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**How Does Economic Crisis Affect Income
Inequality of the Farm Households? Empirical
Evidence in Taiwan**

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Abstract

Given the economic crisis and rising in food price in 2008, a redistribution in income between different sectors can be expected. This paper contributes to this issue by assess the impacts of the change in income inequality between farm households. In addition, we investigate the extent to which the farm, nonfarm, and government payments contributes to income inequality due to the change in macroeconomic environment in 2008. Using a decomposition method on a national household survey data in Taiwan in 2007 and 2008, results indicate farm and nonfarm income have different implications for full-time and part-time farm households. In addition, the income inequality declined significantly among full-time farm households from 2007 to 2008.

Keyword: Financial crisis; income inequality, farm household, decomposition, Taiwan.

Introduction

The world economic crisis beginning in 2008 had resulted in major consequences on the world economy. Since 2008, the weakening in commodity demand had led to economic recession, thus increased the unemployment rates and reduced economic growth. To evaluate the potential impacts from the current global financial crisis on the American theater, a special Council meeting was hosted on January 13 of 2009 in the U.S.¹ As in many other countries, Taiwan is not one of the exceptions of the economic crisis. From January 2007 to December 2008, the unemployment rate was increased from 3.79% to 5.03% which is approximately 33% (see Figure 1). At the same time, the food price had reached its historical high in Taiwan, which increased from 35.74 NT\$/kg in December 2007 to 39.69 NT\$/kg in December 2008. The increase in food price in these two years is approximately 11% (see Figure 2). One of the interesting questions is then raised: how does the household wellbeing is affected by the macroeconomic changes? Also, how the impacts may be different for different types of households? Due to the economic recession and increased food price, a redistribution of the economic wellbeing between farm and nonfarm households can be expected. This paper aims to address this issue by focusing on the farm households in Taiwan.

A growing body of literature had tried to examine the impacts of the economic crisis on the general economy. For instance, Duflos and Gaehwiler (2008) revealed that rising food price caused households to withdraw savings, cut back on nonfood expenses. However, not many studies focused on the farm sector. Very recently, Shane et al. (2009) assesses the impacts of the economic crisis on U.S agriculture. They concluded that the crisis will impact U.S agriculture mostly through indirect

¹ <http://www.actorsequity.org/newsmedia/news2009/jan26.theatreocrisis.asp>

international effects rather than through the changes in the U.S economy. In contrast to the households in general, the examination the impacts of macroeconomic environment changes on the farm households are complex. The complexity can be understood due to the fact that many of the farm household members participate in the off-farm labor market to support their living. For instance, it is reported that 80% of the farm households working off the farm in the U.S. Similar evidence is also revealed in Taiwan, and it is estimated that approximately 75% of the farm household reported income from nonfarm sources in 2005. In addition to nonfarm income, the income transfer from government programs are also critical for farm household income. For instance, Chang and Boisvert (2006) found that the received payments from the Conservation Reserve Program not only increases the mean levels but also stabilize the total household income in the U.S.

Although the impacts of the economic crisis can be assessed by several perspectives, this paper looks at the income inequality between farm and nonfarm households, and also different types of farm households. It is hypothesized that the reduction in employment rates will affect the participation to the off-farm labor market of the farm household members, on the other hand, the rising food price can contribute to the income from agricultural sales. Therefore, a re-distribution in income between farm and nonfarm household can be expected. However, how this may affect income inequality is not that obvious, which will depend on the contribution of each income source to the income inequality. To reach our goal, we first estimate the Gini coefficients for the selected groups and decompose the Gini coefficients by different income sources. The emphasis of the income inequality is due to the fact that income inequality provides a relative measure of the economic wellbeing, rather than the comparisons of the income levels. In addition, though income inequality had been addressed in the economic literature, not many studies had been done among the farm

