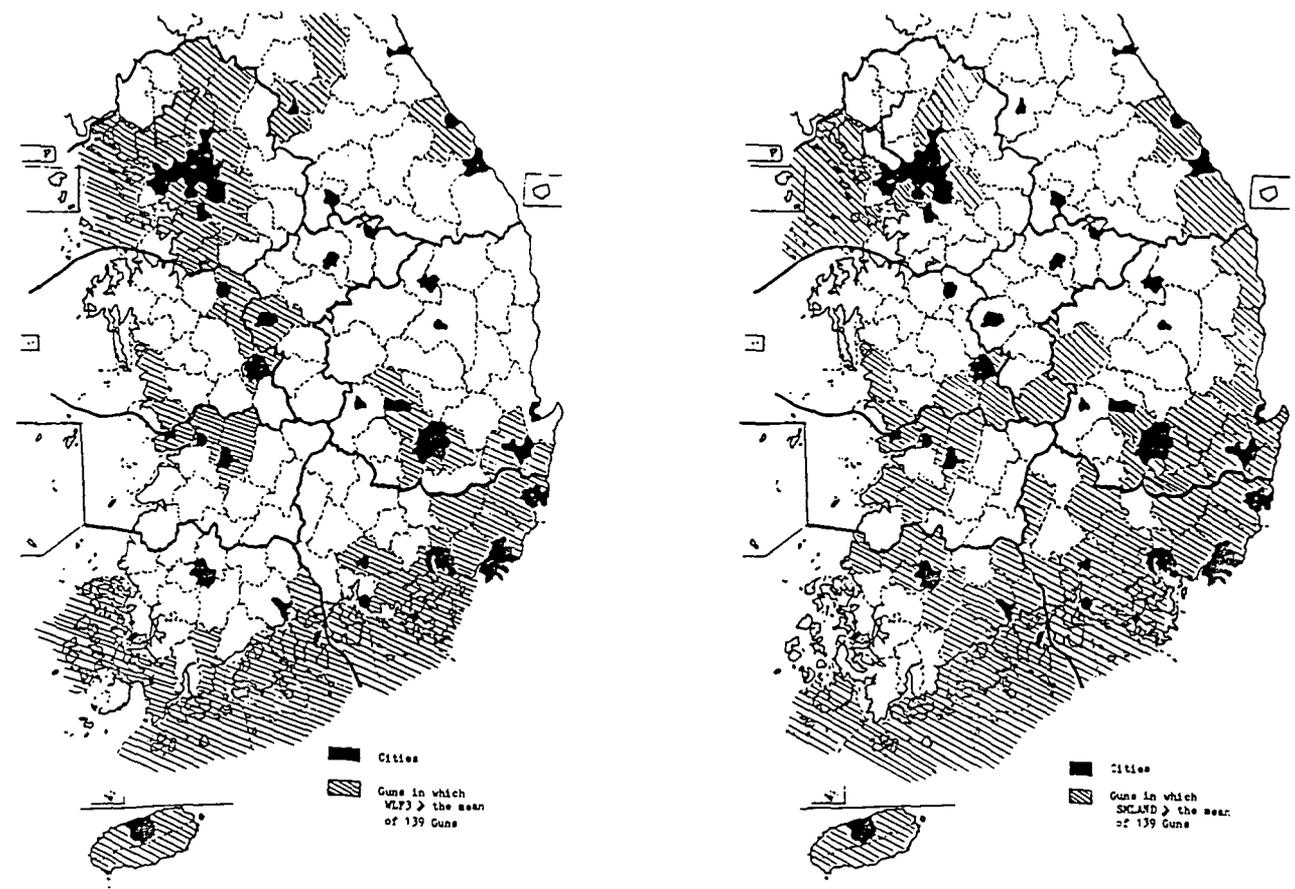
The regression of WLF3 (the proportion of women engaged both in farm and in non-farm work of the total women) shows a quite different picture (Table 1). We used the variable, SMLAND rather than the variable, SMLPDY in the regression because the size of land is thought to be more appropriate independent variable than the size of paddy field as our dependent variable is the proportion of women engaged not only in farm work but also in non-farm work of the total women. All five independent variables in the regression have positive effects on the dependent variable, WLF3. In terms of the magnitude of the effects, the land variable (SMLAND) is the greatest, followed by women's education (WED7UP). The effects of farm machinery (CAP), family size (MEANSIZE), and sex ratio (SEXRATIO) are similar in magnitude. These five variables explain 44 percent of the variation in women's activity rates (WLF3).

