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**Efficiency and Welfare Impact of Landholdings in Vietnam
-Evidence from Field Survey in Red River Delta and Mekong Delta-**

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Efficiency and Welfare Impact of Landholdings in Vietnam
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Abstract

This paper examines the efficiency and welfare impact of landholdings in rural Vietnam. We utilize panel data set from field surveys which have been carried out from 1997 to 2007 in Red River Delta and Mekong Delta.

We find no support for the hypothesis that small farmers in the north survey area have an advantage of efficiency in rice production. Since, although we confirm the inverse relationship between the land productivity and farm size, the average costs have increased rapidly as farm size have decreased. Some farmers, however, in the South have gradually cumulated in a middle-class of landholdings that has achieved the highest productivity, which implies efficient land allocation is realized.

We also clarify the welfare impacts of these landholdings on sample households. In North, the declining farm size is driven by non-market transaction and inevitable. Then, small land endowments cause the diversification of income sources from agriculture to livestock and non-agriculture even if farmers realize high land productivity. In the South, estimation result shows positive relationship between total income and farm size while there is heterogeneity of welfare impact on households who sell their land.

Keywords: efficiency, welfare impact, land allocation, Vietnam

JEL Classification: Q12, Q15

1. Introduction

There is a certain amount of consensus among economists that establishing formal titles of land will lead to raising the number of land transactions which induce the change of land allocation and use (Deininger and Feder[2001]). In Vietnam, Resolution 10 of the 1988 land law which was aimed at liberalizing the agricultural sector has been passed and private property of land has been virtually instituted. After that, the 1993 land law granted five rights to the household: the right to transfer, exchange, inherit, rent and mortgage (Pingali and Xuan[1992], Do and Iyer[2008]). However, the empirical evidence on the efficiency and social equity of land allocation and use in this country is inconclusive (Deininger and Jin[2008], Ravallion and van de Walle[2007]), even though those are important to enhance competitiveness of agricultural sector being exposed to the international market. This paper examines the efficiency and welfare impact of landholdings in rural Vietnam, considering the regional differences in the North and South Vietnam. We adopt econometric analysis, using panel data for which field surveys have been carried out from 1997 to 2007 in Ninh Binh province located in Red River Delta and An Giang province located in Mekong Delta¹.

We find a land distribution in the north survey area doesn't necessary correspond to an efficient land allocation. Although there is the inverse relationship between the land productivity and farm size, the average costs increase at rapidly rate as farm size decrease and cancel out an advantage of land productivity for small holders. A certain farmers in the South have expanded their land and have gradually accumulated at a middle-class of landholdings in which the highest yield has been achieved.

The welfare impacts of these landholdings on sample households are mixed. In North, small land endowments force farmers to diversify their income sources, no matter how small farmers can achieve the high land productivity. In the South, there are mainly positive relationship between farm size and total income, which might induce the polarization of land distribution. The rising of marginal farmers or landlessness through a sale market, however, seems to have a mix implication for welfare impact in the south survey area.

The paper is structured as follows: Section 2 gives a brief introduction about our field

¹ Note that the data used in this paper is partly same with one that Pham and Izumida [2002] used and we added new household information in 2006 and 2007 to this data for econometric analysis

surveys and descriptive analysis. In the next section, we conduct econometric analysis for examining the efficiency of land allocation. Subsequently, in section 4, we also estimate welfare impact on rural households by changing land allocation. Finally, section 5 mentions concluding remarks.

2. Data Sources and Descriptive Analysis

2.1 Data Sources

This study utilizes data derived from repeated surveys which were conducted in early 1997, 2000, 2006 and 2007 (but 2007 survey is only for collecting complementary information of 2006 survey). Two representative villages in each of the two provinces, namely Ninh Binh and An Giang, were randomly drawn. In each village, 50 households were interviewed using questionnaire. From Ninh Binh province, two communes were selected as target areas: Nin Thang, in which there relatively are lots of agricultural resources, and Nam Binh, which is a rural village located in a nearby city. From An Giang province, two communes, namely, An Chau and Vinh Binh were also selected; the former village has more developed than the latter one².

2.2 Descriptive Analysis

Before discussing econometric issues, we highlight some salient features of rural economy of targeted areas by describing characteristics of the data, and presenting evidence on socio-economic characteristics as well as the changing landholdings along with land distribution and transaction.

[Table 1 is inserted here]

Table 1 shows the characteristics of sample households. In both provinces, the number of family members and family labors have declined for survey period. Survey results also point towards an increase of per capita income of more than twice over the 2000-2006 period, and income level of An Giang, in which that is about 48 million VND in 2006, is more than twice that of Nin Binh in same period.

When we categorize sample households by livelihood strategies which are based on the definition suggested in World Bank[2008], the data illustrates that the share of farm-oriented households have decreased during the survey period, while the share of

² See Pham and Izumida [2002] for detailed information on the field surveys, especially on sample designs and features of each targeted villages.

labor-oriented households have increased in both areas. Considering the largest share in livelihood strategies is the household who is belonged to diversified type, the dependency of agricultural income among sample households has declined, while the importance of non agricultural income has raised especially in Ninh Binh. As far as farm-oriented households, it is interesting that market-oriented households totally dominate in An Giang, while there are still some subsistence-oriented households in Ninh Binh.