households (Ahearn et al. 1985; Boisvert and Ranney 1985; El-Osta et al., 1995; Zhu and Luo, 2006; Chinn, 1979 ; Leones and Feldman, 1998; Elbers and Lanjouw, 2001; de Janvri and Sadoulet 2001). However, the empirical results of these studies are at best inconclusive. For instance, off-farm income had been found as an equalizing income source in many countries, including the U.S. (See El-Osta et al., 1995), China (Zhu and Luo, 2006), and Philippines (Leones and Feldman, 1998). On the other hand, Gallup (2002) and de Janvri and Sadoulet (2001) found that income other than farming contributed positively to inequality in Vietnam and Mexico. Also, Canagarajah et al. (2001) found that non-farm employment income was much more disequalizing than non-farm wage in Ghana and Uganda. In this study, we provide an empirical example to investigate how the farm and nonfarm income contribute to income inequality in Taiwan.

This paper contributes to the previous literature in several ways. First, in spite of a growing body of recent studies that examines the impacts of the economic crisis on general economy, little attention had been paid on the household wellbeing, especially on the farm households. We provide empirical evidence to assess how 2008 economic crisis may affect farm household income inequality using a national data set in Taiwan. Second, among the few studies on the income inequality of farm households, the effects of the nonfarm income on household income inequality is at best inconclusive. In this study, we provide an empirical study in Taiwan. Last but not the least, previous studies had shown that government payments play an important role on income inequality of the farm households. However, the effects may be positive or negative depending on the purpose of the farm program. For instance, using a dairy farm survey data in the New York State in the U.S, Boisvert and Ranney (1990) found that government payments decreased income inequality. In this study, we consider a unique social security program, so called Old-Farm-Welfare-Allowance (OFWA)

payment in which all eligible farmer aged 65 and above will receive monthly NT\$ 6,000 in Taiwan. In other words, this can be seen as a decoupled program which is not depending on their production. This study provides an example of the effects of income support program on income inequality of the farm households. To the best of our knowledge, the present study is the first one to address the social security program on income inequality on the farm households.

Given the emphasis on the farm household, the objective of this paper is multiple folds. First, we examine the income inequality between farm and nonfarm households in Taiwan. Further focusing on the farm households only, we investigate the extent to which different income sources may contribute to income inequality between full-time and part-time farm households. Additional analysis is conducted for comparing the results between 2007 and 2008 which will allow us to justify if the economic crisis and increasing in food price may affect the income inequality of the selected households in Taiwan.

The remainder of this paper begins with a description of the data. The empirical model that conduct the decomposition of the income inequality is presented. In what follow, we present the empirical findings and the final section conclude this paper with some policy implications.

Data

Our data were drawn from the 2007 and 2008 Surveys of Family Income and Expenditure (SFIEs), the two most recent waves available, conducted by Taiwan's Directorate General of Budget, Accounting and Statistics (DGBAS 2007, 2008). The SFIE was conducted every two years prior to 1976 and annually thereafter. Each year, approximately 12,000 households were interviewed. Data collected included family income from salaries, entrepreneurial, property, and government transfers. Therefore, the SFIE is an important vehicle for the government to understand the income of the

households in Taiwan. It is noticed that the survey design of the SFIE data set is similar to the commonly used Consumer Expenditure Interview Survey (CEX) in the U.S. However, in contrast to the CEX data, farm households are identified for those households with at least 0.05 hectare farmland or with annual sales of agricultural products more than NT\$ 20,000. Within the farm households, two types of farm households are further recognized depending on the time allocation of family members between farm and nonfarm works. If all of the farm household members work only on their own farm business, or the off-farm working days of any of the members on the off-farm work are less than 30 days per year, they are categorized as the full-time farm households. By contrary, if annual hours working on the off-farm work of any of the family members are more than 30 days per year, they are recognized as part-time farm households.

