Labor Supply and Food Consumption Behavior of Farm Households: Evidence from South Korea

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To reduce income variability and to increase total household income majority of farmers, their spouses, and family members work off-farm, in addition to on-farm activities. This phenomenon is not only observed in the US, where over 80 percent of farm households' income originates from off-farm sources (USDA, 2010; Mishra et al. 2002; Ahearn, El-Osta & Dewbre, 2006) but also in Western European countries (Benjamin and Kimhi, 2006), similar trend is also observed in some of the Asian countries. For example, in 2011 the share of off-farm income in South Korea, Asia's fourth largest economy was 43 percent of the total farm households' income. Off-farm income provides farmers with certain fringe benefits such as health insurance and pension, as well as additional security for income (Mishra et al., 2002). Finally, Anderson (2002) suggests that farmers engaging in off-farm activities also have higher purchasing power than conventional farmers.

The stability of income from off-farm activities can influence on farmers' consumption and investment behaviors. For example, Reardon, Delgado, and Matlon (1992) found that income diversification via off-farm work was associated with higher incomes and food consumption, and more stable income and consumption over years, In another study McGregor and Barooah (1992) suggested that food expenditure, especially food away from home, can be used to evaluate the welfare of farmers with additional income from off-farm activities. Furthermore, Ruben and Van Den Berg (2001) found that off-farm work amplified food expenditure among Honduran farm households.

The South Korean agriculture has progressed over the years from food self-sufficiency to exporting agricultural products to the rest of the world. As South Korea moves into the 21st

century, reliance on agriculture is deemed to diminish somewhat, especially with growing manufacturing and hi-tech sectors. As a result new approach to rural development will have to focus on the promotion and generation of off-farm income earning opportunities for farm households. With increased human capital and ample opportunities to work off the farm off-farm jobs are more attractive to farmers and their spouses. However, due to lack of data, studies of off-farm labor supply and its impact on economic activities and consumption among farmers is limited in South Korea. Non-farm activities (off-farm income) affect the availability of cash to make the farm capital investments (and farm input purchase) needed to adopt appropriate technologies. Thus, non-farm activity by farm households is potentially important for long-term food security because it can increase the use of farm inputs and hence farm productivity and the ability to intensify production.

Therefore, the objective of this study is to assess the impact of off-farm labor supply on food and health expenditure patterns among South Korean farm households. Data from the 2009 and 2010 Farm Household Economy Survey in South Korea is analyzed. The contribution of this study is two folds. First, to our knowledge, this the first study to estimate off-farm income of South Korean farms households. Recall agriculture in South Korea is heavily subsidized and comprises of small farms, and entry into farming is highly restrictive. Secondly, we use longitudinal farm level data. Results from this study could inspire policymakers to design agricultural policies that encourage growth in non-farm economy. Particularly, when there are severe limitations on the capacity of the agricultural sector to absorb the existing supply of labor and to satisfy even the minimum subsistence requirement of a large proportion of the rural population.

This paper is structured as follows. We first review the agricultural sector of South Korea

and literature that discusses the relationship between the employment status of household food expenditures. Empirical model is present in the next section followed by description of the data used in this study. The presentation of results is in the next section, and continues with a discussion of the impacts of off-farm work on household food and healthcare expenses. The conclusions from this study are the presented in the final section.

Agriculture Sector of South Korea

The Korean economy developed faster in a unique way and the economic development is particularly different from other developed countries which had grown at a gradual pace. The rapid development of the Korean economy is reflected strongly in the changing role of agriculture. Until the 1960s, agriculture generated almost half of Korea's GDP and in 1970, agricultural production continued to contribute 25.5% of GDP and the labor force employed in the agricultural sector accounted for 50.5% of the country's total labor force. However, in 2011 the share of agriculture in the national economy declined sharply—about 2.9%--and the agricultural population accounted for 6% of the total population. Nonetheless, South Korea still struggles with inequalities in income between rural and urban families and a low quality of life (Statistics Korea, 2011).

After the Korean War, 1950 to 1953, infrastructure and economies were ruined and even the economy of South Korea lacked behind that of North Korea. The South Korean government created economic policies to combat hyperinflation, provide stable source of food and fiber, and restoring confidence in the government by investing in reconstruction and national defense. In short, in the 1960s Korea's economic policies focused on the labor-intensive light industries. In the 1970s it concentrated on the capital-intensive heavy industries, and in the 1980s economic policies expansion of capital and technology-intensive industries. From late 1980s, the Korean

government was pressed on trade liberalization by trading partner countries, and was supported with relief money from the International Monetary Fund (IMF) in 1997 due to the financial crisis.

