Health Care Reform and Farm Women's Off-Farm Labor Force Participation: Evidence from Taiwan

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Do nonwage fringe benefits affect women's off-farm work decisions? We test the impact of the 1995 introduction of universal National Health Insurance (NHI) in Taiwan on off-farm labor force participation (LFP) among farm wives. Our results, based on a difference-in-differences approach, indicate that employment-delinked NHI reduced farm wives' off-farm LFP by 9.6 to 13.6 percentage points. The larger impact was for wives from small-farm households. The health insurance reform had a larger negative impact on overall LFP among married women in agricultural households than in nonagricultural households.

Key words: agricultural households, difference-in-differences, farm wives, health care, insurance, labor force participation, off-farm, Taiwan

Introduction

Health insurance is an important component of employee compensation packages.[1] In the absence of government-sponsored health coverage, individuals who would otherwise not participate in the labor force may be willing to work in order to obtain employment-linked health insurance. Past research has examined off-farm labor supply of farm wives (Tokle and Huffman, 1991; El-Osta, Mishra, and Ahearn, 2004). In this study, we present findings from what we believe to be the first effort to test for the effect of a nonwage fringe benefit—health insurance—on farm wives' nonfarm labor force participation (LFP).

Health insurance may be particularly valuable to farm households, as agricultural income is usually more volatile than nonagricultural income. This may create strong incentives to protect against unexpected losses due to health problems, which are especially likely among agricultural workers. Farmers are consistently identified as being at high risk for injury and fatality (Hard et al., 1999). Rural populations tend to be older and have lower average incomes than their urban counterparts. Yet despite these risks, few agricultural workers have health insurance.[2]

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[1] For example, average employer cost for health insurance per employee hour in the United States was $2.59 in 2005 among workers with access to health benefits (Kaiser Family Foundation, 2008). Calculations were based on data from the National Compensation Survey, 1999–2005, conducted by the Bureau of Labor Statistics.

[2] According to the U.S. Department of Labor's National Agricultural Worker Survey (NAWS), 85% of migrant and seasonal farm workers in the United States were uninsured in 2000, compared with 37% of low-income adults (Rosenbaum and Shin, 2005).

If agricultural households place a high value on health insurance primarily available through off-farm employment, employment-linked health insurance will be an important positive factor in off-farm employment decisions, ceteris paribus. LFP among married women in particular is likely to be affected by health insurance availability, because the labor supply of married women is more elastic than that of married men or single women (Killingsworth and Heckman, 1986; Currie and Madrian, 1999). In contrast, LFP response to health insurance availability for men should not be pronounced, since men tend to work regardless of their wives' employment. Evidence shows that health insurance, namely Medicaid, has little to no impact on LFP among low-income single mothers (Winkler, 1991; Moffit and Wolfe, 1992; Yelowitz, 1995; Montgomery and Navin, 2000).

The impacts of health insurance and other policies on LFP among women in farm households are important for multiple reasons. Typically, agricultural household incomes are closely related to LFP patterns. Understanding the relationship between health insurance and labor markets is critical when assessing health policy reform cost and welfare outcomes in rural areas. Off-farm employment by farm wives can be viewed as a means to diversify income sources away from risky agricultural activities toward steadier and more predictable off-farm pursuits (Huffman, 1980; Rosenfeld, 1985; Gould and Saupe, 1989; Kyle, 1993; Mishra and Goodwin, 1997). As rural economies of developing countries become less agricultural, access to off-farm income and nonwage fringe benefits becomes an increasingly important factor in rural household incomes, welfare, and income inequality between agricultural and nonagricultural areas.

Taiwan is an ideal setting to study the role of health insurance in shaping rural labor market choices of married women. On March 1, 1995, the Taiwanese government instituted a National Health Insurance (NHI) program. Prior to this program, health insurance coverage was available almost exclusively through employment and only for employed workers, not their dependents. The sole exception was coverage for government employees' spouses, parents, and children under government employee family members' health insurance. Health care expansion resulting from NHI should have had virtually no impact on LFP decisions made by government employees' wives, since they already had access to such insurance. However, it should have had an impact on LFP decisions made by nongovernment employees' wives.

Accordingly, we can view married households in which the husband was a government employee as a control group, and married households in which the husband was a farm operator as a treatment group.[3] We use this "natural experiment" opportunity to test and estimate the effect of Taiwan's universal NHI program on off-farm LFP among farm wives. If employment-linked health insurance increases women's off-farm LFP, employment-delinked health insurance should reduce it. Our econometric findings, based on a difference-in-differences (DID) approach, offer compelling evidence that employment-delinked NHI in Taiwan significantly reduced off-farm LFP among farm wives by 9.6 to 13.6 percentage points. The larger effect was associated with wives from small farms. Taiwan's health insurance reform had a larger negative impact on LFP among married women in agricultural households than in nonagricultural households.

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[3] A similar identification was employed by Chou and Staiger (2001), although they did not consider agricultural households in their analysis.

Literature Review

A number of studies have examined health insurance effects on LFP among members of nonagricultural households. Using the Survey of Family Income and Expenditure (SFIE) from 1992 to 1997 and the DID approach, Chou and Staiger (2001) find that the introduction of NHI in Taiwan caused a 4 percentage point decline in LFP among married women and a 6 percentage point decline among married women from low-income households. We build on the work of Chou and Staiger by adding agricultural households and examining possibly heterogeneous impacts of the NHI program on employment decisions of married women across sectors.

Using March 1993 Current Population Survey (CPS) data, Olson (1998) reports that spousal health insurance availability causes a 7% to 8% LFP reduction and an average 20% (five hours per week) decline in weekly hours worked among married women in the United States. Based on April 1993 CPS data, Buchmueller and Valletta (1999) estimate a similar 6% to 12% LFP reduction among married women. There is also evidence that health insurance availability induces more people to retire, whether via (*a*) an individual's eligibility for employer-provided health care during retirement (Karoly and Rogowski, 1994; Madrian, 1994; Rogowski and Karoly, 2000; Blau and Gilleskie, 2001); (*b*) the introduction of state continuation-of-coverage mandates (Gruber and Madrian, 1995); or (*c*) Medicare eligibility at age 65 (Rust and Phelan, 1997; Madrian and Beaulieu, 1998). The literature on the health insurance and retirement relationship focuses mainly on men.[4] Jensen and Salant (1985) conclude that fringe benefits such as health insurance have significant positive effects on farm operators' off-farm labor supply.