Since one of the primary objective of this study is to investigate the extent to which various income sources may be contributed to the inequality of the total farm household income, it is important to recognize different income sources first. Similar to the definitions of the previous studies (e.g., Boisvert and Ranney 1990; El-Osta et al. 1995), total farm household income is reconfigured into four components: farm income, nonfarm income, government subsidy from old farm pension system, and other government payments. Farm income include the income and revenue related to the farm activities of the farm household, and nonfarm income include wages and salaries of the family members from the off-farm jobs. It is of noticed that a unique social security system for old farm population, called the Old Age Farmers' Welfare Allowance (OFWA), has been implemented since 1995 in Taiwan. Each farmer older than 65 is eligible to receive a monthly lump-sum payment of NT\$ 6,000. Since this lump-sum payment is expected to stabilize the farm household income, we separate the government payments into payments received from OFWA and other payments.

The sample statistics of the household income and its components by farm types and years is presented in Table 1. For comparison purpose, the incomes of nonfarm households are also exhibited. As shown in Table 1, there are 1,018 and 1,139 farm households in year 2008 and 2007. Among these farm households, 24% and 22% of them are full-time farm households in these two years respectively. With respect to the total household income, a decrease trend is evident for all households from 2007 to 2008. However, the magnitude is different among different types of households. For instance, only 1.33% decrease in total income is found among nonfarm households in 2008 compared to the average income level in 2007. However, it is more pronounced among the part-time farm households (-7.26%). Interestingly, only a minor decrease in total income is found among the full-time farm households (-0.80%). This minor decrease in household income among full-time farm households reflects the increasing reliance of the farm incomes under the economic crisis.

With respect to the components of total household income, results show that there is approximately a 10% increase in household income for all farm households. The increasing effect is more pronounced for full-time farm households (15.26%). By contrary, a 8% decrease in farm income is found for part-time farmers.

Empirical Strategy

To select an appropriate inequality index is necessary to explore the impacts of financial crisis on farm household inequality. Several different indices had been used in the previous study of inequality, and these including Theil's entropy index, Theil's second measure of inequality, and the Gini coefficient. In this study, the Gini coefficient is selected because the two Theil measures can only be disaggregated by population subgroup but not by income source. Instead, the Gini coefficient is neat corresponding to the Lorenz curve and easy to interpret decompositions of effects of different income sources to inequality.

The overall Gini coefficient is used to produce an estimate of the inequality in the distribution of total household income over the farm population. The formula upon which this coefficient is based can be expressed in terms of the covariance between total income (Y) and the cumulative distribution of $Y(F)$, and the mean of X (m). The overall Gini is defined as:

$$(1) \quad G = \frac{2 \text{cov}(X, F)}{m}$$

This relationship is derived by Lerman and Yitzhaki (1985) from the formula for half of the Gini's mean difference. The lower the value of the Gini, the lower the inequality in the distribution of expenditures; zero represents absolute equality. The overall Gini is decomposed by income components in the following manner. First let y_1, \dots, y_j represent the level of income components, such that $Y = \sum_{i=1}^j y_j$. Let F_j represents the cumulative distribution of y_j and m_j represent the mean. The Gini coefficient of concentration for component j is then:

$$(2) \quad G_j = \frac{2 \text{cov}(y_j, F_j)}{m_j}$$

Further following Lerman and Yitzhaki (1985), equation (2) can be derived as:

$$(3) \quad G = \sum_{j=1}^j \left[\frac{m_j}{m} * \frac{2 \text{cov}(x_j, F_j)}{m_j} * \frac{\text{cov}(x_j, F)}{\text{cov}(x_j, F_j)} \right] = \sum_{j=1}^j S_j G_j R_j$$

It is obvious that the Gini coefficient of total income can be decomposed into three parts. The term S_j measures the component j 's share of total household income which indicates how important the income source j is with respect to total income. The term G_j measures the Gini correlation between the income component j and the rank of total income which indicates how equally or unequally distributed the income source j is. The last term R_j is the Gini correlation between the income source j and the rank of the total income, which captures whether or not the income source j is correlated with

total income.