Meanwhile, under the goals for the economic growth after the Korean War and it is believed that the agriculture sector was overlooked. Generally, Korean agriculture was highly depended on imports and government subsidies, in 1999, the producer support estimate (PSE) was 74%, while the average of other members' PSE was 40% (IOWA Ag Review, 2002). South Korea's policy support to the agriculture sector ranks among the worlds' highest.[1] Small holdings still persist, entry into the sector is difficult, and the farm population is aging rapidly. The two mainstream policies were self-sufficiency and reduction of the income gap between farmers and people involving other industrial areas. At the primary level after the Korean War, in 1960s, the farm activities mainly focused on rice productions. The government struggled to adjust adequate rice prices for both consumers and producers. To stimulate economic development it was essential to control the labor cost. South Korea places great importance on self-sufficiency in food staples, and achieving income parity between rural and urban households.

There were some specific goals for agricultural policies for the period following the Korean War. However, Kim and Lee (2003) point out that Korean agricultural policy changed with time. In the early stages (pre-1970s) the goal was to achieve economic growth, low grain price polices and conduct land reform. During 1970's to 1980's the goal of agricultural policy was to protect agriculture, two-tier price scheme (government purchase program), productivity enhancement programs, and encourage adoption of new technologies by farmers. Since the late 1980's agricultural policies were designed to make agriculture more market oriented—less reliance on subsidies. Specifically, domestic support systems were modified to include a direct

[1] Rice, soybean and barley are the most heavily supported commodities but beef, pork and dairy also receive considerable support.

payment to farmers—to protect the damages from WTO agreement in 1995, land reform and investment and loan programs (Kim and Lee , 2003) were initiated. The current agricultural policies are diverse. For example, the government has implemented programs to ensure food safety, targeted farm programs, environmental friendly agricultural production, large scale farms, and improvement rural residential life.

The 2008 Organization for Economic Cooperation and Development (OECD) report points out that the Korean government has implemented agricultural policy reforms that in many aspects are broadly consistent with the principles of transparency, targeting, tailoring, flexibility and equity outlined by OECD Ministers. Agriculture in Korea needs to be allowed to evolve into an efficient, modern enterprise that provides a positive economic contribution to society in line with other sectors of the economy. In other prescriptions the OECD ministerial meeting recommends that, among other policy reforms, increased efforts could be made to diversify income sources of agricultural households. Specifically, by promoting investment in education, transport, heath, and housing infrastructure, the desirability of rural areas and the opportunities for off-farm work would be increased. Finally, evidence presented above suggests that farm families in South Korean receive agricultural subsidies. Literature in agricultural economics provides ample evidence that such subsidies can result in production distortions as well as labor reallocation between farm and off-farm work.

Literature Review

There is significant empirical evidence that government program payments (also known as government subsidies in agricultural sector has unintended effects. For example, government subsidies in the US and Europe have either encouraged or discouraged off-farm participation/work by farm operators and spouses (Ahearn, El-Osta, Dewbre, 2006; Dewbre and

Mishra, 2008). Off-farm work provision has been largely responsible for: (1) closing the income gap between farm and nonfarm households (Mishra et al. 2002; Holden et al. 2004); (2) food consumption and nutrition (Chang and Mishra, 2008; Babatunde and Qaim, 2010). Although there is an extensive literature on off-farm work, far less attention has been paid to investigate the effects of the decision to work off the farm on farm household expenditures.

There are a limited number of studies that have investigated the effect of off-farm work on food expenditures. In a recent study Chang and Yen (2010) investigates the impact of off-farm labor supply on food expenditure pattern of full time and part time farmers in Taiwan. They separated food expenditure into two parts: expenditure at home and expenditure away from home. The authors found that operators and spouse's full-time off-farm employment are positively related to food expenditure away from home. Full-time and part-time spouses' off-farm work decreased food expenditure at home. Chang and Mishra (2008) studied the relationship between off-farm labor supply decisions and farm characteristics, and government subsidies. The authors examined how off-farm participation affected food consumption. Chang and Mishra (2008) found that government subsidies encouraged off-farm labor participation, but only the operator's decision to work off the farm positively affected household's food expenditure. Therefore, off-farm labor supply is positively related to food consumption as well as the farm income.

Despite a plethora of literature on off-farm work in the developed countries, relatively little attention has been paid to the effects of off-farm labor supply on Korean farm household food expenditures. Results from this study can used to provide policymakers the evidence that non-farm income (or off-farm income) is an important factor in rural household economies, including farm households, and therefore also in food security, since it allows greater access to food. This source of income may also prevent rapid or excessive urbanization as well as natural

resource degradation through overexploitation. Finally, off-farm income affects the performance of agriculture by providing farmers with cash to invest in productivity- Furthermore, development of non-farm sector in the food system (including agro processing, distribution and the provision of farm inputs) may increase the profitability of farming by increasing the availability of inputs and improving access to market outlets. In turn, better performance of the food system increases rural incomes and lowers urban food prices enhancing inputs.