To our knowledge, no previous research tests for the effect of employment-delinked health insurance on off-farm LFP of members of agricultural households.

The Taiwan Case Study

The exogenous introduction of NHI in 1995 decoupled health insurance from employment. SFIE data from 1992-1994 and 1996-1997 offer a clean identification strategy for under-standing the policy's impact on off-farm LFP among farm wives.

Health Insurance in Taiwan Prior to 1995

Prior to the introduction of NHI in 1995, health insurance in Taiwan was provided by three main government-subsidized social insurance programs: Labor Insurance, Government Employee Insurance, and Farmer's Health Insurance.[5] All three were primarily employment-linked except for Government Employee Insurance, which provided health insurance coverage to government employees and their nonworking dependents. Because most of the

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[4] The main reasons for focus on males are: (*a*) LFP rates among older women historically have been lower than those among older men, and (*b*) a large proportion of older women who do participate in the labor force obtain health insurance coverage via their husbands. Consequently, the effect of health insurance on the likelihood of retirement among older women is expected to be small (Gruber and Madrian, 2002).

[5] Several other social insurance programs provided health insurance coverage, including Military Personnel Insurance and Low-Income Household Health Insurance. These programs covered only a small fraction of the population, as military personnel and low-income households constituted 3% and 0.5% of the population, respectively, in 1992 (Peabody et al., 1995).

labor force worked in the private sector and private health insurance markets were non-existent,[6] 43% of Taiwanese people did not have health insurance coverage in 1994.

In 1950, Labor Insurance (LI) was introduced as Taiwan's first compulsory social insurance program aimed at protecting workers' livelihoods and promoting social security. The government required three categories of workers between the ages of 15 and 60 to participate in this program: (*a*) workers employed by mines; companies or firms; or journalistic, cultural, or nonprofit cooperative enterprises with more than five employees; (*b*) employees of government offices or schools who were not legally entitled to join Government Employee Insurance or the Insurance of Teachers and Employees of Private Schools; and (*c*) workers employed in fishing production (Bureau of Labor Insurance, 2010). The LI premium was 6% to 8% of monthly salary, 80% of which was paid by the employer and 20% by the worker. LI provided medical care benefits including outpatient medical care benefits and inpatient hospitalization benefits. Insured persons could seek medical care from hospitals or clinics that were operated or specially contracted by the insurer, the Bureau of Labor Insurance. In addition, insured persons were entitled to claim lump-sum benefits for maternity, injury, or sickness,[7] disability, old age, and death of insured's dependents.[8] However, LI only provided health insurance coverage to workers, not to their nonworking spouses, parents, or children.[9]

Government Employee Insurance (GEI) was implemented in 1958, and was mandatory for all government employees. It provided the same outpatient medical care benefits and inpatient hospitalization coverage as LI and Farmers' Health Insurance. However, unlike those programs, its coverage was extended to include government employees' nonworking spouses in 1982, parents in 1989, and unmarried children in 1992. The GEI premium was 3% to 5% of monthly salary, 65% of which was paid by the employer (government) and 35% by the employee. An additional premium paid for nonworking dependents was 3% to 5% of monthly salary, 50% of which was paid by the employee. Medical care expenses were fully paid by the insurer, Central Trust of China; the insured was responsible for registration fees. Insured dependents were responsible for registration fees and 10% of prescription drug costs. Insured government employees and their dependents could seek medical care from hospitals or clinics operated or specially contracted by Central Trust of China. Government employees were also entitled to claim lump-sum benefits for disability, old age, and death of a dependent.[10] Health care expansion resulting from NHI should have had virtually no impact on LFP decisions of government employees' wives, who had access to health insurance prior to 1995.

Farmers' Health Insurance (FHI) was introduced as an experiment in 1985 and launched fully in 1989. Its purpose was to maintain the health and increase the welfare of farmers and to promote stability in rural areas. Members of farmers' associations were required to be insured by the FHI. Farmers who were not members of farmers' associations could still participate in the program if they were older than 15 and qualified under the Examination Guidelines on the Application of Farmers' Health Insurance Recognition Standards and Qualifications.[11] There

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[6] Only supplementary coverage was available for certain conditions, such as cancer or accidental injury (Chiang, 1997).

[7] Besides outpatient medical benefits and inpatient hospitalization benefits, insured persons who did not receive salary payments as a result of injury or sickness were entitled to receive injury or sickness benefits.

[8] Dependents are defined as the insured's spouse, parents, or children. Funeral subsidy and survivors' benefits were payable to the insured's dependents in the event of his or her death.

[9] For more detailed information regarding LI, see the Bureau of Labor Insurance web site at http://www.bli.gov.tw/en/laws.asp?a=0010271&preview=.

[10] Survivors' benefits were payable to the dependents in the case of the insured's death.

[11] For the list of the Examination Guidelines on the Application of Farmers' Health Insurance Recognition Standards and Qualifications in its entirety, see the Bureau of Labor Insurance web site at http://www.bli.gov.tw/sub.asp?a=0006786 (in Chinese).

were several major obstacles to obtaining FHI: (*a*) farming requirements and off-farm job restrictions (the insured had to be farm operators and were not allowed to have a full-time off-farm job); (*b*) time limits (work as a farm operator had to be continuous for one year prior to seeking eligibility for FHI); (*c*) property rights requirements (operators, spouses, and immediate relatives who had lived with operators for more than one year had to own the property rights to farm lands); and (*d*) landholding size restrictions (greater than 0.1 hectares per farm worker).[12] FHI provided the same medical care benefits as LI, and insured farmers were responsible for the same co-payment share. FHI also included lump-sum benefits for maternity, disability, and death of insured. The premium was 6% to 8% of the monthly insured amount (NT$10,200), 70% of which was paid by the government and 30% by the insured person. Similar to LI, insured farmers' nonworking spouses, parents, and children did not receive health insurance coverage under FHI.