Our findings suggest that there are salient differences between survey areas in terms of landholdings. Even in the start point of our survey, in 1996 level a farm size per landholder in An Giang (1.12 ha) is much bigger than that in Ninh Binh (0.36 ha). This difference has been gradually expanded until 2006 since An Giang has slightly inclined to increase the farm size (1.18 ha in 2006), on the other hand Nin Binh has inclined a downsizing of farm size (0.23 ha).

[Figure 1 and 2 are inserted here]

Clearly from figure 1 and 2, the distribution of number of sample households and of land area by farm size class respectively, sample households in the North accumulate in the 0.2 – 0.5ha class over 1996-2006 periods. The number of households in this size category, however, has trend to decline from 80 in 1996 to 59 in 2006 and the less than 0.2ha class is slightly increasing. In addition, the distribution of agricultural land area by farm size has generally same shape with the distribution of sample households that we discussed above. So this implies that the landholdings in the North can be characterized as “unimodal”, which means relatively equitable land distribution (Tomich et al.[1995]). Sample households in the South accumulate in Landless and 0.5 – 3.0ha class over the survey period, especially the share of landless is quite high (25%). Then, we can call the figure of distribution of households as the inverted N – shape. Moreover, the distribution of agricultural land area by size category in the South seems to be interpreted as uneven distribution, “bimodal”. It is because the less than 2ha class which is account for 16% in the distribution of households only seizes about 2% of total land area, while the more than 3.0ha class which is account for 10% in the distribution of households seizes about more than 50% of the total land area. Also using a Gini coefficient of per capita land endowments, we can confirm that land was quite equitably distributed in the Ninh Binh where a Gini coefficient of per capita land endowments is 0.29 in 2006, and unevenly distributed in An Giang where a Gini coefficient gets worse

from 0.66 in 1999 to 0.70 in 2006. Focusing on changes for the number of sample households in each size categories over the 1996 – 2007, there may be a polarization from the size category of 0.5 – 3.5ha toward top and bottom of farm size (Figure 3).

[Figure 3 and Table 2 are inserted here]

Table 2 presents how the land transaction is done during the survey period. According to this table, there are 10 and 25 households to be engaged in the distribution of property or inheritance of land in the case of increase and decrease respectively, and which is the most common phenomenon and has much impact on landholdings in Ninh Binh. In 2003, Agricultural lands that cooperatives owned were redistributed to improve the equity of landholdings in survey area, Ninh Binh, corresponding to “Redistribution” in Table 2 which accounts for 4 households. In addition, the expropriation by government accounts for 23 households as the reason to decrease land and is the second highest number after inheritance. Therefore, a land distribution characterized by unimodal and the trend of downsizing in Ninh Binh has been caused by non-market factor i.e. equal inheritance and government expropriation. Contrary to this, in An Giang, land transactions through “buy” and “sell” account for 20 and 22 households respectively. This implies a land market penetrates among sample households in An Giang³. Then the features of land distribution in An Giang, as referred above, are likely formed by market transactions and there are both those who accumulate agricultural lands and who sell out their land and fall into landless⁴.

3. Efficiency of land allocation

Is the pattern of land allocation among farmers an efficient one? In this paper, an efficient land allocation is based on making production decisions so that the marginal costs for additional land as an input equal the revenue expected from the resulting increase in production⁵. And then, the land allocation can be thought as an efficient one if producers in a certain farm size class maximize profits and they can do so

³ 6 households of those who distributed their property to children (13 households) inherited the land which they got through market transaction. So this can be interpreted that even inheritance system is closely related with land market in this survey area, An Giang.

⁴ We also find that there are rental market for land and some transactions (12 in Nin Binh and 20 in An Giang), but that doesn't affect the features of land distribution by farm class very much. So we don't deal with that transaction explicitly.

⁵ This definition of the efficiency is same with “allocative efficiency” in Tomich et. al [1995;p.122]. See Otsuka [2007] for review of previous studies about efficiency of land allocation and use.

instantaneously. In this section, we adopt econometric analysis to assess an efficiency of land allocation following model;

$$y_{it} = cons + a_i + \beta'X_{it} \quad (1)$$

$$c_{it} = cons + a_i + \beta'X_{it} \quad (2),$$

where y is a yield of paddy (kg/ha), c is an average costs per area (1000 VND/ha), $cons$ is a constant, a is a fixed effect, and X are independent variables of which $land$ is a cultivated area for paddy (ha), $land2$ is a square of land, and $land_agriasst$ is a interaction term between a dummy for whether households have their own agricultural machines or not and $land$. In addition, $lnland$ is natural logarithms of $land$ and $lnland2$ is a square of that. Each i and t correspondingly means household's number and crop season. And we estimate above equation (1) and (2) as both fixed effect model and random effect model.

[Table 3 is inserted here]

Table 3 shows estimation results. Note that a hausman test rejects a random effect model in both of equations for (1) and (2). We make attempt to analyze results of Nin Binh, after that, move on results of An Giang.

