The Land Rental Market in Thai Agriculture and Its Impact on Household Welfare

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Abstract:

This study uses panel data from 384 Thai rural farm households collected annually from 2000-2013 to examine the determinants of household's land rental market participation, and the impacts of renting land on household incomes. A preliminary finding indicates that households with relatively poor land endowment cultivate more land than do other households to the extent that more than half of the land is rented in. Consistent with previous literature, the study find evidence that land rental markets in Thailand promote farm productivity and reduce landholdings inequality by transferring land from less-efficient to more-efficient households and from land-abundant to labor-constrained households, respectively. More importantly, the rental markets significantly raise the net farm incomes of tenants, most of whom are land-constrained households. Mechanisms to reduce land conflicts and remove local restrictions on land rental are needed in order to improve the functioning of land rental markets, and thereby enhancing farm income.
Key Words: Land rental market, household income, Thai agriculture, Townsend Thai data

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Introduction

In developing countries, land is one of the most important assets for rural households mainly for two reasons. First, it is used as an input in agricultural production which appears to be a major source of household income. Second, land can be used as collateral when acquiring loans or capitals for production activities as well as other needs (Jin and Jayne 2013). For these reasons, several literatures in the past have focused on the role of land tenure and land ownership on productivity, equity, and incomes (Feder 1987; Feder and Feeny 1991; Brasselle, Gaspart, and Platteau 2002; Deininger 2003; Gine 2005). Later, studies involving rural land markets, which include both land rental and land sales markets, have emerged and gained considerable interest from policymakers. Economic theory suggests that the land markets can potentially improve production efficiency by equilibrating land and non-land factor ratios across farms when non-land factor markets are imperfect (Feder 1985; Binswanger et al.1993; Deininger 2003) However, the land sales markets are generally less prevalent than the land rental markets due to some developmental barriers (Holden, Otsuka, and Place 2010; Jin and Jayne 2013). Thus, the issues regarding land rental markets have been widely studies, especially in Asia and recently in Africa.

Theoretically, land rental market reduces the inequality in landholdings by allocating lands from the land-abundant (relative to labor) households to household with relatively higher labor-to-land ratio. Such allocation should improve farm productivity and raise farm income. (Feder1987; Deininger and Jin, 2008; Holden, Otsuka, and Place 2010). These benefits have significant economic implication especially for the countries facing rapid population growth and constrained land resource. However, the efficiency of land markets depends on the efficiency of other input markets, such as labor and capital markets. In some counties, the gain from renting in additional land is limited due to the immaturity of land markets. In such setting, the gain from renting land can be offset by transaction costs (Jin and Jayne 2013; Chamberlin and Ricker-Gilbert 2016). Furthermore, instead of increasing farm productivity land rental markets may lead to re-concentration of land. Yet, only few empirical evidences supporting such notion are available (Carter and Salgado 2001).

In Thailand, the surge of rice export had led to a rapid expansion of agricultural land following the signing of the Bowring Treaty between Thailand and the United Kingdom in 1855.[1] The economic growth and rising population resulted in an increasing pressure on land resources and caused undesirable consequences, such as forest reserve encroachment, disputes over land rights, and land

[1] The treaty liberalized foreign trade which previously had been subject to heavy royal taxes, leading the country's gradual involvement in international trade (The National Archives of the UK (TNA). 1855. Treaty of Friendship and Commerce between Great Britain and Siam. Reference: FO 94/492).

inequality. Thus, legal frameworks were seriously needed in order to dissolve the issues. The government started issuing land titles to individuals across the country. However, due to limited resources, only 20 percents of all private lands were issued land-title document during 1901-1985. To accelerate the issuance of title deeds to eligible landholders throughout Thailand, the Thai Government partnering with the World Bank and the Government of Australia launched a 20 year Land Title Program (LTP) in 1984. The project aimed to achieve several desirable outcomes including rural poverty reduction, increasing tenure security, and improving access to credit by titleholders (Bowman 2004). Findings from several studies confirm this contention. The provision of secure ownership significantly increases farm productivity (Feder 1987; Feder1988; Feder, Onchan, and Chalamwong 1988), better access to formal credit, higher land values, and higher land-improving investment (Feder and Onchan 1987; Chalamwong and Feder 1988; Feder and Nishio 1998). This is consistent with economic theory which suggests that farmers will use higher variable inputs and obtain higher output per unit of land if land ownership is legally secured. This happens because farmers have more incentives and better ability to invest due to a lower perceived risk and better access to credit. The achievements of the LTP have had positive effects on regional economic growth, greater social stability, and sustainable resource management (Rattanabirabongse, Eddington, Burns, and Nettle 1998; Bowman 2004; Burns 2004).