NHI Introduction in 1995

On March 1, 1995, NHI began providing health insurance to all citizens. Health benefits originally provided under LI, GEI, and FHI were transferred to the new insurer, Bureau of National Health Insurance. However, LI, GEI, and FHI schemes regarding other lump-sum benefits still applied. Table 1 highlights the historical background of health insurance reform in Taiwan. In summary, prior to NHI, the LI, GEI, and FHI programs provided a similar range of medical care benefits. Hospitals and clinics accepted LI, GEI, and FHI patients equally; the quality of health care and choices of medical services were not significantly different among the three programs. A crucial distinction was that prior to 1995, GEI covered sickness and injury for government employees' nonworking dependents, whereas LI and FHI provided health insurance coverage only for the working insured. Thus, farm wives could work either on the farm to obtain FHI or off the farm to obtain LI.

When employment-delinked NHI became available, those who worked primarily to qualify for health insurance would be expected to withdraw from the labor force. The difficulties in qualifying for FHI (outlined above) may have led some farm wives to work off farm to obtain LI prior to 1995. These considerations suggest that NHI reduced the attractiveness of working off farm for farm wives who placed a high value on health insurance access.

Identification Strategy

The goal of this study is to identify off-farm LFP responses to NHI among farm wives. If no contemporaneous shocks to labor market outcomes occurred other than the introduction of NHI, one could identify the impact of NHI by comparing off-farm LFP rates before and after 1995 for groups affected by the policy. However, Taiwan, like many developing nations, has experienced a general upward trend in LFP rates among married women.[13] A counterfactual (control group) is therefore needed in order to identify the impact of NHI.

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[12] We choose 1.5 hectares as the cutoff because the average cultivated land size per agricultural household in 1995 was around 1.1 hectares, but the corresponding landholding size category in the SFIE is 1–1.5 hectares (Council of Agriculture, 2008). Total farm size had to be greater than 0.1 hectares multiplied by number of farm workers. This rule applied to most owner-farmers. However, the size restriction was 0.2 hectares per forest worker or tenant farmer and 0.05 hectares per farm worker for indoor agriculture.

[13] For example, the LFP rate among married women aged 15–64 was 47% in 1990 and 50% in 2000.

Table 1. Health Insurance Reform in Taiwan

Description	Insurance Program			
	Labor Insurance (LI)	Gov't. Employee Insurance (GEI)	Farmers' Health Insurance (FHI)	National Health Insurance (NHI)
Year introduced	1950	1958	1985	1995
Individuals insured	Workers aged 15–60 in three categories	Government employees	Farmers	All citizens
Year amended to cover insured's dependents:				
▪ Spouse	N/A	1982	N/A	1995
▪ Parents	N/A	1989	N/A	1995
▪ Children	N/A	1992	N/A	1995
Insured / Dependents' benefits:				
▪ Maternity	Yes / Yes	Yes / Yes	Yes / Yes	Yes
▪ Injury	Yes / No	Yes / Yes	No / No	Yes
▪ Sickness	Yes / No	Yes / Yes	Yes / No	Yes
▪ Disability	Yes / No	Yes / No	Yes / No	No
▪ Old age	Yes / No	Yes / No	No / No	No

We exploit the nature of Taiwanese health insurance reform by using married households in which the husband is a government employee as a control group. Because wives of government employees already had access to health insurance prior to 1995, there is no reason to expect them to alter their employment decisions in response to the introduction of NHI. Married households in which the husband is a farm operator comprise the treatment group because FHI did not provide health insurance coverage to insured farmers' nonworking spouses prior to 1995. Changes in off-farm LFP rates among the control group are assumed to be due to non-NHI factors, whereas changes in off-farm LFP by the treatment group are assumed to be due to the same non-NHI factors plus the introduction of NHI. By comparing differences in off-farm LFP rates among married women before and after 1995 for the treatment group to the same differences for the control group, we can identify the impact of NHI on off-farm LFP among farm wives. This is the DID approach. Inasmuch as the control group (wives of government employees) is comprised of people included in the program prior to 1995, this is a "reverse experiment," unlike standard DID studies.

Data

The data used in this analysis are from the 1992–1997 Survey of Family Income and Expenditure. The SFIE is a nationwide cross-sectional survey that has been conducted annually by the Taiwanese government since 1964. Approximately 14,000 households are sampled each year.[14] In 1990, just prior to the introduction of NHI, 17% of all households in Taiwan

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[14] Households are sampled independently each year and cannot be tracked, i.e., the data set is not longitudinal. Therefore, the repeated cross-sectional SFIE may not eliminate averages of the individual time-invariant effects by simply taking a difference. However, SFIE households are randomly selected and the number of households is large, allowing the possibility of obtaining a consistent estimator asymptotically.

were agricultural (Council of Agriculture, 2008).[15] The SFIE gathers the following data: (*a*) household characteristics and basic demographic information, including whether or not a household is agricultural, landholding size by category, location, family composition, gender, age, education level, and marital status; (*b*) labor market data, including whether household members were employed, their sector of employment, occupation, job title, and whether they held secondary jobs; (*c*) housing conditions and facilities; (*d*) individual income levels and sources of incomes; and (*e*) household-level consumption and expenditures.[16]

We use a subset of the SFIE sample, restricting our observations to (*a*) married-couple households with a wife who was either a female household head or the spouse of a male household head,[17] (*b*) married women between the ages of 25 and 64 (to eliminate potential students and retirees), (*c*) married couples who resided together, and (*d*) households in which husbands were either government employees or farm operators.[18] We excluded SFIE data for 1995, the NHI introduction year, because it was unclear to what extent LFP was affected by the health insurance reform in that year. The final sample comprised 7,809 married households.

Table 2 reports sample means of the main variables for the control and treatment groups before and after the 1995 NHI introduction. Overall LFP rates among married women in the treatment group (wives of farm operators) before and after 1995 were higher than those of the control group (wives of government employees). This is primarily a function of high participation rates for on-farm work by married women in the treatment group: 63.4% between 1992 and 1994, and 56.3% between 1996 and 1997. Overall LFP (equivalent to off-farm LFP) among married women in the control group increased from 55.1% to 62.4% during the study period, whereas off-farm LFP among those in the treatment group decreased from 21.3% to 18.2%. This could suggest that NHI reduced off-farm LFP among farm wives. Such a conclusion, however, is not necessarily justified; if part of the decline in the off-farm LFP rate among treatment group wives was due to non-NHI factors, then the pre-existing differences in off-farm LFP between the two groups will be mistakenly attributed to policy reform.