First, since a coefficient of $land$ in equation (1) is statistically significant at the 1% level in Ninh Binh, cultivated area is negatively correlated with yield (i.e. inverse relationship). Assuming that a quality of land is controlled as fixed effect, imperfect labor market can be thought of the factor to cause this inverse relationship. Then we examine the relationship between labor input and cultivated area in following fixed effect model;

$$lnlbrinpt_{it} = -0.88 \lnland - 0.25 \lnland2 + 4.60 \quad (3)$$

(-4.99)*** (-5.03) *** (30.18)***

where $lnlbrinpt$ is labor input per area (day/ha), total number of households in this estimation is 392 and t-value for each coefficient are in parenthesis. All of these coefficients are statistically significant at the 1% level. And then, as far as in a range of

about more than 0.15ha class, there is the inverse relationship between labor input per area and cultivated area in Ninh Binh. Agricultural households, who are engaged in noon-market transactions by which land distribution are consequently characterized as unimodal, respond with that dimension by using more labor input per area in rice production⁶. Second, in estimation results of equation (2) in which a dependent variable is an average cost, a coefficient of land is negative and statistically significant. This is likely to be attributed to inverse relationship between labor input and cultivated area as discussed above. In addition, a coefficient of *land_agriasset* is positive (statistically significant at the 1% level). This can be interpreted that an agricultural machine may ease the inverse relationship between an average cost and cultivated area through saving labor inputs. A scale of this effect, however, doesn't enough to clear away the inverse relationship itself.

[Figure 4 is inserted here]

In summary, paddy yields in Ninh Binh increase as farm sizes decline, but so, too, does average production costs at even more rapid rate than paddy yields (Figure 4). Thus, this result doesn't provide conclusive evidence that marginal farmers who can gain higher yields achieved greater efficiency in land allocation in Ninh Binh. Put another way, it's possible for the marginal farmers to improve their income from rice production by expanding farm size.

On the other hand, in An Giang, a coefficient of *Inland2* is negative and statistically significant at the 10% level in equation (1). Fitted values obtained by estimating equation (1) are depicted in Figure 5.

[Figure 5 is inserted here]

This shows relationship between yield and farm size shifts from positive to negative at the threshold, near 2.5ha class⁷. That is to say, this farm size class enjoys the highest land productivity. In terms of equation (2) for relationship between average costs and farm size, none of coefficients is statistically significant except for *dagriasset*. Furthermore so is in equation for relationship between labor input and cultivated land too, although estimation results are not listed. So we find no support that there is some

⁶ Note that labor input has trend to decrease as cultivated area also decreases from less than 0.15ha class. We will discuss this phenomenon in following section to clarify how declining farm size affects livelihood strategies of agricultural households.

⁷ The fitted value function in figure 5 is maximized at point square of log of x is equivalent to 1 which is equal to 2.72 in unit of ha.

sort of differences by farm size in production costs and labor inputs. An efficiency of land allocation is only depending on whether decision-makers specifically maximize their land productivity or not without considering production costs explicitly. In this case, a point where the highest land productivity should be same with a point at the highest shares of land distribution under an efficient land allocation. Those estimation results are consistent with the fact that the number of 1.0~3.0ha class accounts for a great part of share in bimodal land distribution in An Giang. Therefore it is likely that sample households in An Giang are cumulating at middle farm size class through markets transaction in a context of an advantage of land productivity in this class. This may induces polarization in land distribution as mentioned in the last section. So we can say that farmers would achieve an efficient land allocation caused by decision-making based on profit maximization under an active land market in An Giang.

4. Choice of livelihood strategy and welfare impact

An important question to address on the implication of changing landholdings is how those changes have an impact on livelihood strategies of households and subsequently their income level. In this section, we examine the welfare impact of changing landholdings over the survey period, considering regional differences in the way of land transaction; non-market transaction in Ninh Binh and market transaction in An Giang.

[Table 4 is inserted here]

First, table 4 presents the comparing of rice production (winter – spring crop) between Ninh Binh and An Giang. As to paddy yield, 5,786kg in Ninh Binh is not so much smaller than in An Giang (8,408kg). Agricultural income in Ninh Binh (1,938,000VND), however, only accounts for about 11% of that in An Giang (18,430,000VND). This gap is because of exceedingly small land endowments (0.22ha) in Ninh Binh. Since poverty lines per household per annual as of 2004 are 8,288,000VND for general poverty and 7,651,000VND for food poverty, it is quite obvious that the agricultural income in Ninh Binh (1,938,000VND) is too low to get their daily bread even if considering two crop system in this area⁸. Minimum cultivated land area to

⁸ We calculated poverty line per household per annual from poverty line per capita per month; 173,101,000VND for general poverty line and 159,788,000VND for food poverty line (Vietnam Academy of Social Science [2004]).

satisfy food poverty in 2004 level is 0.43ha *ceteris paribus*, and this means farmers should accumulate more 2,100 m² in 2006 level. Average area per transaction in rental land market in 2005/06 is only 750 m². That's why it is difficult to realize that necessary amount of landholdings and subsist depending only on agricultural income in Ninh Binh. Then the choice of their livelihood strategies results in as discussed in previous section; plenty of labor-oriented and diversified households and survival of subsistence-oriented farmers. Those strategies represent their decision-making to earn more income from non-agricultural activities because of low profitability of rice production and their difficulties to subsist on only agricultural income. As we confirmed in last section, positive relationship between labor input and farm size in less than 0.1ha class appears to be evidence for displacement of labor force by marginal households in Ninh Binh.