Empirical models

Sample selection model is commonly used in labor supply model. In this study we use Heckman's (1979) two-stage method, in conjunction with pooled data (2009 and 2010), to analyze off-farm labor supply and food consumption behavior of from Korean farm household. Heckman's two-stage model considers the observations in the censored sample to reduce the sample selection bias. Since it is hard to derive the likelihood functions, therefore, as a suboptimal the Heckman's two step model is commonly used (Kennedy, 2008). The adopted empirical model is from Green's book that outlines the method and notation (Green, 2011). Consider Y and z two variables that are bivariate and normal distributed and the correlation between Y and z is given by ρ. If we consider z, which is greater than certain threshold say a, than the joint density function of the bivariate normal distribution shifts and the change in the joint density of Y and z is given by.

$$f(Y, z|z > a) = \frac{f(Y,z)}{Prob(Z>a)} \quad (1)$$

Moreover, the mean and variance of the truncated normal distribution would be changed as follows (Green, 2011):

$$E[Y \mid z > a] = \mu_y + \rho\sigma_y\lambda(\alpha_z),$$

$$Var[Y \mid z > a] = \sigma_y^2[1 - \rho^2\delta(\alpha_z)]. \quad (2)$$

where, means of y and z are μ_y and μ_z, respectively, and the associated standard deviations are σ_y and σ_z, α_z=(a - μ_z) / σ_z, $\lambda(\alpha_z)$ = $\phi(\alpha_z)$ / [1 - Φ (α_z)], and $\delta(\alpha_z) = \lambda(\alpha_z)[\lambda(\alpha_z) - \alpha_z]$.

As mentioned before, we need two equations. First, the selection model determines the sample selection. However, z_i^* cannot be observed but we know whether the observation is in the sample or not.

$$z_i^* = w'\gamma_i + u_i \quad (3)$$

Second, regression model which we are interested, food expenditures can be specified a Tobit where the Y_i (food expenditures) is only observed when z_i^* is censored over zero (Green, 2011).

$$Y_i = x_i'\beta + \varepsilon_i \quad (4)$$

Then, we can estimate the expected value of censored y_i, as:

$$\begin{aligned} E[Y_i|y_i\ is\ observed] &= E[Y_i|\ z_i^* > 0] \\ &= E[Y_i|u_i > -w'\gamma_i] \\ &= x_i'\beta + E[\ \varepsilon_i \mid u_i > -w'\gamma_i] \\ &= x_i'\beta + \rho\sigma_\varepsilon\lambda_i(\alpha_u) \\ &= x_i'\beta_i + \beta_\lambda\lambda_i(\alpha_u)\ . \end{aligned} \quad (5)$$

where $\alpha_u = -w'\gamma_i/\sigma_u$, $\lambda(\alpha_u)$= ϕ ($w_i'\gamma/\sigma_u$) / Φ($w_i'\gamma/\sigma_u$).

Therefore,

$$\begin{aligned} Y_i|\ z_i^* > 0 &= E[y_i|\ z_i^* > 0] + v_i \\ &= x_i'\beta + \beta_\lambda\lambda_i(\alpha_u) + v_i\ . \end{aligned} \quad (6)$$

As we know in equation (6), if we estimated the censored sampled model by general least squares regression, the estimates has omitted variable problem in the amount of $\beta_\lambda\lambda_i(\alpha_u)$ and

inconsistent. Therefore, the least squares analysis should consider both x and λ as independent variables instead of only x. However, the error term v_i has heteroscedastic problems, and the estimates are inefficient (Green, 2011). We will use bootstrapping method to remedy heteroskedasticity problem and consistently estimate the standard errors

The censored marginal effects are separated by two parts as shown in equation 7. One is the direct effect by y_i, another is the censored effect by λ_i according to $z_i^* > 0$.

$$\frac{\partial E[Y_i|\, z_i^*>0]}{\partial x_{ik}} = \beta_k - \gamma_k \left(\frac{\rho\sigma_\varepsilon}{\sigma_u}\right) \delta_i(\alpha_u). \quad (7)$$

where $\delta_i = \lambda_i^2 - \alpha_i\lambda_i$.

Sample selection bias occurs when the sample is non-randomly drawn. If the error term is correlated with explanatory variables, we can expect the sample selection problem or selection bias. As we only can observe the positive values, the unobserved traits may affect the dependent variable of regression the model or the selection model to determine participation (Kennedy, 2008). To solve the selection bias problem, the expected error term, i.e., inverse mills ratio, should be added to the original regression model as an additional independent variable. More specifically, we estimate the following equations:

Selection model:

$z_i^* = w_i'\,\gamma + u_i,\ z_i = 1$ if $z_i^* > 0$ and 0 otherwise;

Prob $(z_i = 1|\, w_i) = \Phi\,(\mathrm{w}_i'\gamma)$, Prob $(z_i = 0|\, w_i) = 1 - \Phi\,(\mathrm{w}_i'\gamma)$.