Table 2 reveals differences in other characteristics between the control and treatment groups. Married couples in the treatment group were older, had fewer children on average, were more likely to reside with their parents, were less educated, had lower unearned income, and received more government transfers. Ideally, one would like the baseline characteristics to be similar between control and treatment groups. We control for differences in observable characteristics and explore various alternative explanations in an effort to increase confidence in the identification strategy.

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[15] The Taiwanese government requires that agricultural households meet at least one of the following conditions for the year: (*a*) having raised at least one head of cattle, (*b*) having raised at least three head of hogs or goats, (*c*) having raised at least 100 birds or poultry, and (*d*) having sold self-operated agricultural products worth at least NT$20,000. (In 1991, US$1 = NT$25.75.) There were not any changes in the agricultural household definition during the study period.

[16] The major drawback of SFIE is that the survey did not collect information on hours worked, making it impossible to identify the test we seek if the introduction of NHI affected hours worked but not participation.

[17] A household head is defined as the main earner and family economic supporter in the household.

[18] The public sector is classified into two categories in SFIE: government and public enterprise. Some public enterprise employees are not eligible for GEI; these individuals are covered under LI, so their dependents do not have health insurance coverage. We therefore excluded the small number of married households in which the husband was a public enterprise employee.

Table 2. Sample Means of Main Variables for Control and Treatment Groups

Variable	Control Group: Households w/Government Employee Husband		Treatment Group: Households w/Farm Operator Husband	
	Pre-NHI 95 1992–1994	Post-NHI 95 1996–1997	Pre-NHI 95 1992–1994	Post-NHI 95 1996–1997
Overall LFP Among Married Women (%)	55.1	62.4	84.7	74.5
Off-Farm LFP (%)	55.1	62.4	21.3	18.2
On-Farm LFP (%)	—	—	63.4	56.3
Husband's Age (years)	43.7	43.5	51.5	52.6
Wife's Age (years)	40.0	40.5	48.8	49.5
Number of Children: ■ Under 3 years old	0.18	0.19	0.05	0.05
■ 3–5 years old	0.22	0.20	0.09	0.09
■ 6–11 years old	0.47	0.45	0.29	0.22
■ 12–17 years old	0.52	0.51	0.43	0.41
Residing with Parents/In-laws (%)	15.7	17.5	21.5	20.9
Husband is a High School Graduate (%)	87.4	88.1	12.5	14.8
Wife is a High School Graduate (%)	67.5	73.4	6.8	9.6
Unearned Income (in NT$10,000s)	74.99	81.13	35.19	38.29
Government Transfers (in NT$10,000s)	0.34	1.62	1.34	3.62
Sample Size	3,080	1,499	2,320	910

Notes: All monetary figures are in 1991 NT$ (in 1991, US$1 = NT$25.75). Refer to text for description of sample selection and definitions for control and treatment groups.

Off-Farm LFP Impact of NHI

How did the introduction of NHI affect off-farm LFP among farm wives? We seek to answer this question with the following probit regression framework:

$$(1) \quad \Pr(OFF\_FARM_{it} = 1) = \Phi(\beta_0 + \beta_1 \times AgHH_i + \beta_2 \times \boldsymbol{\eta}_t$$
$$+ \beta_3 \times (AgHH \times Post1995)_{it} + \beta_4 \times \mathbf{Z}_{it} + \varepsilon_{it}),$$

where *OFF_FARM* is a dummy variable equal to one if a married woman *i* participates in the off-farm labor market in period *t*; *AgHH* is a dummy variable equal to one for agricultural households and zero otherwise; $\boldsymbol{\eta}_t$ is the year fixed effects, which include dummy variables for 1993, 1994, 1996, and 1997 (the omitted year is 1992); and *Post1995* is a dummy variable equal to one for any year after 1995, the year of the NHI introduction. The vector **Z** includes the following family characteristics: number of children under 3 years of age, and children aged 3–5, 6–11, and 12–17; education levels of husband and wife; age and age squared of husband and wife; and a dummy variable indicating whether the couple resides with either set of parents. We assume that the random error term ε_{it} is normally distributed. The parameter β_1 measures unobserved differences related to off-farm LFP between married women in the control and treatment groups; β_2 measures changes in off-farm LFP rates common to all married women in the control and treatment groups over time. The DID off-farm labor outcome responses are captured by the β_3 coefficient (treatment effect). We expect β_3 to be negative given the difficulties in enrolling in FHI prior to 1995.

There are several advantages to using a regression framework to estimate off-farm LFP among farm wives. First, as shown in table 2, there are a number of significant differences in demographic characteristics between the control and treatment groups. It is crucial to control for these if they are correlated with the off-farm LFP decisions of married women. Second, controlling for observable characteristics improves estimate efficiency. Third, by adding the year fixed effect, we can control for time-series changes in the off-farm labor market.

Column 1 of table 3 reports the coefficient estimates of equation (1). For ease of interpretation, the table presents marginal effects evaluated at the means of all variables in the regression. The coefficient of $AgHH \times Post1995$ is −0.100, which indicates that the introduction of NHI reduced off-farm LFP among farm wives by 10 percentage points (statistically significant at the 1% level). The signs of the other coefficients are consistent with our expectations and with past research findings on female LFP. For example, having more young children, especially children under the age of five, significantly reduces the likelihood of off-farm work. Off-farm LFP increases monotonically with education level of married women. Off-farm LFP rates follow a quadratic age pattern consistent with a life-cycle hypothesis (Sumner, 1982). Married women who reside with parents are more likely to participate in the off-farm labor market, compared with those who do not reside with parents in the same households. This finding should not be surprising, inasmuch as married women and parents may be substitutes in domestic work.[19] The coefficient on $AgHH$ captures unobserved differences related to off-farm LFP between married women in the control and treatment groups. Farm wives are less likely to work off farm (by 17.1 percentage points) compared to wives of government employees, ceteris paribus. Off-farm LFP rates among all married women show a general upward time trend.