In An Giang, since a bimodal land distribution is formed by decision-making of agricultural households, there should be endogenous problem between farm size and income level. So we run the following household level regression by using random effect model:

$$lnincm_{it} = cons + a_i + \beta'X_{it} \quad (4)$$

[Table 5 and 6 is inserted here]

Independent variables and estimation results are shown in table 5 and table 6. Coefficients of *lnland* and *lnland2* are negative and positive respectively and statistically significant. Then generally total income is positively related with farm size. However, we should not ignore the fact that, as far as less than 0.05ha class, total income is negatively correlated with farm size because this indicates that marginal landholder or landlessness might enjoy relatively higher income than middle firm size class. A coefficient of *buy* is positive and statistically significant, while coefficients of *sell* and *sell_dagri* is positive (0.07) and negative (-0.95) correspondingly although those coefficients are not statistically significant. Those imply there might be heterogeneity among those who sell out their land through land market transactions. To be more precise, if those farmers who possess their own an agricultural machine sell out agricultural land, they are supposed to decrease their total income. This implication is quite important as so-called distress sale problem, so we discuss in further detail using

figure 6. This figure represents relationship between farm size and total income which consists of agricultural and non agricultural income in 2006 among those who sell out their land over survey period. First, we can confirm that almost only landless and marginal farmers earn more money than average income of total sample households (47,914,000VND). And total income among those who sell land is negatively correlated with farm size as we see above. Moreover, when both agricultural income and non agricultural income is plotted in this figure, we find out that those who own less agricultural lands depend strongly on non agricultural income, while those who own more agricultural lands depend more on agricultural income. Put it all together, some households still depend on agricultural income even after they sell out agricultural land and settle for being on a low income; other households expand the share of non agricultural income after selling land and this shift in livelihood strategy certainly contribute to increase their income. Again we have to note that there should be heterogeneity in supply of land, and these fact findings are consistent with the estimation results of equation (4).

5. Concluding Remarks

First, we find out that there are remarkable differences in changes on landholdings between the two survey areas, in line with the differences in land transaction: non market-based factor in the North (i.e. land inheritance and government expropriation.) and market-based factor in the South. These regional differences between north and south are generally consistent with the characteristics that previous literatures have pointed out, which is featured by unimodal land distribution in the North where farm size has been downsizing, and bimodal land distribution in the South where both landless and middle class of farmers are dominated caused by polarization (Pingali and Xuan [1992], Ravallion and van de Walle [2007]).

In a context of those regional differences, this paper analyzes the efficiency of land allocation in each survey area. Consequently, we find no support for the hypothesis that small holders in the north survey area have advantages of efficiency in rice production. It is because that although there is the inverse relationship between the land productivity and farm size, the average costs have increased rapidly as farm size have decreased and cancel out an advantage of small holders in terms of land productivity. Estimation results also indicate that there is possibility of improving agricultural

income in the North by expanding land. In An Giang, we conclude that an efficient land allocation is achieved since those who enjoy the highest land productivity dominate the share of number of households in land distribution, while we cannot reject hypothesis that there is no gap of average costs by firm size. Therefore it is likely that sample households in An Giang try to cumulate at middle farm size class through markets transaction responding to an advantage of land productivity in this class. This behavior results in polarization in land distribution.

The welfare impacts of the changing landholdings on sample households are complicated. In the North, declining farm size is driven by non-market transaction which is not directly related with the decision-making in structure of agricultural production and inevitable dimensions. So sample households shift their livelihood strategy from own farming to livestock, home industry, and nonfarm employment opportunities to compensate their total amount of income. In this view, a crucial factor to affect their choice of livelihood strategy is not land productivity but land endowments itself. In the South, the expanding of farm size through market transaction is positively correlated with the increase of total income. This may suggest that middle-class household who realize the highest land productivity can earn more income by cumulating additional land. Finally, the rise of marginal farmers through a sale market in the South seems to have a mix implication for welfare impact. Namely, there might be a duality; one household who can access remunerative nonfarm opportunities voluntarily sell their land, and other household who is exposed to exogenous shocks is forced to sell their land (i.e. distress sale). It seems that further empirical studies are needed to clarify this duality.

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Table 1. The characteristics of Sample Households