Regression model:

$Y_i = x_i'\beta + \varepsilon_i$ is observed if $z_i = 1,\ (u_i, \varepsilon_i) \sim bivariate\ normal\ [0,0,1, \sigma_\varepsilon, \rho]$.

$[Y_i|z_i = 1, x_i, w_i\,] = x_i'\beta + \rho\sigma_e\lambda(\mathrm{w}_i'\gamma)$. (8)

Including *inverse mills ratio (IMR)* in the food expenditures equation and applying an Ordinary Least Squares method (OLS) results in a consistent estimation (Vella and Verbeek, 1999). After correcting for the self-selection decisions of off-farm work the estimated food expenditures equation can be specified as:

$$Y_t = \beta' X_t + d_H * I_H + k_H * IMR_H + e_t \quad (9)$$

where Y_t is the level of food expenditures of the farm household. β is the vector of parameters to be estimated, and X_t contains exogenous variables. I_H is a binary indicator that specifies if the farm household received off-farm income.

In this study the first stage of Heckman's technique involves the estimation of off-farm work by farm households using probit model. Estimated parameters from the probit model are used to estimate a random variable $\hat{\lambda}_i$, also known as the inverse mills ratio (IMR) $\hat{\lambda}_i = \phi(w_i'\hat{\gamma}$ $/\Phi(w_i'\hat{\gamma})$ and $\widehat{\delta_i} = \hat{\lambda}_i(\hat{\lambda}_i - w_i'\hat{\gamma})$. In the second stage of Heckman's technique, $\hat{\lambda}_i$ is used as a regressor in the linear regression model. The significance of $\hat{\lambda}_i$ can be interpreted as a test for selectivity bias, and its inclusion allows for the consistent estimation of the model's parameters. In this study, attending to the selectivity concerns when estimating food expenditures is accomplished by appending to the predicted probabilities ($\widehat{P_i}$) of working off the farm and the IMR ($\hat{\lambda}_i$) as additional regressors. To avoid the identification and accomplish the correct estimation at least one of the independent variables between two equations should be different (Kennedy, 2008).

Data

The data used in this study is obtained from 2009 and 2010 Farm Household Economy Survey (FHES) in South Korea. FHES is administered annually and collects information of farming practices, demographics and production costs from approximately 2,800 farm households who operate a farm of about 10a ($1{,}000m^2$) or more, or generate an annual sales of farm products of 500,000 won (₩) ($\approx$ US$444, based on 5/28/2013: $1=₩1,127) (Farm Household Economy Survey Report, 2012). However, it should be noted that the survey changes the sample of farmers periodically. We use recent data available to use. Specifically, we use 2009 and 2010 FHES.

The data is mainly categorized into two categories, daily logs and assets logs. In the daily logs, cultivated crops, livestock, receipts, expenses, agricultural labor hours, and agricultural production input costs are specified. In the assets log, total farm assets, liabilities, and farm household characteristics are reported by farm households (senior operator). Specifically, the survey includes demographic characteristics, farm type, land area, labor supply (e.g., on-farm and off-farm labor work hours), and financial performance (e.g., capital, assets, and farm income). Moreover, farm household expenditures including consumption expenditures and non-consumption expenditures are also collected.

Farm household expenditures are separated into consumption and non-consumption expenditures. Consumption expenditures, are categorized into 13 groups, include food & non-alcoholic beverages, alcohol & cigarette, clothing & footwear, house, home appliance & house service, health, transportation, communication, recreation, education, lodge, extra commodities & service, and depreciation. Non-consumption expenditures include tax, pension, and social

security. For the purpose of this paper we only include food expenditures which include cereals, vegetables, fruits, dairy products, meat, and non-alcoholic beverages.

Table 1 reports summary statistics and definition of variables used in model. All financial values and food expenditures are changed to natural log. In the probit model the dependent variable is participation in off-farm labor market (=1 if participated, 0 otherwise), and in the second model the dependent variable is total food consumption expenditures (in natural logs). Independent variables include operator's characters, farm characters, and location of the farm . We use 6 provinces (large areas), this criteria is the same as the old Korean provision standards. On average 26% farm households reside in Gyeongsang-do, provision/province and 25% of farm households reside in Jeolla-do. Since Jeolla-do is located on the plains and produces plenty of agricultural products. The farm type or specialization was categorized into 9 categories in the survey, in this study, we define three farm specialization : crops, livestock, and other products. Data reveals that on average, 52% of the farms produced crops, and 9% of farmers raised livestock. The farm scale which depicts farm size has 9 categories, from under the 0.5 hectare to over 10 hectare. In our analysis, use three dummy variables to depict farm size : *Fam_scale_small* (under 0.5 hectare, about 20% of farms), *Farm_scale_medium* (0.5~2 hectare, about 23% of farms), and *Farm_scale_big* (over 2 hectare, about 26% of farms) scale. Data reveals that during 2009 and 2010 on average, 72% of farmers owned less than 2 hectares.