In an alternative specification (column 2 of table 3), we account for wives' unearned income and government transfers. Wives' unearned income is defined as the sum of husband's labor income and any nonlabor income received by a married couple, excluding government transfers. Unearned income is likely to affect wives' reservation wages and thus their employment decisions. Mishra and Goodwin (1997) conclude that government payments may reduce the need to work off farm by providing agricultural households with alternative income sources. Introducing wives' unearned income and government transfers into the regression does not have a sizable impact on the treatment effect in terms of magnitude or significance. The introduction of NHI reduces off-farm LFP among farm wives by 9.6 percentage points. An NT$10,000 (US$388.4) increase in unearned income and government transfers, respectively, is associated with a 0.3 and 1.2 percentage point fall in off-farm LFP among married women. The negative impact on off-farm LFP decisions is larger for government transfers than for unearned income. This may be explained by the fact that government transfers are politically difficult to eliminate once they take effect. Consequently, households tend to regard these transfers as more predictable and permanent than other income sources.

The relatively large fall in off-farm LFP among farm wives could be due to a deterioration in off-farm labor market opportunities for farm wives relative to the control group over the study period. Changing human capital demands are a particularly important concern; for example, a decrease in demand for less educated labor could create a contemporaneous shock, independent of the introduction of NHI. Such a shock would have a disproportionately large effect on labor market opportunities for farm wives, inasmuch as married women in the

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[19] Women living with parents may have child care advantages, but we find a similar DID treatment effect when we include an interaction term between the presence of parents and children under the age of five.

Table 3. NHI Impact on Off-Farm LFP Among Married Women: Marginal Effects (*N* = 7,809) (Dependent Variable: *Off-Farm LFP Among Married Women*)

Explanatory Variables	[1] Baseline	[2] With Unearned Income and Gov't Transfers	[3] With Education Interaction	[4] With Clustered Errors
AgHH×Post1995	−0.100***	−0.096***	−0.114***	−0.114***
	(0.026)	(0.027)	(0.028)	(0.005)
Number of Children				
■ Under 3 years old	−0.072***	−0.070***	−0.069***	−0.069***
	(0.019)	(0.019)	(0.019)	(0.004)
■ 3–5 years old	−0.064***	−0.063***	−0.063***	−0.063***
	(0.016)	(0.017)	(0.017)	(0.017)
■ 6–11 years old	−0.002	0.002	0.002	0.002
	(0.010)	(0.010)	(0.010)	(0.022)
■ 12–17 years old	0.035***	0.039***	0.039***	0.039***
	(0.008)	(0.009)	(0.009)	(0.009)
Wife's Education				
■ Literate	−0.000	0.013	0.014	0.014**
	(0.056)	(0.056)	(0.056)	(0.006)
■ Elementary School	0.052**	0.069***	0.069***	0.069***
	(0.026)	(0.026)	(0.026)	(0.010)
■ Junior High School	0.086**	0.112***	0.111***	0.111***
	(0.035)	(0.035)	(0.035)	(0.006)
■ High School (senior)	0.216***	0.247***	0.246***	0.246***
	(0.038)	(0.038)	(0.038)	(0.024)
■ High School (occupational)	0.261***	0.290***	0.289***	0.289***
	(0.034)	(0.034)	(0.034)	(0.031)
■ College (occupational)	0.478***	0.503***	0.516***	0.516***
	(0.027)	(0.025)	(0.025)	(0.005)
■ College (academic)	0.531***	0.555***	0.566***	0.566***
	(0.024)	(0.022)	(0.021)	(0.004)
■ Graduate School	0.572***	0.583***	0.587***	0.587***
	(0.018)	(0.014)	(0.012)	(0.004)
Wife's Age	0.031***	0.037***	0.306***	0.036***
	(0.010)	(0.010)	(0.010)	(0.005)
Wife's Age^2	−0.0004***	−0.0005***	−0.0005***	−0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Residing with Parents	0.033**	0.046***	0.047***	0.047**
	(0.016)	(0.017)	(0.017)	(0.022)
AgHH	−0.171***	−0.198***	−0.191***	−0.191***
	(0.020)	(0.020)	(0.020)	(0.014)
1993	0.025	0.039**	0.040**	0.040*
	(0.018)	(0.018)	(0.018)	(0.021)
1994	0.043**	0.059***	0.059***	0.059***
	(0.018)	(0.018)	(0.018)	(0.021)
1996	0.087***	0.128***	0.149***	0.149***
	(0.023)	(0.024)	(0.026)	(0.036)
1997	0.075***	0.112***	0.134***	0.134***
	(0.023)	(0.024)	(0.026)	(0.039)

(continued . . .)

Table 3. Continued

Explanatory Variables	[1] Baseline	[2] With Unearned Income and Gov't Transfers	[3] With Education Interaction	[4] With Clustered Errors
Wife's Unearned Income (in NT$10,000s)		−0.003*** (0.000)	−0.003*** (0.000)	−0.003 (0.002)
Government Transfers (in NT$10,000s)		−0.012*** (0.004)	−0.012*** (0.004)	−0.012* (0.006)
CollegeEdu×Post1995			−0.067** (0.034)	−0.067*** (0.003)
Log Likelihood	−4,220	−4,159	−4,156	−4,157
Dependent Variable Mean	0.421	0.421	0.421	0.421

Notes: Single, double, and triple asterisks (*,**,***) denote coefficients are statistically different from zero at the 10%, 5%, and 1% levels, respectively. Values in parentheses are standard errors. The data come from 1992–1994 and 1996–1997 of the SFIE. The sample consists of married women aged 25–64 whose husbands are either government employees or farm operators (refer to text for detailed description on sample selection). *AgHH* is a dummy variable equal to one if women are married to self-employed farm operators. *Post1995* is a dummy variable equal to one for any year after 1995. All regressions also include controls for husbands' education level, age, and age squared. The STATA command *dprobit* is used to obtain marginal effects. In column [4], standard errors are adjusted for clustering. We create a single-dimensioned ID variable for the unit of observation in the control and treatment groups and use the STATA command *cluster*.

control group are more educated. To address this concern, we recast equation (1) by adding an interaction term involving *Post1995* and a new dummy variable, *CollegeEdu*, equal to one if a married woman has at least a college degree. Column 3 of table 3 presents the results with this new interaction term. The coefficient estimate on the interaction term is negative and significant, and compared with the previous specification, the treatment effect increases slightly to 11.4 percentage points. The basic conclusion still holds: the introduction of NHI significantly reduced off-farm LFP among farm wives.