| | Ninh Binh | | | An Giang | | |
|--|-----------|-------|--------|----------|--------|--------|
| | 1997 | 2000 | 2006 | 1997 | 2000 | 2006 |
| Family member | 4.59 | 4.16 | 3.99 | 6.16 | 5.72 | 5.04 |
| Labor force ¹⁾ | 2.84 | 2.70 | 2.12 | 4.16 | 3.93 | 3.42 |
| Age | 49.0 | 50.9 | 55.9 | 50.7 | 53.7 | 54.9 |
| Education | 6.2 | 8.4 | 7.5 | 6.0 | 5.6 | 5.8 |
| Total income ²⁾ | - | 8,179 | 20,831 | - | 21,781 | 47,914 |
| Growth rate ³⁾ | - | - | 2.5 | - | - | 2.2 |
| Livelihood strategy (%) ⁴⁾ | | | | | | |
| Farm oriented | - | 42 | 18 | - | 35 | 28 |
| Market oriented | - | 18 | 6 | - | 25 | 28 |
| Subsistence oriented | - | 24 | 11 | - | 10 | 0 |
| Labor oriented | - | 4 | 27 | - | 30 | 35 |
| Migration oriented | - | 4 | 9 | - | 0 | 1 |
| Diversified | - | 50 | 46 | - | 35 | 37 |
| Land holdings (ha, person) ⁵⁾ | | | | | | |
| | 0.36 | 0.26 | 0.23 | 0.83 | 0.87 | 0.85 |
| Agricultural land | 0.36 | 0.26 | 0.23 | 1.12 | 1.17 | 1.18 |
| | 100 | 100 | 98 | 72 | 72 | 71 |
| | 0.30 | 0.24 | 0.22 | 0.76 | 0.80 | 0.73 |
| Paddy | 0.30 | 0.24 | 0.22 | 1.23 | 1.31 | 1.33 |
| | 100 | 100 | 98 | 60 | 59 | 53 |
| | 0.05 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 |
| Pond | 0.14 | 0.09 | 0.23 | 0.10 | 0.10 | 0.23 |
| | 36 | 34 | 13 | 35 | 35 | 40 |

Source: Questionnaire

Note: 1) The number of adult person between 16 to 60 years of age, 2) This figure is a nominal value and unit is 1

3) The value in 2006 is divided by the value in 2000.

4) The definition of each livelihood strategy is following (World Bank[19]p.72);

Farm-oriented household: more than 75% of total income from farm production.

Farm, market-oriented household: more than 50% of agricultural production sold on market.

Farm, subsistence-oriented household: less than or equal to 50% of agricultural production sold on market.

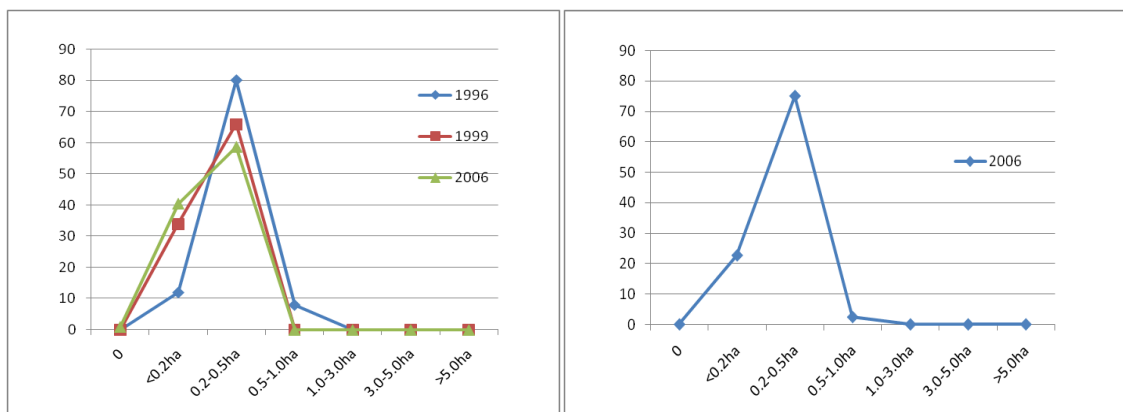
Labor-oriented household: more than 75% of total income from wage or nonfarm self-employment.

Migration/transfers-oriented household: more than 75% of total income from transfers/other nonlabor sources.

Diversified household: Neither farming, labor, nor migration income source contributes more than 75% of total in

5) We focus on an agricultural land with land use certification which consists of paddy, orchard, and pond. In addition, the value in upper is average area in which denominator is the number of sample households, the value in middle is average area in which denominator is the number of those households who own land, and the value in lower is the number of landholder.

Figure 1. Land distribution and Land share by farm size in Ninh Binh

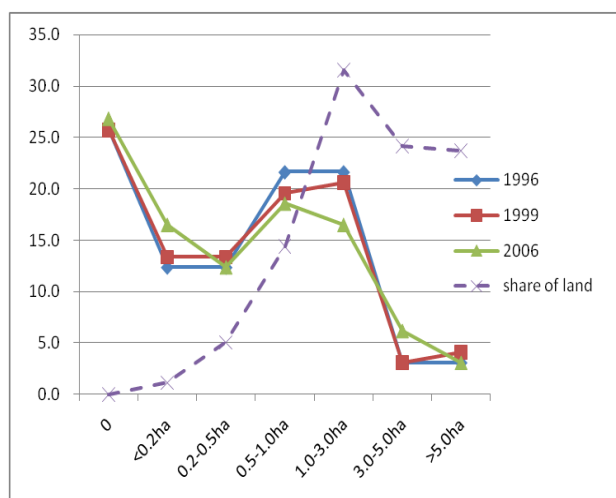


Source: Questionnaire

Note: The left one is for land distribution by farm size and the right one is for land share by farm size.