The primary advantage of using equation (3) is because its usefulness in examining how marginal changes in income for particular components can affect overall inequality. To fix idea, suppose there is a change in each household's income for a particular component j equal to ey_j . If e represents a percentage change in income for component j that is identical for all households, the component's marginal effect relative to the overall Gini coefficient can be expressed as:

$$(4) \quad \frac{\partial G / \partial ey_j}{G} = \frac{S_j G_j R_j}{G} - S_j$$

The result from equation (4) can be seen as the marginal effect which measures the percentage changes in overall Gini coefficient of total income that is due to a 1% change in the income source j . When the marginal effect is positive, it shows that increasing income source j will increase overall inequality, all else being equal. In contrast, an increase in source j will decrease the overall inequality if the marginal effect is negative.

Results

The empirical results are presented in several sets. The estimated Gini coefficients for different types of households in 2007 and 2008 are exhibited in Table 2. Table 3 presents the results of the Gini decomposition for different types of farm households in these two years.

Changes in the income inequality over time and across households

We begin our discussion on the estimated Gini coefficients in Table 2. The 95% confident intervals are calculated using the bootstrap method with 500 replications. Our results reveal some interesting findings. First, the estimated Gini coefficients are 0.335, 0.350, and 0.340 for full-time farm, part-time farm, and nonfarm households respectively in 2007. By comparing the 95% confident intervals, no significant

differences are found in income inequality among different types of households. However, a different story is found in 2008. The estimated Gini coefficients are different for different types of households. The most equal income distribution is evident among the full-time farm households with the estimated Gini coefficient 0.273, while the nonfarm households are more unequal in income distribution (Gini is 0.346). Since the 95% confident intervals of these two Gini coefficients do not come across each other, the distinction in income inequality between these two types of households is statistical significant. Significant differences in income distribution are also evident between full-time and part-time farm households (0.273 vs. 0.328), and results indicate that total household income of full-time farm households are more equally distributed.

In regard to the changes in income inequality between 2007 and 2008, significant change in income inequality is revealed among full-time farm households. The Gini coefficients decreases approximately by 20% from 2007 to 2008 (0.335 to 0.273). A slightly decrease in Gini coefficients is also found among part-time farm households from 2007 to 2008 (0.350 to 0.328), however, this change is not statistically significant. The estimated Gini coefficients are 0.340 and 0.346 for nonfarm households in 2007 and 2008 respectively. Therefore, the change in income inequality is stable among nonfarm households.

To sum, this result concludes that full-time farm households are impacted the most due to the change in the macroeconomic environment between 2007 and 2008 compared to part-time and nonfarm households, and these changes significantly decrease the income inequality of households within this group.

Decomposition of the Income Inequality

To better understand the changes in the effects of different income sources on income inequality over time, Table 3 presents the results of the Gini decompositions

by different types of households. The analysis is conducted separately for the two selected years. By looking at the effects of different income sources that may contribute to income inequality in Table 3, we find that the results are qualitatively robust across years. However, the effect differs for different types of households. It is not surprising to see that the shares of farm income to overall household income are 64% and 13% for full-time and part-time farm households. Also, the nonfarm income accounts for 25% and 78% of these two types of households respectively. However, the shares of government transfer to their total household income don't differ much, which account for 11% and 8% respectively.