Another concern is nonzero correlation between errors within a cluster (control or treatment group). For example, there may be an unobservable effect common to all agricultural households. To control for the dependence on unobservables within a cluster, we adjust the standard errors of the regression parameters. Column 4 of table 3 presents the results when intra-cluster correlation is considered. Clustering leads to substantial changes in standard errors. The standard error for the treatment effect (*AgHH×Post1995*) decreases from 0.028 to 0.005, increasing the significance of our key finding and suggesting that it is desirable to adjust for intra-cluster correlation.

Extensions

Treatment Effect Heterogeneity by Landholding Size

As mentioned previously, landholding size restrictions may make women ineligible for FHI. As a result, women from small farms might have worked off farm in order to acquire health insurance coverage under the LI program. In addition, FHI required operators to be full-time farmers in order to qualify for health insurance benefits. Hence, farm operators could not work off farm, but spouses could. This restriction would have reduced the substitutability of male and female labor, which could be particularly important on small farms. The move to NHI would have lifted this restriction, allowing male operator labor to flow more freely into

Table 4. NHI Impact on Off-Farm LFP Among Farm Wives Stratified by Landholding Size (Dependent Variable: *Off-Farm LFP Among Married Women*)

	Size of Landholding	
Explanatory Variables	[1] Small	[2] Large
AgHH×Post1995	−0.119*** (0.003)	−0.103*** (0.013)
AgHH	−0.153*** (0.028)	−0.272*** (0.005)
No. of Observations	6,868	5,520

Notes: Single, double, and triple asterisks (*,**,***) denote coefficients are statistically different from zero at the 10%, 5%, and 1% levels, respectively. Values in parentheses are standard errors, adjusted for clustering. The data come from 1992–1994 and 1996–1997 of the SFIE. The sample consists of married women aged 25–64 whose husbands are either government employees or farm operators (refer to text for detailed description on sample selection). A small-farm household is defined as holding less than 1.5 hectares. All regressions include controls for number of children under 3 years old, and 3–5, 6–11, and 12–17 years old; wife's and husband's education levels; wife's and husband's age and age squared; dummy variable for residing with parents; year dummy variables for 1993, 1994, 1996, and 1997; unearned income; government transfers; and *CollegeEdu×Post1995*. The STATA command *dprobit* is used to obtain marginal effects.

off-farm work and resulting in more female on-farm work as female labor was substituted for male labor on the farm. Thus, we expect that the introduction of NHI would have a larger negative impact on off-farm LFP from small-farm households.[20]

To explore how NHI impacts vary with farm household size, we stratify agricultural households into two landholding size groups. We define a small-farm household as holding fewer than 1.5 hectares. (See footnote 12 for an explanation of the criteria used.) Table 4 documents differences in the treatment effect between the two landholding groups. The introduction of NHI reduced off-farm LFP among married women in small-farm households by 11.9 percentage points. The impact of NHI on off-farm LFP among married women in large-farm households was smaller. The difference in coefficients on *AgHH* implies that, compared to wives of government employees, married women in large-farm households were 27.2 percentage points less likely to participate in off-farm work, and those in small-farm households were 15.3 percentage points less likely. In other words, the likelihood of working off farm was 11.9 percentage points (27.2 − 15.3) higher for small-farm wives. This result is consistent with Mishra and Goodwin (1997), who find farm size to be negatively correlated with off-farm labor supply in Kansas. They argue that members of larger farms are likely to have less flexibility in supplying labor to off-farm work activities than members of smaller farms.

Treatment Effect Heterogeneity Across Regions

To further explore the validity of the treatment effect estimates, we divided the sample into two regional subgroups: "comparatively agricultural regions" and "comparatively nonagricultural regions."[21] If the introduction of NHI did not affect off-farm LFP among farm wives,

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[20] Participation incentives for nonfarm work may be larger for small-farm households for other reasons. For example, if small-farm households are more risk averse, there may be added incentives for farm wives to seek off-farm income, which is more predictable than farm production returns. A small farm size may also create flexibility for members to supply labor to off-farm work activities. If this is the case, a differential effect of NHI by farm size would tend to be more difficult to identify.

[21] Comparatively agricultural regions include: Taoyuan County, Miaoli County, Taichung County, Changhua County, Nantou County, Yunlin County, Chiayi County, Tainan County, Kaohsiung County, Pingtung County, Taitung County, and Hualien County. Most of these regions are located in central, southern, and eastern Taiwan.

Table 5. NHI Impact on Off-Farm LFP Among Farm Wives Stratified by Regions (Dependent Variable: *Off-Farm LFP Among Married Women*)

	Region	
Explanatory Variables	[1] Comparatively Agricultural	[2] Comparatively Nonagricultural
AgHH×Post1995	−0.118*** (0.007)	−0.099*** (0.002)
AgHH	−0.292*** (0.038)	−0.293*** (0.022)
Small-Farm Household	0.162** (0.080)	0.221*** (0.036)
No. of Observations	7,433	4,955

Notes: Single, double, and triple asterisks (*,**,***) denote coefficients are statistically different from zero at the 10%, 5%, and 1% levels, respectively. Values in parentheses are standard errors, adjusted for clustering. The data come from 1992–1994 and 1996–1997 of the SFIE. The sample consists of married women aged 25–64 whose husbands are either government employees or farm operators (refer to text for detailed description on sample selection). All regressions include controls for number of children under 3 years old, and 3–5, 6–11, and 12–17 years old; wife's and husband's education levels; wife's and husband's age and age squared; a dummy variable for residing with parents; year dummy variables for 1993, 1994, 1996, and 1997; unearned income; government transfers; *CollegeEdu×Post1995*; and landholding size.

then the DID results comparing off-farm LFP rates of government employees' wives and farm wives in "comparatively agricultural regions" should be zero, since agricultural households are the majority in these regions.[22] On the other hand, finding similar DID results between the full sample and the subsample of "comparatively agricultural regions" should increase confidence in the identification strategy.