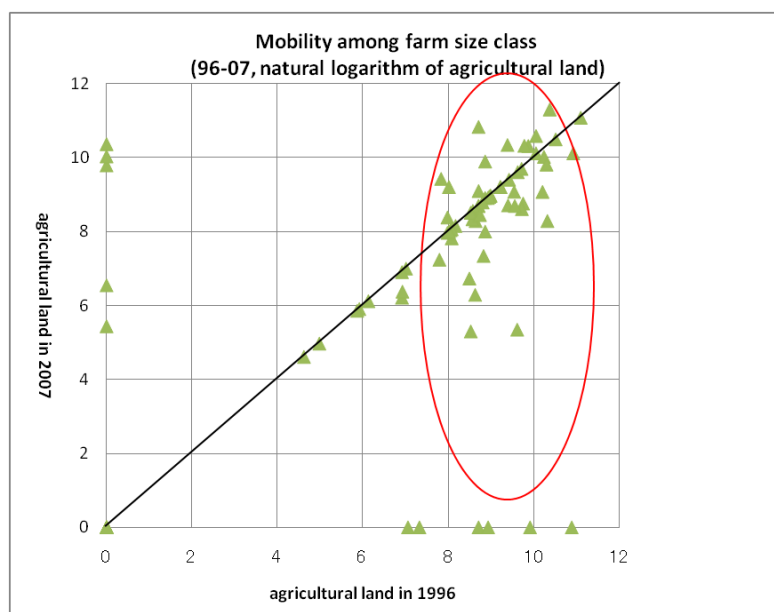
Unit for both of figures are a percentage of the number of households.

Figure 2. Land distribution and Land share by farm size in An Giang



Source: Questionnaire

Figure 3. Mobility among farm size class in An Giang



Source: Questionnaire

Note: Households are plotted based on both of scales of agricultural land in 1996 and 2007 and note that the area of agricultural land (m²) is adjusted by adding 1 to include landless in this figure.

Table 2. Mobility of land and the type of transaction (Ninh Binh :2000~2006, An Giang:1997~2007)

| | Ninh Binh | No. of farmers | Total area (m ²) | Average area (m ²) | | An Giang | No. of farmers | Total area (m ²) | Average area (m ²) |
|----------|----------------|----------------|------------------------------|--------------------------------|----------|----------------|----------------|------------------------------|--------------------------------|
| Increase | Buy | 0 | - | - | Increase | Buy | 20 | 286,409 | 9,239 |
| | Inheritance | 10 | 11,159 | 1,116 | | Inheritance | 0 | - | - |
| | Redistribution | 4 | 3,487 | 872 | | Redistribution | 1 | 700 | 700 |
| | Other | 3 | 1,228 | 409 | | Other | 0 | - | - |
| | Sub-total | 17 | 15,874 | — | | Sub-total | 21 | 287,109 | 8,972 |
| Decrease | Sell | 0 | - | - | Decrease | Sell | 22 | 156,752 | 4,354 |
| | Inheritance | 25 | 25,804 | 1,032 | | Inheritance | 13 | 116,010 | 5,524 |
| | Expropriation | 23 | 12,378 | 538 | | Expropriation | 1 | 40 | 40 |
| | Other | 4 | 1,787 | 447 | | Other | 1 | 3,000 | 3,000 |
| | Sub-total | 52 | 39,969 | — | | Sub-total | 37 | 275,802 | 4,675 |

Source: Questionnaire

Note: 1) "Inheritance" includes the case that wife of son distribute agricultural land from parent's home.

2) Information in 1996 is not available because the design of questionnaire is a little bit different.

3) Average area is the value that total area is divided by farmers who are engaged in that transaction.

Table 3. The estimation results of fixed effect model

| Ninh Binh | | | | | |
|------------------------|---------------|-----------|---------------------------|-----------|--|
| | yield (kg/ha) | | Average costs (000VND/ha) | | |
| | Coefficient | t-value | Coefficient | t-value | |
| <i>land</i> | -2904 | -3.39 *** | -20239 | -6.57 *** | |
| <i>land_agriasst</i> | 652 | 1.11 | 13195 | 6.22 *** | |
| Constant | 5764 | 28.7 *** | 11639 | 16.10 *** | |
| No. of sample | 392 | | 391 | | |
| F-test | 1.35 ** | | 1.32 ** | | |
| Hausman test | 6.30 ** | | 55.6 *** | | |
| An Giang | | | | | |
| | yield (kg/ha) | | Average costs (000VND/ha) | | |
| | Coefficient | t-value | Coefficient | t-value | |
| <i>inland</i> | 283 | 0.44 | 55 | 0.06 | |
| <i>inland2</i> | -483 | -1.90 * | -545 | -1.47 | |
| <i>inland_agriasst</i> | -650 | -0.98 | -895 | -0.94 | |
| <i>dagriasst</i> | 2275 | 3.41 *** | 5940 | 6.20 *** | |
| Constant | 4885 | 8.18 *** | 2333 | 2.71 *** | |
| No. of sample | 227 | | 225 | | |
| F-test | 1.34 * | | 2.13 *** | | |
| Hausman test | 9.72 ** | | 56.56 *** | | |

Note: ***, **, * means statistical significance at 1%, 5%, and 10% level.