With respect to the contribution of the farm income to the overall household income (G_j), taking the result in 2008 for instance, our results show that the estimated Gini coefficients for farm income are 0.336 and 0.527 for full-time and part-time farm households respectively. This indicates that farm income is more equally distributed among the full-time farm households compared to part-time counterpart. In addition, the estimated correlation between farm income and overall Gini coefficients (R_j) is 0.945 for full-time farm households, which shows that the farm income favors the richer households within the full-time farm households. Perhaps, the most interesting finding is the marginal effects since the estimated marginal effects have different signs for full-time and part-time farm households. Results show that a 1% increase in farm income will result in a 0.105% increase in Gini coefficient for full-time farm households. This demonstrates that farm income is positively associated with the income inequality of the full time farm households. In contrast, a 1% increase in farm income will result in a 3.8% decrease in Gini coefficient for part-time farm households. For this type of household, farm income reduces overall income inequality. This finding is inconsistent with most of the findings in the U.S (e.g., Boisvert and Ranney 1990; El-Osta et al. 1995).

The story is somehow different in terms of the contribution of nonfarm income to the overall household income. Although the nonfarm income is more unequally distributed among part-time farm households, the results did not differ much (0.403 vs. 0.358 for part-time and full-time farm households). Results also indicate that the nonfarm income favor the part-time households with higher overall household income since the estimated Gini correlation is high (0.973). With respect to the marginal effects, it is evident that a 1% increase in nonfarm income will result in 0.154% increase in income inequality of the part-time farm households respectively. The positive association between nonfarm income and household inequality is consistent with the findings from the evidence provided in many other countries, including Vietnam (Gallup, 2002) and Mexico (Ecuador de Janvri and Sadoulet 2001). It is of noticed that the marginal effect for the full-time farm households is 0.004 and it is statistically insignificant. Therefore, the contribution of nonfarm income to the overall household income have different implication for different types of farm households. This finding may be explained the inconclusive finding from the previous studies of the role of nonfarm income to farm household income inequality.

Changes in Income Inequality Across Years

To investigate the effects of the changes in macro environmental conditions, especially the financial crisis, we compare the results in Table 3 between year 2007 and 2008. In general, the results in these two years are qualitatively consistent, however, the magnitude of each effect is different. For the full-time farm households, the marginal effects of the farm income to overall income inequality decreases by only 5% (from 0.111 to 0.105). However, a relatively higher changes in government transfers are observed across years. The marginal effects decrease by 19% (from -0.054 to -0.064) and 18% (from -0.039 to -0.046) for government transfers from the OFWA payments and the other payments respectively. This result demonstrates that

although government payments equalize the income distribution, the effects are more pronounced under the financial crisis for the full-time farm households.

For the part-time farm households, it appears that farm income still equalize the overall income distribution, however, the magnitude of the effect decreases by 16% from 2007 to 2008 (-0.045 to -0.038). Although the estimated marginal effects are not large, a 1% increase in the OFWA payment decrease the income inequality by -0.059% in 2007 to -0.068% in 2008. This result show that the OFWA payment has a stronger effect on decreasing the income inequality for part-time farm households under the financial crisis.

Conclusions

The world had witnessed of the changes in the macroeconomic environment that began in 2007. The consequent economic recession of the economic crisis and rising food price had resulted in severe impacts of the economic and household welling. Most importantly, this may result in a redistribution effect in income distribution between farm and nonfarm households. Although a growing body of literature had examined the impact of exogenous macroeconomic changes on the general population or the economy, little attention had been paid on the farm household. This paper aims to fulfill the knowledge gap by investigating the extent to which economic crisis and increasing food prices may affect the income inequality between farm and nonfarm households, as well as among different types of farm households.

Using a decomposed method of the income inequality on a national household survey in Taiwan in 2007 and 2008, several interesting findings are revealed. Comparing results between 2007 and 2008 shows that the proportion of farm income increased among the full-time farm households, while a significance decrease in nonfarm income is evident for part-time farm households. With respect to the income inequality, the macroeconomic changes significantly equalize the income inequality

among the full-time farm households, while not much change is observed in income inequality among part-time farm and nonfarm households. With respect to the effects of each income component on the income inequality, a significant change is evident for the farm income to the overall household income for part-time farm households. The change of an additional percentage increase in farm income results in the changes in income inequality increased by 16%. Results also indicate that a pure money transfer for old-farm population equalize the income inequality, and this result is robust for both full-time and part-time farm households.