In the original survey data the age of operators was divided into 6 groups. Group 1 represents farmers who are younger than 30 years; group 2 includes farmers between 30 to 39; group 3 includes farmers between 40 to 49; group 4 includes farmers between 50 to 59; group 5 includes farmers between is 60 to 69; and group 6 includes farmers who are over 70 years old. Among the sample groups 22% of the farmers were in the first 4 groups, 35% of the farmers

were in group 5, and 34% of the farmers were in group 6. In our empirical model we include three dummy variables to represent farmer age. For example, *operator_age_young* represents farmers under 50 (group 1, 2, and 3); *operator_age_middle* includes farmers between 50 and 69 (group 4 and 5); and *operator_age_old* includes farmers 70 or older –(group 6). Similarly, household size was defined in 5 groups. Group 1 had two household members,; group 2 had three members; group 3 had four members; group 4 had five members; finally group5 had over six household members. As with any other newly industrialized country, majority of farm households in Korea had three or fewer members in the household—81% were in group 1 and 2. We use three dummy variables in our empirical model. For example, *Household_size_small* dummy variable represents farm households with 2 or members; *Household_size_medium* dummy variable represents farm households with 3 members; *Household_size_big* dummy variable represents farm households with 4 or more members.

Results and discussions

We begin our discussion of the results in Table 2 with the fit of the model. McFadden's R^2 (0.20) is used to evaluate the fit of the model and results indicate a reasonable fit of the model, considering the cross-sectional nature of the data (Hensher and Johnson, 1981). Results in table 2 indicate that the financial exposure[2] (measured by *debt-to-asset ratio*) of farm has a negative and significant effect on the likelihood of farm household having off-farm income. A plausible explanation is that farms with higher risk exposure—those who have borrowed more money—may be medium sized farms who may have borrowed money for farm expansion and by lender's business plan may be asked to put in more hours of farm work, in order to make farming

[2] This ratio measures the financial position or solvency of the farm by comparing the farm liabilities (debts) to farm assets. It measures the portion of the farm assets that have debt against them. A higher ratio is generally considered to be an indicator of greater financial risk and lower borrower capacity.

business a success. Small farms (*Farm_scale_small*) are more likely to have off-farm income. The coefficient on *Farm_scale_small* is positive and significant at the 10% level of significance. Small farms may need additional income from other sources for survivability and marinating the lifestyle. Findings here are consistent with Chang and Mishra (2008), who found positive and significant relationship between off-farm work and farm size in the case of US farm households.

The effect of significant variables on the propensity to have an off-farm income is expected and is in agreement with some of the findings in previous studies. For instance, the life-cycle effect on the likelihood of off-farm income is quadratic. At younger ages, the probability of having off-farm income by farm households' increases as age increases. This is evident from a positive and statistically insignificant coefficient on young operator age (*Operator_age_young*, those under 50) compared to middle aged farm operators (between 50-69). However, the probability of having off-farm income decreases in the older age group. This is evident from a negative and statistically significant coefficient on old operator (*Operator_age_old*, those 70 or over), compared to middle aged farm operators (age 50-69). These results are consistent with findings in the literature.

Composition of the farm households also has an effect on the probability of off-farm income. For example, findings in table 2 indicate that, compared to farm households with 3 members, farm household with 2 members are less likely to have off-farm income. On the other hand, results in table 2 indicate that, compared to farm households with 3 members, farm household with 4 or more members are more likely to have off-farm income. This finings is in contrast with the findings of Chang and Mishra (2008) who found a negative relationship between household size and off-farm work when investigating US farm households. A plausible

explanation is that Korean farmers own small farms that are less competitive, and additional labor is absorbed in the off-farm labor market.

Location of the farm is another important in determination off-farm income of Korean farm households. Results in table 2 indicate that farm households of farms located in the Jeolla-do, or Jeju-do are likely to earn off-farm income (i.e., members of the household are more likely work off the farm) compared to the farms located in the base Gyeongsang-do region (see figure 1). Regions may be proxy variables like unemployment rate, industry type—such as manufacturing etc. Although the agricultural production of Jeolla-do is high, but the average total income is rather low compared to other regions, however, with the presence of marine and land-based national parks and spectacular coastal views as well as service sectors like fresh seafood restaurants—an attraction for tourists—Jeolla-do farmers and their family members can easily find off-farm work. On the other hand, Jeju-do region is popular for tourist attraction as well as tangerine farming; farmers in Jeju-do can easily find off-farm work in tourism and related industries.