While several findings confirm that the LTP improve farm performance, the impact of the project on landholding has not been investigated. However, accelerating the issuance of land might have arguably induced capitalism to rural sector, leading to large farms and agribusiness firms seeking to purchase suitable lands from financially constrained smallholders. The result is land re-consolidation and a widening gap of landholding inequality between smallholders and wealthy households. According to Israngkura and Setthasiroj (2010), the prevalence of poverty and income inequality in Thailand cause land inequality, in turn exacerbating the poverty and income inequality.

Whether the land rental markets in Thailand can deliver beneficial outcomes as predicted by economic theory still remains an empirical question. Empirical evidence on the impact of land rental market in Thailand and the factors determining households' participation decisions in the markets is relatively thin (Gine 2005). Furthermore, no existing empirical studies have quantified the impacts of land rental markets on household welfare or incomes in particular. The magnitude of the impacts may differ from those reported in the relevant literatures in Africa and few other countries in Asia due to several factors, such as degree of distortions in agricultural markets, the strength of property rights, and entry barriers in the rural non-farm sector (Reardon, Berdegué, and Escobar 2001). To address these issues, this study will use panel estimation method to determine the factors that influence rural

farm households' decisions to participate in land rental markets, as well as their impacts on household welfare measured in term of incomes.

Conceptual Model

The estimation of a land rental market participation uses a tobit model following Jin and Deininger (2009), Jin and Jayne (2013), Chamberlin and Ricker-Gilbert (2016). These previous studies assume that, in order to maximize utility, households adjust their operational farm size to match their desired farm size through rental market (Skoufias 1995). Three rental regimes are considered, namely rent-in, autarky, and rent-out regime. Each household compares the marginal value product from cultivating at the household's land endowment to the associated transaction costs and rental income (in case of renting-out) or rental payment (in case of renting-in) under each regime (Jin and Jayne 2013). Desired farm size is conditioned on household endowments of non-land assets and household characteristics. Given that the land rental decision depends and the distance between a household's actual farm size (land endowment) and desired farm size, the land rental decision for household *i* in province *j* is represented as follow (Chamberlin and Ricker-Gilbert 2016)

$$R_{ij} = \lambda A_{ij}^{*}\left(\alpha_{ij}, H_{ij}, V_j\right) + \delta A_{ij} + \varepsilon_{ij} \quad (1)$$

where R_{ij} is the amount of land rented in or rented out by the household. When $R_{ij} > 0$, the household rents in land, when $R_{ij} < 0$, the household rents out land, and when $R_{ij} = 0$, the household is autarkic meaning that the household does not engage in the land rental market. Actual landholdings (land endowment) and desired farm size are represented by A_{ij} and A_{ij}^{*}, respectively. Here, desired farm size is determined by household's farming ability, α_{ij}, household's socio-economic characteristics, H_{ij}, and provincial-specific variables that are exogenous to the household such as rainfall expectations and market access, V_j. The error term is represented by ε_{ij}.

When $A_{ij} < \mathrm{A}_{\mathrm{ij}}^{*}$, households rent in land until their operational farm size reaches desired farm size. In contrast, when $A_{ij} > \mathrm{A}_{\mathrm{ij}}^{*}$ households rent out land until their operational farm size reaches desired farm size. The coefficient δ in (1) indicates the efficiency of land rental market. Specifically, $\delta = 1$ for renting-in land and $\delta = -1$ for renting-out land would indicate an efficient land-rental market, as households can fully adjust their operational farm size to match their desired farm size through the land-rental market. The presence of transaction costs imposes inefficiencies to the land rental market and hence households cannot fully adjust their operational farm size to its optimum. In this case, $0 < \delta < 1$ for renting-in land and $-1 < \delta < 0$ for renting-out land

would indicate that the land rental market only allows partial adjustment of operational farm size towards desired farm size.