Some policy implications can be further inferred by our study. First, the changes in macroeconomic environment in 2008 result in an impact on income inequality of the farm households, and the effects are more pronounced for full-time farm households. In addition, a unique social security system that aims to provide the wellbeing of the old-farm population not only provides the income safety net of the farm population but it also helps to equalize the income inequality of the farm households in Taiwan.

Although several interesting findings are revealed, some caveats still pertain. It is of noticed that the explanations of our results should cause some cautions since our findings are more appropriately to be regarded as the short-run effects of the economic crisis and increasing food prices on farm household wellbeing. The long run effects can be quite different, however, a further examination requires a longer time period data to address this issue.

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Table 1: Sample distributions by different income sources and years

Household types	Year 2008							
	All farm		Full-time farm		Part-time farm		Nonfarm	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sample size	1,018		248		770		12,787	
Total	873,476 (-2.13%)	537,082	917,613 (-0.80%)	558,749	724,283 (-7.26%)	412,051	1,116,596 (-1.33%)	789,269
Farm	195,231 (9.52%)	242,770	119,009 (15.26%)	134,088	466,460 (-8.06%)	321,959		
Nonfarm	597,956 (-5.20%)	532,993	718,261 (-2.64%)	542,984	178,384 (-8.53%)	135,541		
Governmentet_OFWA	31,935 (-3.34%)	44,227	31,539 (-4.97%)	44,072	31,848 (5.51%)	44,136		
Government_others	48,355 (-4.00%)	34,483	48,803 (-3.94%)	33,647	47,591 (-1.64%)	36,737		
	Year 2007							
Sample size	1,139		250		889		12,673	
Total	892,450	647,481	924,972	658,100	780,973	569,700	1,131,597	776,769
Farm	178,266	272,276	103,249	114,855	507,380	445,495		
Nonfarm	630,778	629,850	737,726	651,823	195,022	186,155		
Governmentet_OFWA	33,039	40,459	33,190	40,689	30,186	38,924		
Government_others	50,368	40,396	50,807	39,667	48,385	41,456		

All income is measured by NT\$.

(.) are the % changes of income in 2008 compared to 2007 level.

Table 2: Estimated Gini coefficients by groups and years

Household type	Year 2008			Year 2007		
	Gini	95% CI		Gini	95% CI	
All farm	0.324	0.313	0.338	0.352	0.338	0.373
Full-time farm	0.273	0.241	0.304	0.335	0.304	0.368
Part-time farm	0.328	0.315	0.340	0.350	0.337	0.369
Nonfarm	0.346	0.341	0.350	0.340	0.334	0.345

95% confident intervals are calculated using the bootstrap method with 500 replications

Table 3: Gini decomposition by income sources and years

Income source	Year 2008				Year 2007				
	S _j	G _j	R _j	% Chang	S _j	G _j	R _j	% Chang	
	<i>All farm</i>								
Farm	0.224	0.563	0.365	-0.082 (-0.103, -0.056)	0.200	0.598	0.420	-0.057 (-0.080, -0.024)	
Nonfarm	0.685	0.464	0.901	0.198 (0.167, 0.223)	0.707	0.477	0.910	0.164 (0.137, 0.190)	
Government_OFWA	0.037	0.692	-0.413	-0.069 (-0.077, -0.061)	0.037	0.631	-0.324	-0.059 (-0.063, -0.053)	
Government_others	0.055	0.346	0.133	-0.048 (-0.053, -0.043)	0.056	0.360	0.137	-0.049 (-0.053, -0.044)	
	<i>Full-time farm</i>								
Farm	0.644	0.336	0.945	0.105 (0.071, 0.139)	0.650	0.407	0.965	0.111 (0.079, 0.145)	
Nonfarm	0.246	0.358	0.774	0.004 (-0.023, 0.033)	0.250	0.386	0.808	-0.018 (-0.051, 0.011)	
Government_OFWA	0.044	0.691	-0.180	-0.064 (-0.082, -0.046)	0.039	0.652	-0.207	-0.054 (-0.067, -0.043)	
Government_others	0.066	0.355	0.237	-0.046 (-0.059, -0.028)	0.062	0.380	0.322	-0.039 (-0.049, -0.028)	
	<i>Part-time farm</i>								
Farm	0.130	0.527	0.442	-0.038 (-0.052, -0.022)	0.112	0.526	0.398	-0.045 (-0.054, -0.034)	
Nonfarm	0.783	0.403	0.973	0.154 (0.136, 0.172)	0.798	0.428	0.977	0.154 (0.144, 0.168)	
Government_OFWA	0.034	0.695	-0.466	-0.068 (-0.078, -0.060)	0.036	0.632	-0.356	-0.059 (-0.066, -0.053)	
Government_others	0.053	0.342	0.094	-0.048 (-0.053, -0.043)	0.055	0.351	0.082	-0.050 (-0.055, -0.046)	