Fame type is also a factor in the determination off-farm income. Results in table 2 indicate that, compared to all other farm types, farms specializing in crops and livestock[3] are less likely to receive off-farm income. Recall that crops and livestock enterprises are well protected under the South Korean agricultural policy. Therefore, the government intervention, when prices fall below the market price, seeks to stabilize prices and smoothes income of crop and livestock producers. Even though South Korean government has signed free trade agreement Korean

[3] Data does not allow us to differentiate between livestock and dairy. Off-arm work literature indicates that dairy farmers are less likely to work off the farm because of the higher on-farm opportunity cost of labor.

livestock farmers will receive cash assistance from the government if the price of their products drop after a free trade agreement comes into effect. [4]

Food Consumption

The impact of off-farm income by farm household on food expenditures of the household (equation 9) is presented in Table 3. The Ordinary Least Squares (OLS) method was used to estimate the model. Since the primary objective of this study is to investigate the effects of off-farm income by farm households on food expenditures, we begin our discussion of the results on testing the hypothesis (on the bottom of Table 3). The test value under the null hypothesis, that the off-farm income has no impact on food expenditures (H_0: OFF_INC=0), is rejected since the test value (9.90) is higher than the 5% level. This result provides evidence that off-farm income of the farm households is an important determinant of households' food expenditures. Findings here are consistent with previous studies in the literature Chang and Mishra (2008).

As stated in the preceding section, the other crucial issue of interest is to determine if self-selection bias occurs between the off-farm income and the food expenditures of Korean farm households. The test value under the null hypothesis that the IMR is equal to zero is 10.41, which is higher than the 1% level. This result provides evidence of a self-selection problem. In other words, the results of this analysis will be inappropriate if the endogeneity between off-farm income and food expenditures of the farm household is not corrected.

Other explanatory variables are found to be significantly associated with food expenditures of thee Korean farm households. For example, total farm income (*Total-*

[4] Under the new plan, the government will compensate up to 90 percent of the losses that farmers see if the price of a product drops by more than 10 percent after an FTA goes into effect. And the government will also support those who choose not to raise livestock in the future. If an FTA drives a farmer out of business, he will be eligible to receive monetary compensation equivalent to the amount he would have earned for three years.

farm_income), government farm subsidy (*Public_Subsidy*) and households with more than four members (*Household_size_big*) have positive and statistically significant impact on food expenditures by Korean farm households (table 3). Government farm subsidies may increase disposable income of Korean farm households that could be used for additional consumption—especially meat products. These results are consistent with the findings in the literature (Chang and Mishra 2008; Sexauer, 1980; Smallwood and Blaylock, 1981; Redman, 1980; Kalwij, 1998).

Although small farms may be more likely to have off-farm income, but they may not consume the additional income, as evidenced by a significantly negative coefficient on *Farm_scale_Small*. It is plausible that these small farm households are self-sufficient and may be operating small farms for the rural residential lifestyle purposes. Additional income from off-farm sources could be used for the consumption of durable goods or perhaps household savings—which is much appreciated in Korean culture. Finally, compared to the base region (Gyeongsang-do) farm households located near the capital region have higher food expenditures. On the other hand, compared to the base Gyeongsang-do region, farm households located in the Chungcheong_do and Jeju_do regions have lower food expenditures. Because of absence of prices in the model, these results may reflect regional price differences. Further, the results may also reflect that away from home food expenditures are poorly reported. This may be indicative of the transitory increase in food expenditures due to increased spending on food away from home by operators in our sample.

Summary and Conclusions

While the South Korean economy is growing rapidly, its agricultural sector has been going in the opposite direction. For example, the number of farms and farming population, like any other industrialized nation, has been consistently decreasing. The agricultural sector that was

protected and highly subsidized has been opening up under WTO rules and free trade agreement, recently. Farm households have found other means to increase and/or stabilize household income. One such way is to work off the farm and increase the share of off-farm income in total income. In this study we investigated the impact of off-farm income on food expenditures among farm households in South Korea using 2009 to 2010 Farm Household Economy Survey. Using a relatively innovative two-staged econometric procedure that combines the strength of the endogenous treatment effects model and a discrete choice model is employed to estimate the parameters in our empirical model.

Our empirical results reveal some interesting findings. First, it confirms that off-farm income is endogenous to food expenditures. Second, variables like farm and family attributes and operator's age, and regional location of the farm impact off-farm income of Korean farm households. Third, in contrast to previous studies, this analysis indicates that financial exposure also plays an important in off-farm income of farm households. For example, the proportion of farm debt to farm assets is found to be negatively associated with off-farm income of farm households.

The off-farm income is also found to be positively associated with food expenditures of the Korean farm household. This implies that a portion of off-farm income may be allocated to food expenditures of the farm household. Among other factors found to be positively associated with household food expenditures are household size, total farm income, location of farms near capital area, and farms specializing in crops have higher food expenditures. Findings here highlight the fact that Korean farm households are deriving income from other sources. Findings here also suggest that Korean farm households may be relying more on the local and global economy more than even before.