Econometric Estimation

To evaluate the impacts of land rental market, the conceptual model is operationalized in three steps involving the estimation of three econometric models: production model, land-rental participation model, and economic income model. The specifications of these models closely follow those presented in Chamberlin and Ricker-Gilbert (2016). First, the estimates of a household's farming ability are obtained from a modified Cobb-Douglas production function. The functional form of the production function for household *i* in province *j* in year *t* can be represented as follows

$$\log(Q_{ijt}) = \alpha_i + \beta_1 \log(A_{ijt}) + \beta_2 \log(L_{ijt}) + \beta_3 \log(K_{ijt}) + \beta_4 \log(X_{ijt}) + \beta_5 V_{jt} + \beta_6 T_t + \varepsilon_{ijt} \quad (2)$$

where Q_{ijt} is the real value of agricultural production, A_{ijt} is the amount of landholdings or cultivated land, L_{ijt} is the amount of labor availability in the household measured in adult equivalents, K_{ijt} is the real value of agricultural asset, X_{ijt} is a vector of agricultural inputs (such as fertilizers, hired labor, and seeds), V_{jt} is provincial specific variable capturing the differences in market access and production environment, T_t is a time dummy used to control for technological change, and ε_{ij} is the error term. The time-invariance component α_i represents a household's farming ability. Although, the household's farming ability cannot be observed directly, it can be derived indirectly via household-fixed effect procedure (Jin and Deininger 2009; Jin and Jayne 2013; Chamberlin and Ricker-Gilbert 2016). The other parameters to be estimated in equation (1) are represented by β_{1-6}.

The second step involve the estimation of a household's land-rental decision which takes the derived estimate of farming ability in equation (2), $\hat{\alpha}_i$, which is obtained from the first-step estimation as one of the covariates. The model can be represented as follows

$$R_{ijt} = \theta_1 \hat{\alpha}_i + \theta_2 A_{ijt} + \theta_3 L_{ijt} + \theta_4 Z_{ijt} + \theta_5 V_{jt} + \theta_6 T_t + u_{ijt} \quad (3)$$

where R is the amount of land rented in or rented out, and Z is a vector of household characteristics. Other remaining variables in equation (3) are as previously defined in (2). The error term is represented by u. According to Chamberlin and Ricker-Gilbert (2016), the statistical significance of $\widehat{\theta_1}$ would support the hypothesis that land rental market increases efficiency. If $\widehat{\theta_1} > 0$ in the

renting-in equation and $\widehat{\theta_1} < 0$ in the renting-out equation, it would indicate that land rental markets facilitate the transfer of land from less-productive to more-productive households. Similarly, the statistical significance and the positive sign of $\widehat{\theta_3}$ would also support the hypothesis of land rental market improving efficiency, as land is transferred from labor-rich to relatively labor-abundant households. The statistical significance and the positive sign of $\widehat{\theta_2}$ would provide an evidence to support the hypothesis that land rental markets promote land equity (or reduce land inequality) by transferring land from land-abundant to land-constrained households. The other parameters to be estimated in equation (3) are represented by θ_{4-6}.The model in (3) is estimated via tobit model.

Finally, the third step estimates a set of models to determine the impacts of land-rental markets on household's economic incomes, including net income, net farm income, and net non-farm income. These income indicators are represented by Y in equation (4) below.

$$Y_{ijt} = \gamma_1 R_{ijt} + \gamma_2 F_{ijt} + \gamma_3 L_{ijt} + \gamma_4 Z_{ijt} + \gamma_5 V_{ijt} + \gamma_6 T_{ijt} + w_{ijt} \quad (4)$$

where R represents household's land rental market decision (dummy or continuous), other independent variables are defined as those appear in (3), and w is the error term. The models in (4) are estimated by household-level fixed-effect procedure.

Data and Household Descriptive Summary

This study uses fourteen rounds of rural farm household survey (2000-2013) from the Townsend's Thai Project.[2,3] The sample contains a balanced-panel data of 384 farm households (each year) in four provinces, namely, Lopburi, Chachoengsao, Buriram, and Srisaket. The first two provinces are located in the central part of the country while the last two provinces are in the northeastern part, generally perceived as having less soil fertility, less irrigation, and lower average household income. Descriptive summary of household's characteristic variables are presented in **Table 1**. A comparison of these variables across years from 2000 to 2013 provides some interesting observations.