Figure 4. The function of fitted value in Ninh Binh

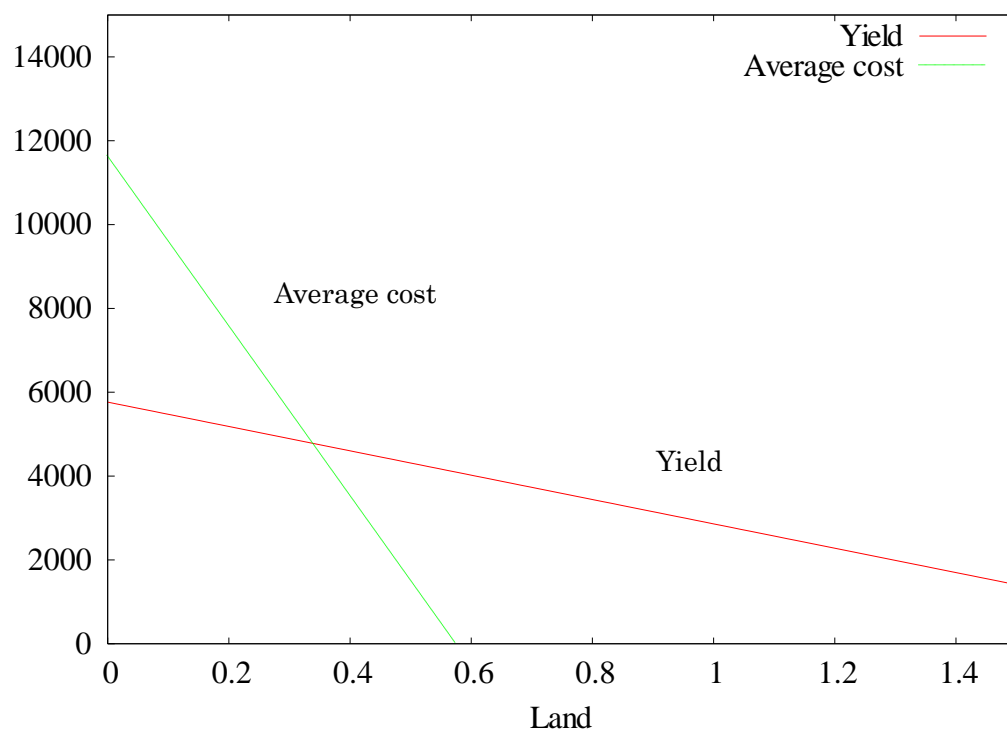


Figure 5. The function of fitted value in An Giang

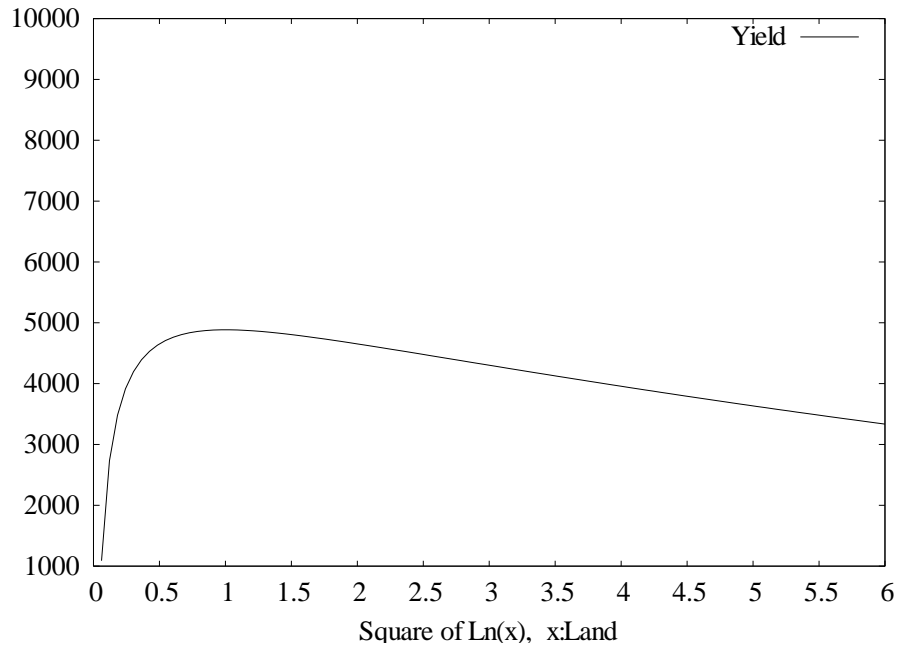


Table. 4 The structure of rice production and agricultural income in Ninh Binh and An Giang (in 2005, winter- spring crop)

| | Paddy yield | Cultivated area | Average cost | Cost -family labor | The amount of | Selling price | Revenue | Profit | Income | Total income |
|-----------|-------------|-----------------|--------------|--------------------|---------------|---------------|-------------|-------------|-------------|--------------|
| | (kg/ha) | (ha) | (000vnd/kg) | (000vnd/ha) | (kg/ha) | (000vnd/kg) | (000vnd/ha) | (000vnd/ha) | (000vnd/ha) | (000vnd) |
| An Giang | 8,408 | 1.35 | 12,392 | 9,578 | 11,235 | 2.40 | 20,125 | 11,300 | 13,663 | 18,430 |
| Ninh Binh | 5,786 | 0.22 | 10,882 | 5,892 | 1,273 | 2.54 | 14,699 | 3,817 | 8,807 | 1,938 |