Households with more access to income generating activities or access to higher paying work have higher income and more food secure than households who do not have these benefits. Policies aimed at increasing human capital and training programs that increase the likelihood of securing an off-farm employment should be put forth by policymakers. Finally, there are two ways in which one can improve this study; (1) obtain information on the number of hours worked off the farm by both the operator and spouse increase the accuracy of the results; (2) obtaining accurate and consistent data on food consumption, both at home and away from home; and (3) analyzing the impact of off-farm work by operators and spouses on at home and away food consumption by Korean farm households.

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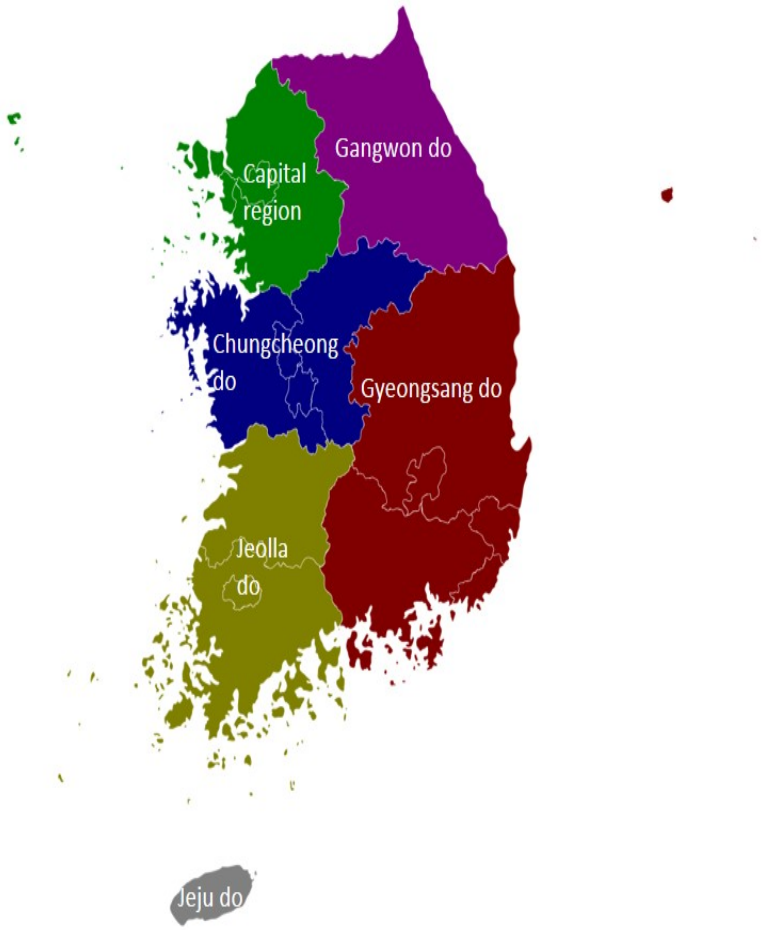
Figure 1. Regions of South Korea



* For convenience, we reduced the current 16 providences to 6 major areas. Capital region includes Seoul, Incheon, and Gyeonggi-do; Chuncheong-do includes Daejeon, Chungcheongbuk-do, and Chungcheongnam-do; Gyeongsang do includes busan, Daegu, Ulsan, Gyeongsangbuk-do and Gyeongsangnam-do; Jeolla do includes Gwangju, Jeollabuk-do, and Jeollanam-do.