First, farm households are smaller while aging population is imminent. The averages of household members and adult equivalents gradually fall from 4.88 to 4.04 and from 4.04 to 3.34, respectively. The average age of household head increases from 51.44 to 56.29. The increase of less than 6 years during the course of 14 years implies that several households have experienced a transition of changing household head. Death, migration, and aging population can explain this change. These household heads have higher education. Females gain more important role in a

[2] http://riped.utcc.ac.th/data-services/fedr/townsend-thai-data-en/

[3] http://townsend-thai.mit.edu/

household, as it shows that the proportion of female-headed household rises from 22.18% to 31.65%. Farm income has increased markedly from 75,196 to 207,431 baht per household. Farm asset value also increases mainly due to an accumulation of farm equipments while livestock values remain stable. The size of cultivated land per household falls from 32.29 to 27.77 rai[4] while owned land slightly decreases from 21.63 to 20.66 rai. The amount of land rented in and out has fallen to the extent that the size of the former is relatively much larger. This indicates that significant amount of land rented out come from households not included in the surveyed sample, possibly urban households.

Table 1 Descriptive Summary of Household's Characteristics

	2000	2003	2007	2010	2013
Number of household members	4.88	4.66	4.37	4.21	4.04
Adult equivalence per household	4.04	3.87	3.62	3.48	3.34
Age of HH head	51.44	54.08	54.91	54.62	56.29
Female-headed household (=1)	22.18%	23.59%	26.81%	28.63%	31.65%
HH head with secondary education (=1)	7.49%	8.58%	9.54%	11.58%	12.94%
Farm income	75,196	105,574	114,141	174,544	207,431
Net farm income	36,807	56,794	68,348	107,336	121,321
Total income	184,191	209,939	250,509	410,449	442,984
Area cultivated (rai)	32.29	33.27	29.25	28.73	27.77
Area owned (rai)	21.63	20	21.19	21.06	20.66
Rainfall (mm)	550.20	1195.44	1177.36	1206.49	1147.26
Farm expenses	38,388	48,780	45,793	67,208	86,110
Farm asset value	45,133	57,995	58,037	38,589	60,221
Farm equipment value	19,879	22,285	20,719	17,907	32,390
Livestock value	25,254	35,710	37,318	20,682	27,831
Credit constraint (=1)	38%	16%	4%	3%	2%
Areas rented-in (rai)	8.72	10.86	8.42	7.88	6.86
Areas rented-out (rai)	1.59	2.29	0.87	0.94	0.86

Source: Author's calculation from Townsend Thai Project

Table 2 provides a comparison of landholdings across farm households grouped by their land rental status: renting-in, autarky, and renting-out. Despite having the smallest land endowment (14.46 rai on average), the renting-in households have the largest amount of cultivated land of 44.49

[4] 1 hectare is approximately 6.25 rai.

rai on average, of which as much as 28.67 rai is rented in. On the other hand, the renting-out households have the largest average land endowment of 50.74 rai while renting out as much as 28.67 rai. These results preliminarily indicate that land rental market promote land equality by transferring land from land-rich to land-constrained households. It should also be remarked that the renting-out households have gradually reduced the size of their land endowments; from 63.28 rai in 2000 to 42.26 rai in 2013. The size of landholdings for the autarky households has remained almost constant during this period.

Table 3 compares real net incomes (net total income, net farm income, and net nonfarm income) across farm households grouped by their land rental regimes. Nonfarm income contributes to a greater portion of total income for the renting-out households and to a lesser extent for the renting-in households. This result is in line with the evidence that the amount of land rented out by the renting-out households is much larger than other groups. Farm income has substantially increased since 2007, which can partly be explained by the surge of world commodity prices during the world food price crisis between 2007-2008 and the price intervention programs of the Thai government in the domestic grain market since 2009 (especially rice market). Farm income constitutes a much higher proportion of total income for the renting-in land households. This is consistent with the fact that the renting-in households' cultivated land doubles that of other groups. Also, having more aging members and less family labors lead to more land being rented out for the renting-out households.