In order to better understand the strong positive effect of SMLAND on WLF3, Figure 1 shows two maps, one showing the locations of Guns in which the proportion of women engaged both in agricultural work and in non-agricultural work of the total women is greater than or equal to the national average, i.e., the average of the proportions of 139 Guns, and the other showing the locations of Guns in which the proportion of households with less than or equal to 0.3 ha of land of the total households is greater than or equal to the national average. We can see a close match between these two maps. The locations of these two groups of Guns cluster around urban centers and coastal regions. They seem to reflect the relationships among urban proximity, price of land, and non-agricultural job opportunities for women. The price of land in rural areas near urban centers tends to be high and thus the sizes of individual family-lands tend to be small. At the same time the proximity to urban centers offers women in these areas opportunities to work in non-agricultural jobs. The fact that individual families tend to have small land in coastal regions may reflect the environmental conditions of these areas rather than the price of land. The land may not fit for extensive agricultural production and people may combine small scale of agricultural production and jobs in fisheries for family income.

Education attainment substantially increases women's multiple job holdings in farm and non-farm sectors. This is quite a contrast with what we saw in the case of WLF2. We noted above that education had a negative effect on women's involvement in farm work in high sex ratio areas and slightly positive effect on women's involvement in farm work in low sex ratio areas. We may infer from these three beta coefficients of WED7UP on WLF2 (-0.11 in high sex ratio areas and +0.04 in low sex ratio areas) and on WLF3 (+0.30) that women's educational attainment is effective in increasing women's participation only in non-agricultural sector.

With regard to the sex ratio variable, the higher the sex ratio in the area, the higher the

Figure 1.
Geographical Locations of Guns in Which Each of WLF3 and SMLAND is Greater than or Equal to the National Average of Each Variable



Source: See Table 1.

proportion of women holding multiple jobs. This may be interpreted as that when men are in the house agricultural work is men's job and women perform a minor role in farming and are free to engage in non-farm jobs. The effect of the family size variable is not as great as in the case of WLF2 but in the same positive direction. Larger families require more family income than smaller families to live on and thus more women may have to contribute to the family income.

The effect of the ownership of farm machines on women's multiple job holdings is quite different from that on women's involvement in farming. We noted above that the ownership of farm machines greatly decreased women's participation in farming in low sex ratio areas. But in the case of women with multiple jobs, the ownership of farm machines has a positive effect on their job involvement. In both cases farm machines have a substitution effect for female labor in farming. The latter case shows that the availability of farm machines tends to further encourage women to take up non-agricultural jobs in addition to working in agriculture.

Conclusion

Our findings show what happened in rural areas when the country was experiencing rapid industrialization and urbanization. Rural women's work experiences varied depending upon whether they lived in high sex ratio areas or in low sex ratio areas, and whether they worked only in agricultural sector or both in agricultural and in non-agricultural sectors. While the importance of areal sex ratios in this analysis reflects the impact of urbanization on rural areas, the importance of the nature of women's work reflects the impact of industrialization in urban areas on rural living.

Although our study is not directly comparable with previous studies mentioned in the review section, our findings, in general, seem to be in congruence with their findings, and our study provides more detailed information in that the effect of each independent variable on women's economic activities varied by sex ratio of the area where they lived and by the nature of their work.

In previous studies it has been found that the size of farm land has a negative effect on women's farm work. In our study this is the case only in low sex ratio areas. The land variable (SMLAND) which has a strong positive effect on women's multiple job holdings seems to represent more of the effects of proximity to urban areas and non-agricultural job opportunities for women than the effect of the size of land per se. Previous studies have shown various effects of mechanization of agriculture on women's work. Some studies have found that because mainly men's agricultural tasks tend to get mechanized, women's agricultural work remains the same or increases after mechanization. In our study the ownership of farm machines has no effect on women's agricultural work in high sex ratio areas, but it substantially decreases women's agricultural work in low sex ratio areas. With regard to women holding both agricultural and non-agricultural jobs, the ownership of farm machines moderately increases their economic activity. We do not know whether this indicates "mechanical poverty" mentioned earlier. The family size variable has positive effects on women's work as expected although the strength of the effects varies by the areal sex ratio and the nature of women's work.