Parentheses are 95% confident intervals calculated using the bootstrap method with 500 replications.

S_j: ratio of income from source j to total income; G_j: inequality contributed of income from source j;

R_j: Gini correlation; % change measures 1% changes income source j to the Gini coefficient of total income.

Figure 1: Monthly unemployment rates in 2007 and 2008

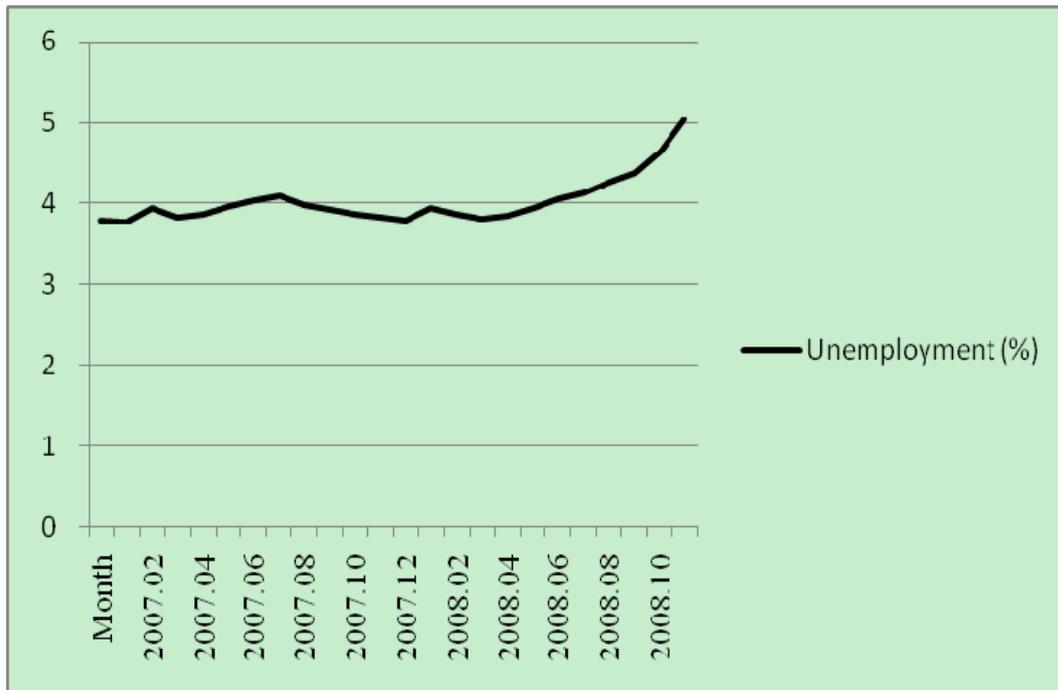


Figure 2: Monthly retail rice price in 2007 and 2008 in Taiwan