Table 2 Landholdings by Rental Regimes (Rent-out, Autarky, and Rent-in)

Year	Cultivated land (rai)			Owned land (rai)			Rented-in land (rai)			Rented-out land (rai)		
	Rent-out	Autarky	Rent-in	Rent-out	Autarky	Rent-in	Rent-out	Autarky	Rent-in	Rent-out	Autarky	Rent-in
2000	42.36	25.55	43.02	63.28	20.87	15.44	1.74	0.00	26.25	24.17	0.00	0.44
2001	36.72	26.00	43.84	62.18	19.79	13.58	1.83	0.00	28.30	24.96	0.00	0.38
2002	35.77	25.60	48.38	55.34	19.58	15.57	1.52	0.00	30.59	21.94	0.00	0.69
2003	30.99	25.07	46.21	53.99	18.90	13.11	0.73	0.00	29.83	21.89	0.00	0.81
2004	33.56	24.48	46.18	52.43	18.55	12.64	0.95	0.00	31.10	21.03	0.00	0.71
2005	41.18	24.14	42.78	57.13	19.54	11.91	1.91	0.00	28.00	17.30	0.00	0.19
2006	26.53	24.61	44.91	45.47	22.28	14.99	0.56	0.00	29.63	21.69	0.00	0.60
2007	25.27	23.63	41.87	48.07	22.67	14.56	0.00	0.00	27.64	20.53	0.00	0.22
2008	31.72	22.15	42.70	48.50	21.06	14.22	0.00	0.00	28.83	15.79	0.00	0.18
2009	20.71	21.19	44.25	36.32	20.12	14.35	1.06	0.00	29.17	16.67	0.00	0.43
2010	28.76	22.44	43.42	43.79	21.62	16.21	1.47	0.00	27.29	16.93	0.00	0.65
2011	25.27	22.66	46.26	39.18	21.39	17.92	1.06	0.00	27.16	16.33	0.00	0.50
2012	29.17	21.73	42.39	43.14	21.10	14.42	2.00	0.00	27.18	16.51	0.00	0.35
2013	27.49	22.04	45.99	42.26	21.11	15.05	2.71	0.00	29.41	17.91	0.00	0.28
Average	32.02	23.55	44.49	50.74	20.68	14.46	1.25	0.00	28.67	20.00	0.00	0.47

Source: Author's calculation from Townsend Thai Project

Table 3 Household's Real Net Income by Rental Status and Source of Income

Year	Net Income (baht)			Net Farm Income (baht)			Net Nonfarm Income (baht)		
	Rent-out	Own	Rent-in	Rent-out	Own	Rent-in	Rent-out	Own	Rent-in
2000	148,120	75,560	149,688	36,529	32,022	45,784	111,591	43,539	103,904
2001	179,712	82,458	159,344	35,091	40,013	56,158	144,620	42,445	103,187
2002	164,268	74,701	134,504	37,631	27,462	55,553	126,637	47,239	78,951
2003	129,167	111,149	165,250	34,662	47,147	76,941	94,505	64,002	88,309
2004	181,195	113,019	184,365	48,016	37,961	80,697	133,179	75,058	103,668
2005	173,039	116,451	137,774	59,354	22,161	63,388	113,686	94,290	74,386
2006	144,922	98,167	164,315	14,332	26,341	82,648	130,590	71,826	81,668
2007	186,820	125,349	197,096	29,929	44,097	125,505	156,890	81,252	71,590
2008	193,097	135,189	224,327	29,279	45,235	141,290	163,818	89,954	83,037
2009	253,352	166,264	287,938	28,654	60,101	189,848	224,697	106,163	98,090
2010	280,427	176,780	315,507	37,571	77,143	188,659	242,856	99,637	126,848
2011	279,567	211,337	390,793	55,313	84,653	228,297	224,254	126,685	162,496
2012	368,418	223,652	386,528	91,416	95,517	211,681	277,002	128,136	174,847
2013	299,867	254,000	384,790	89,897	99,636	196,141	209,970	154,363	188,648
Average	201,689	144,318	222,616	44,130	54,603	116,590	157,559	89,715	106,026

Source: Author's calculation from Townsend Thai Project

Econometric Results

This section reports estimation results from three sets of regressions, namely, the modified Cobb-Douglas production function used to derive household's farming ability variable, the tobit model used to investigate determinants of household's land rental market decision, and the income model measuring the impacts of household's land rental market participation on incomes. The estimation results are largely consistent with prior expectations. The coefficients of the production function for the main inputs have the expected signs and are statistically significant, except for the adult equivalent variable whose corresponding coefficient is not statistically significant in the fixed-effect specification. The results from the tobit model are consistent with the main hypothesis as suggested by economic theory that land rental market increases efficiency by transferring land from inefficient to efficient households. Lastly, the results from the income models indicate that household's participation in land rental markets lead to income gains, especially for the renting-in households. The detailed results and discussions on each of these findings are presented below.