Table 5 shows the results of this analysis. In "comparatively agricultural regions," the introduction of NHI reduces off-farm LFP among farm wives by 11.8 percentage points (significant at the 1% level); this result is similar to the full sample results. The treatment effect in "comparatively nonagricultural regions" is a similar 9.9 percentage point decline (also significant at the 1% level). This similarity should not be surprising, since health insurance reform equally affected farm wives in "comparatively nonagricultural regions" and those in other areas. The likelihood of working off farm, however, is higher for small-farm wives in "comparatively nonagricultural regions" than those in "comparatively agricultural regions," suggesting that "comparatively agricultural regions" have fewer off-farm work opportunities for farm wives.

Off-Farm LFP Trends

It is possible that differences in off-farm LFP rates among married women in the control and treatment groups reflect preexisting trends prior to 1995 rather than the effect of NHI policy. Figure 1 presents average off-farm LFP rates among married women in the control and treatment groups between 1992 and 1997. Prior to 1995, off-farm LFP rates among married women in the two groups seem to display similar trends. In 1995, there is a decline in off-farm LFP rates of farm wives compared to wives of government employees, suggesting the introduction of NHI reduced off-farm LFP among farm wives.

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[22] According to the SFIE, 88% of agricultural households are located in the comparatively agricultural regions we defined.
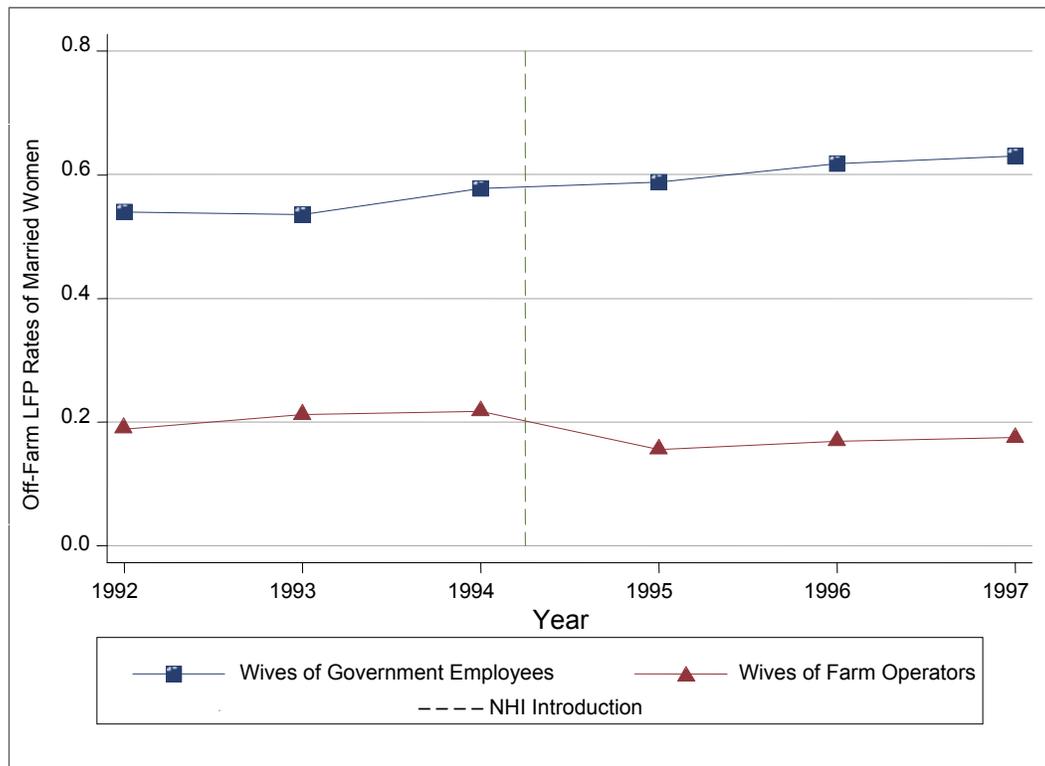
Figure 1. Trends in off-farm LFP rates of married women, 1992–1997

Table 6. Placebo DID Results: Impact of Hypothetical NHI on Off-Farm LFP Among Married Women (Dependent Variable: *Off-Farm LFP Among Married Women*)

Placebo DID Results for Off-Farm LFP: 1992–1994 ($N = 5,400$)	
AgHH×Post1993	0.004
	(0.005)
Log Likelihood	−2,872
Dependent Variable Mean	0.405

Notes: Value in parentheses is standard error, adjusted for clustering. This table assumes that a hypothetical NHI was introduced on December 31, 1993. The sample consists of married women aged 25–64 whose husbands are either government employees or farm operators (refer to text for detailed description on sample selection). The STATA command *dprobit* is used to obtain marginal effects. All regressions include controls for an agricultural household dummy, year dummy variables for 1993 and 1994, number and ages of children, education levels of husband and wife, age and age squared of husband and wife, a dummy variable indicating whether the couple lives with their parents, unearned income, and government transfers.

Econometrically controlling for the confounding effect of preexisting trends, we used 1992–1994 data and assumed that a hypothetical NHI program was introduced on December 31, 1993. Specifically, we viewed the 1992–1993 data as "pre-policy" and the 1994 data as "post-policy," and then reestimated equation (1). The logic behind this placebo experiment is that in the pre-intervention (1992–1994) time period, the estimated DID treatment effect should be zero since NHI did not exist. Table 6 reports the resulting placebo DID estimate. The placebo DID for off-farm LFP is close to zero (0.004) and insignificant. Hence, it is unlikely that preexisting trends in off-farm LFP rates among married women explain the

estimated treatment effect. The placebo check increases our confidence that the relative fall in off-farm LFP among farm wives is due to the introduction of NHI.

It is also possible that long-term off-farm LFP trends are different for married women in the control and treatment groups. To test this possibility, we reestimated equation (1) using all of the data for the 1992–1997 period with group-specific time trends (an interaction between *AgHH* and the trend variable). The result is a negative treatment effect that is statistically significant and larger than the previously estimated effects—the introduction of NHI reduces off-farm LFP among farm wives by 13.6 percentage points.