Previous studies on the relationship between women's education and women's labor force participation have also shown diverse findings. Some studies have found a positive relationship while others have found no or negative relationship. In our study the relationship between women's educational attainment and women's farm work is negative in high sex ratio areas and almost nil in low sex ratio areas. But the relationship between women's educational attainment and women's engagement both in agricultural and in non-agricultural jobs was positive and substantial.

In a previous analysis of rural women's labor force participation in 1970 (Min, 1985) the variables representing land, labor and capital had different effects on women's rural work in areas where the sizes of family lands were large and in areas where the sizes of family lands were small. In other words, the variable representing the sizes of land holdings was significantly interacting with other independent variables affecting women's farm work. In the present analysis, it is the variable representing areal sex ratios which has a significant interaction with other independent variable

representing the ownership of farm machines. Although these two studies are not exactly comparable due to slight changes in the measurement of variables, it is interesting to see the change in the variables with significant interactions. In 1970 the size of land has an important bearing on our understanding of rural women's participation in economic activities. Then, the mechanization of agriculture has just begun and it must not have great impact on either male or female labor force. A decade of a full scale industrialization and urbanization has brought about structural transformation in the agricultural system. It is no longer the size of land but the interplay among human labor, farm machines, and urban industries that has an important bearing on our understanding of rural women's economic activities.

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Appendix

The index of CAP was calculated as follows. First, the proportion of households that owned each of the following five farm machines was calculated: tiller, binder, thresher, pump, and transplanter. These five machines were selected for index formulation because they have relatively high correlation with the dependent variables (WLF1, WLF2, and WLF3). Second, the national average of these proportions for each of these machines was calculated (i.e., five mean proportions were calculated). Third, if the proportion of households in a Gun owning a farm machine was equal to or higher than the national average, number 1 was assigned for that machine for the Gun; if the proportion was below the national average, 0 was assigned. The same process was done with the five farm machines. Fourth, the index was the sum of the number 1's for each Gun. For example, the index of 3 means that the given area (Gun) has three kinds of farm machines whose ownership in the area was equal to or higher than the national average.

Table A. Means and Standard Deviations of the Variables

Variables	High Sex Ratio Areas (69 Guns)		Low Sex Ratio Areas (70 Guns)	
	Mean	SD	Mean	SD
WLF1	32.7	15.6	43.3	19.2
WLF2	27.1	15.6	37.7	19.3
SMLPDY	23.5	12.8	25.9	12.8
WED7UP	27.9	6.4	28.1	5.6
MEANSIZE	5.1	0.2	4.9	0.2
CAP	1.9	1.8	1.9	1.8

	All Guns (139)	
	Mean	SD
WLF1	38.1	18.3
WLF2	32.5	18.3
WLF3	5.6	3.8
SMLAND	13.6	4.8
SMLPDY	24.7	12.8
WED7UP	28.0	6.0
SEXRATIO	98.7	4.5
MEANSIZE	5.0	0.2
CAP	1.9	1.8

Source: See Table 1.

Table B. Correlation Matrix of the Variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WLF1 (1)								
WLF2 (2)								
WLF3 (3)								
SMLAND (4)	.20	.09	.51					
SMLPDY (5)	.22	.20	.10	.46				
SEXRATIO (6)	-.34	-.35	.03	-.27	-.13			
WED7UP (7)	-.04	-.12	.41	.13	-.20	-.05		
MEANSIZE (8)	.07	.04	.09	-.01	-.02	.57	-.16	
CAP (9)	-.33	-.36	.15	-.16	-.44	-.03	.51	-.37

Source: See Table 1.

Note: The test of significance is not necessary because 139 Guns are the population, not a sample.