Source: Questionnaire

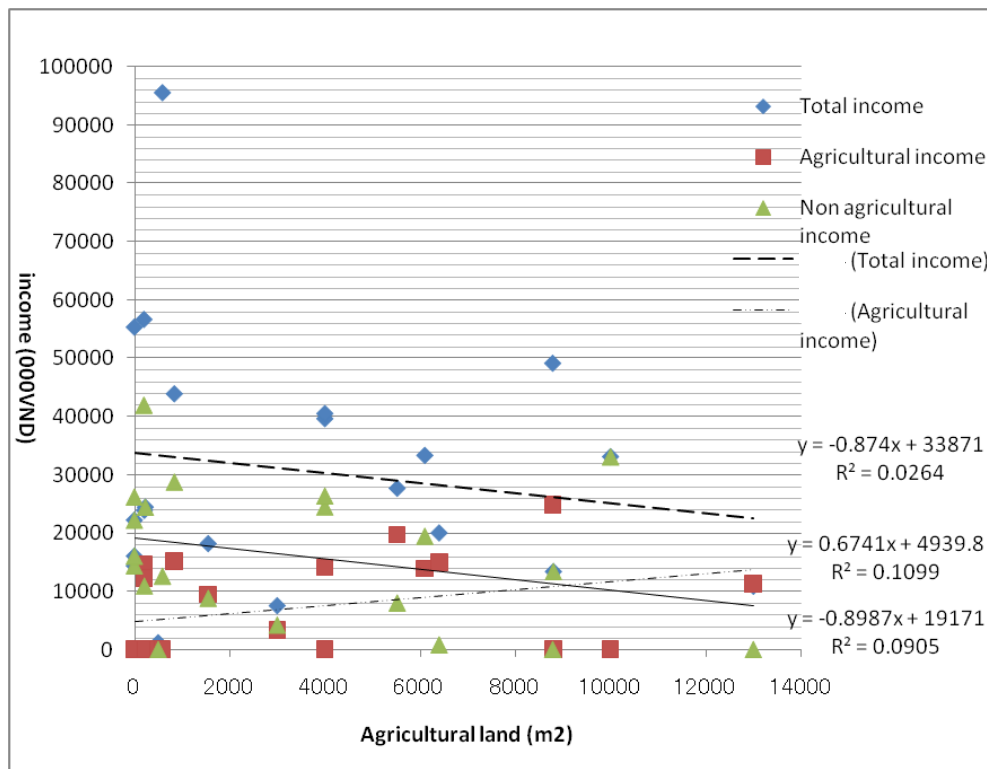
Table 5. The definition of variable in equation (4)

| | Definition |
|-------------------|---|
| <i>income</i> | Total income (000VND) |
| <i>lnincm</i> | Natural logarithm of <i>income</i> +1 |
| <i>fmlbr</i> | The number of family labor |
| <i>land</i> | Landholdings in 1999 and 2006 respectively (m2) |
| <i>lnland</i> | Natural logarithm of <i>land</i> +1 |
| <i>lnland2</i> | The square of <i>lnland</i> |
| <i>agrishare</i> | Share of agricultural income in total income (%) |
| <i>wageshare</i> | Share of income from wage labor in total income (%) |
| <i>dagriasset</i> | Dummy for ownership of agricultural machine (e.g. tractor) 1= own |
| <i>sell_dagri</i> | The interaction term <i>sell</i> and <i>dagriasset</i> |
| <i>buy</i> | Number of times to buy land (96~06) |
| <i>sell</i> | Number of times to sell land (96~06) |
| <i>dcrdt</i> | Dummy for outstanding of loan from formal financial institution, 1 = loan > |
| <i>year</i> | Dummy for year, 2006= 1 , 1999= 0 |
| <i>darea</i> | Dummy for area, Vinh Binh= 1 , An Chau=0 |

Table 6. The estimation results of random effect model

| Dependent variable | | lnincm | |
|----------------------|-------------------|-------------|-----------|
| | | Coefficient | z-value |
| Independent variable | <i>fmlbr</i> | 0.15 | 2.75 *** |
| | <i>lnland</i> | -0.24 | -2.04 ** |
| | <i>lnland2</i> | 0.02 | 1.71 * |
| | <i>agrishare</i> | 0.01 | 2.02 ** |
| | <i>wageshare</i> | -0.01 | -1.17 |
| | <i>buy</i> | 0.46 | 2.53 ** |
| | <i>sell</i> | 0.07 | 0.28 |
| | <i>sell_dagri</i> | -0.95 | -0.85 |
| | <i>dagriasset</i> | -0.10 | -0.23 |
| | <i>dcrdt</i> | -0.12 | -0.55 |
| | <i>darea</i> | -0.67 | -3.11 *** |
| | <i>year</i> | 1.17 | 5.39 *** |
| | <i>_cons</i> | 9.18 | 27.59 *** |
| No. of sample | | 189 | |

Figure 6. Relationship between farm size and income among households who sell land



Note: The value of income and agricultural land are based on questionnaire in 2006.