Table 1. Data descriptions of Korea farm households in 2009 and 2010

Variable	Description	Total (n=5301)		2009 (n= 2652)		2010 (n= 2649)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Dependent variables							
Off_farm_labor	Off-farm labor=1	0.58	0.49	0.58	0.49	0.58	0.49
Food_consumption	Log(food_consumption)	15.27	0.40	15.25	0.39	15.30	0.40
Explanatory variables							
Total_farm_income	Log(Total_farm_income)	16.81	0.94	16.81	0.93	16.80	0.96
Public_subsidy	Log(Public_subsidy)	14.76	1.20	14.75	1.19	14.78	1.21
Debt/Asset	Log(Debt)/Log(Asset)	0.84	0.09	0.84	0.09	0.84	0.09
Binary explanatory variables							
y_2010	Year 2010=1	0.50	0.50	0.00	0.00	1.00	0.00
Capital region	Seoul, Incheon, Gyeonggi-do	0.12	0.33	0.12	0.33	0.12	0.32
Gangwon_do	Gangwon_do	0.10	0.30	0.10	0.30	0.10	0.30
Chungcheong_do	Daejeon, Chungcheongbuk-do, Chungcheongnam-do	0.22	0.41	0.22	0.41	0.22	0.41
Gyeongsang_do	Busan, Daegu, Ulsan, Gyeongsangbuk-do, Gyeongsangnam-do	0.26	0.44	0.26	0.44	0.26	0.44
Jeolla_do	Gwangju, Jeollabuk-do, Jeollanam-do	0.25	0.43	0.25	0.43	0.25	0.43
Jeju_do	Jeju_do	0.06	0.23	0.05	0.23	0.06	0.23
Farm_scale_small	Less than 0.5ha	0.21	0.41	0.20	0.40	0.21	0.41
Farm_scale_medium	Between 0.5~2ha	0.51	0.50	0.51	0.50	0.51	0.50
Farm_scale_big	Greater than 2ha	0.28	0.45	0.29	0.45	0.28	0.45
Operator_age_young	Under 50	0.09	0.28	0.10	0.29	0.08	0.27
Operator_age_middle	Between 50~69	0.56	0.50	0.57	0.50	0.55	0.50
Operator_age_old	Greater than 70	0.35	0.48	0.34	0.47	0.37	0.48
Household_size_small	Household member is 2	0.63	0.48	0.62	0.49	0.64	0.48
Household_size_medium	Household member is 3	0.19	0.40	0.20	0.40	0.19	0.39
Household_size_big	Household member is over 4	0.18	0.38	0.19	0.39	0.17	0.38
Farm_type_crops	Crop farm	0.52	0.50	0.52	0.50	0.53	0.50
Farm_type_livestock	Livestock farm	0.09	0.28	0.09	0.29	0.09	0.28
Farm_type_others	Other type farm	0.39	0.49	0.39	0.49	0.39	0.49

Source: Korean Farm Household Survey, 2009 and 2010.

Table 2. Probit model for off-farm labor participation among Korean farm households

Variables	Dependent variable: Off-farm labor	
	Coefficient	Marginal effects
Public_subsidy	-0.0222	-0.216
	(0.0204)	(0.199)
Debt/Asset	-0.469*	-0.254*
	(0.275)	(0.150)
y_2010	0.0455	0.015
	(0.0472)	(0.015)
Capital region	-0.0711	-0.005
	(0.0841)	(0.007)
Gangwon_do	-0.0641	-0.004
	(0.0880)	(0.006)
Chungcheong_do	-0.0808	-0.012
	(0.0691)	(0.011)
Jeolla_do	0.286***	0.042***
	(0.0663)	(0.009)
Jeju_do	0.851***	0.019***
	(0.113)	(0.001)
Farm_scale_small	0.132*	0.010*
	(0.0759)	(0.005)
Farm_scale_big	0.0319	0.008
	(0.0535)	(0.013)
Operator_age_young	0.00321	0.000
	(0.0908)	(0.004)
Operator_age_old	-0.454***	-0.118***
	(0.0559)	(0.017)
Household_size_small	-0.456***	-0.216***
	(0.0611)	(0.032)
Household_size_big	0.220**	0.016**
	(0.0814)	(0.005)
Farm_type_crops	-1.117***	-0.523***
	(0.0572)	(0.034)
Farm_type_livestock	-1.039***	-0.088***
	(0.0830)	(0.011)
Intercept	1.959***	-
	(0.397)	
Log-likelihood	-1891.17	
Pseudo R^2	0.20	
correctly predicted %	72.14%	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3. Regression model for effect of off-farm labor participation on food expenditure

Variables	Dependent variable: Food expenditure	
	Coefficient	Marginal effects
Public_subsidy	0.0328***	0.0316***
	(0.00531)	(0.0051)
y_2010	0.0553***	0.0018***
	(0.0106)	(0.0003)
Capital region	0.104***	0.0008***
	(0.0243)	(0.0002)
Gangwon_do	-0.00359	-0.00002
	(0.0214)	(0.0001)
Chungcheong_do	-0.0295*	-0.0004*
	(0.0176)	(0.0002)
Jeolla_do	0.0164	0.0003
	(0.0185)	(-0.0003)
Jeju_do	-0.379***	-0.0018***
	(0.0309)	(0.0001)
Farm_scale_small	-0.128***	-0.0013***
	(0.0174)	(0.0002)
Operator_age_young	-0.0191	-0.0001
	(0.0248)	(0.0002)
Household_size_big	0.186***	0.0025***
	(0.0167)	(0.0002)
Farm_type_crops	0.0986***	0.0033***
	(0.0180)	(0.0006)
Total_farm_income	0.120***	0.1332***
	(0.00878)	(0.0097)
Off_farm_Income	0.0919**	0.0022**
	(0.0403)	(0.0010)
Inverse mills ratio, IMR (λ)	0.134*	0.0057*
	(0.0723)	(0.0031)
Intercept	12.59***	-
	(0.178)	
Wald chi2	1170.51	
Adj R-squared	0.23	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.