Overall LFP

When NHI decoupled health insurance from employment, it should have reduced overall LFP (on-farm plus off-farm LFP) for farm wives. Table 7 presents the difference-in-differences-in-differences (DIDID) estimation of the impact of NHI on overall LFP among farm wives. Panel A compares overall LFP rates among married women for the treatment (wives of farm operators) and control (wives of government employees) groups in the years before (1994, denoted "period 0") and after (1996–1997, "period 1") the 1995 NHI introduction. From period 0 to period 1, overall LFP among married women in the control group increased by 4.7 percentage points, compared to a 9.1 percentage point fall for the treatment group. This finding suggests that the introduction of NHI had a statistically significant 13.8 percentage point negative effect on overall LFP among married women in agricultural households.

However, if there were group-specific underlying trends in overall LFP among married women prior to 1995, the DID estimate above would not identify the true impact of NHI. We performed another placebo DID to address this concern. The results appear in panel B of table 7. Unlike the insignificant placebo DID in table 6 for off-farm LFP, we find a significant 5.4 percentage point fall in overall LFP among wives of farm operators compared to wives of government employees. That is, prior to 1995, there were unobserved attributes that affected overall LFP among married women differently for the two groups.

To remove group-specific unobserved biases, we take the difference between the two DID estimates in panels A and B of table 7. The DIDID estimate suggests there was an 8.4 percentage point relative fall in overall LFP among wives of farm operators compared to wives of government employees. The DIDID estimate is marginally statistically significant at the 5% level and provides evidence that employment-delinked health insurance reduced overall LFP rates among farm wives. This reduction is larger for agricultural households; findings for non-agricultural households show a 4 percentage point decline in LFP among married women (Chou and Staiger, 2001). Based on these findings, we conclude that health insurance availability is a more important determinant of LFP for farm than nonfarm wives. In addition, the difference in treatment effects between off-farm LFP and overall LFP implies an increase in on-farm LFP. The likelihood of working on a farm varies from 1.2 (9.6 − 8.4) to 5.2 (13.6 − 8.4) percentage points higher for farm wives after the introduction of NHI. Wives from small farms have a larger on-farm LFP increase, as implied by the larger impact of NHI on their off-farm LFP.

Conclusions

By exploiting the 1995 introduction of NHI in Taiwan as a "reverse experiment," we find that employment-delinked health insurance had a negative impact on off-farm LFP among farm wives. Our DID analysis using a regression framework confirms these findings: NHI provided

Table 7. DIDID Estimates of NHI Impact on Overall LFP Among Farm Wives

	Pre-NHI95		Post-NHI95	
	[1] 1992–1993 (Period −1)	[2] 1994 (Period 0)	[3] 1996–1997 (Period 1)	[4] Difference
PANEL A				
Treatment Group: Wives of Farm Operators	—	0.836 (0.009) [740]	0.745 (0.014) [910]	−0.091 (0.020)
Control Group: Wives of Government Employees	—	0.578 (0.156) [1,004]	0.624 (0.013) [1,499]	0.047 (0.020)
Difference		0.259 (0.021)	0.121 (0.019)	
Difference-in-Differences				**−0.138** **(0.028)**
PANEL B				
Treatment Group: Wives of Farm Operators	0.851 (0.009) [1,580]	0.836 (0.014) [740]	—	−0.015 (0.016)
Control Group: Wives of Government Employees	0.538 (0.011) [2,076]	0.578 (0.156) [1,004]	—	0.040 (0.019)
Difference	0.313 (0.014)	0.259 (0.021		
Placebo Difference-in-Differences				**−0.054** **(0.025)**
Difference-in-Differences-in-Differences				**−0.084** **(0.047)**

Notes: Values in parentheses are standard errors; sample sizes are given in square brackets. The data come from 1992–1994 and 1996–1997 of the SFIE. The DIDID estimate is the difference-in-differences from Panel A minus that from Panel B.

a significant disincentive for farm wives to work off farm, reducing their nonfarm LFP by 9.6 to 13.6 percentage points. Given the constraints on enrolling in the farm health insurance program prior to the 1995 health care reform, it appears that health insurance coverage via off-farm employment was an important factor in women's off-farm LFP decisions. When NHI decoupled health insurance from employment, it also reduced the attractiveness of working off farm for farm wives as a means of gaining health insurance access. Post-reform reductions in nonfarm LFP are largest for wives from small farms, for whom the constraints on access to health insurance in the past were greatest. In addition, Taiwanese health insurance reform had a larger negative impact on overall LFP among married women in agricultural households than in nonagricultural households.

The finding that decoupling health insurance from employment reduces LFP has potentially important policy implications. In Taiwan, the explicit objective of NHI was to provide equitable and cheap access to health care, but the generosity of NHI decreased off-farm LFP among farm wives, especially those from small-farm households. This suggests that small-farm households increased their reliance on farm income sources post-NHI, and thus their exposure to production and price risks. If so, farm programs may be more vital to rural household welfare in the wake of NHI reform.

An elastic labor-market response to the introduction of NHI suggests that policy makers can expect significant labor-market impacts if policy changes affect health insurance availability or funding. In countries that replace employment-linked health insurance with universal national health insurance, as in Taiwan, the implications of our analysis are relatively straightforward. Where health care reforms are more complex, so are the likely effects on LFP. For example, in the United States (where reforms keep health insurance private), the creation of health-insurance exchanges, the provision of premium subsidies and cost-sharing for low-income individuals, and the expansion of Medicaid would weaken the link between employment and access to low-cost health insurance. In contrast, requiring all uninsured individuals to obtain coverage, either through their employers or by purchasing it themselves, could have the opposite effect.

People living in rural areas tend to be older, have preexisting conditions, face dangerous working conditions, have lower incomes, and are more likely to be uninsured or under-insured.[23] This suggests that subsidy and cost-control components of health care reform could provide an important stimulus to rural households independent of their LFP. A farm operator's spouse might no longer need to work in order to provide her family with affordable insurance if the operator gains access to a low-cost insurance exchange and subsidized premiums. On the other hand, a farm worker who does not currently have an employer-provided insurance plan may gain access to one if reforms require employers to provide coverage for their employees.

Despite the complexities of drawing international comparisons among health care reforms, the key finding of this study suggests that any components of policy reforms which decouple health care from employment are likely to discourage LFP. Employment-linked health insurance is an important determinant of the decision to work off farm; health care reforms could therefore have unexpected consequences for the supply of labor to off-farm jobs.

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[23] See http://www.ers.usda.gov/StateFacts/US.htm for a comparison of rural and urban incomes, poverty rates, and other characteristics.

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