Production Function

The estimation result obtained from the production function via household-level fixed-effect procedure is presented in **Table 4**. For robustness of the estimation, the estimation results from two alternative estimation procedures are also reported, namely, household-level random effect and pooled ordinary least square. Overall, the results from these models are largely similar. The coefficients of the production function for the main inputs have the expected signs and are statistically significant, except for the adult equivalent variable whose corresponding coefficient is not statistically significant in the fixed-effect specification. The amounts of landholding, farm expenses (including costs of fertilizers, seeds, pesticides, hired labors, and machine rents and maintenances), farm assets, and rainfall expectation positively affect the value of crop production. The statistical significance of the coefficients corresponding to these variables is robust across all three alternative models.

Doubling operational land size (cultivated land) only increases value of production by 30%. This finding is consistent with an inverse farm size-productivity relationship found in other studies (Jin and Jayne 2013). Household's production increases only by 2% when farm assets double. This is quite a concern as it implies that households do not use these assets efficiently. The accumulation of farm assets (especially farm equipments) and the failures to operate them efficiently seem odd. If acquiring own assets is too costly or not plausible, households can conveniently seek for machine rental services available in the areas. Further review on this issue is needed.

The coefficient corresponding to adult equivalents in the fixed-effect model is not statistically significant while it is significant in the other models. Despite the lack of definitive answer, one possible explanation could be that hired labors and machine services are widely used in many stages of farm

production, hence, households rely more on the development of these services and less on family labors. In addition, the prevalence of these services implies that the migrations of household members, potentially causing the change of household head from male to female, will less likely affect crop production. This perception is in line with the finding that gender of household head is not statistically correlated with crop production in most specification. Nevertheless, the negative coefficients on female variable suggest that households with female head are less productive than their male counterparts. Higher education is often associated with an increase in crop production due to better management skills. Lastly, the presence of credit constraints, a dummy variable indicating whether a household can obtain credits from formal institutions, reduces value of crop production but its impact is not statistically significant in most models.

Table 4 Estimates of household's Cobb-Douglas production function

Variables	Pooled OLS		Random Effects		Fixed Effects	
Area cultivated	0.489***	(23.37)	0.469***	(19.68)	0.383***	(13.92)
Adult equivalence	0.083***	(3.24)	0.066**	(2.07)	0.024	(0.64)
Farm asset value	0.026***	(8.74)	0.019***	(5.42)	0.011***	(2.61)
Farm expenses	0.332***	(28.07)	0.254***	(21.64)	0.215***	(17.90)
Rainfall in previous year	1.088***	(2.63)	1.332***	(3.46)	0.592***	(5.58)
Age of HH head	-1.473	(-1.13)	-1.614	(-1.06)	-1.760	(-1.01)
Age of HH head squared	0.163	(0.99)	0.186	(0.96)	0.208	(0.94)
Female HH head (=1)	-0.046*	(-1.84)	-0.045	(-1.32)	-0.043	(-0.93)
HH secondary education or higher (=1)	0.114***	(2.64)	0.141**	(2.46)	0.127*	(1.72)
Credit constraint (=1)	-0.109**	(-2.28)	-0.0689	(-1.40)	-0.0454	(-0.88)
R^2	0.641				0.401	

Note: Numbers in parentheses are *t* statistics

* p< 0.1, ** p< 0.05, *** p< 0.01

Land Rental Market Participation

Table 5 presents the estimation results regarding the determinants of land rental market participation using a tobit model. Two specifications of for the renting-in land and renting-out land models are considered. In both specifications, a variable measuring farming ability derived from the fixed-effect production function is included as one of the covariates in the regression. The positive (negative) and significant coefficient on farming ability in the renting-in (renting-out) model suggest that land rental markets enhance efficiency by transferring land from relatively more efficient farmers to less efficient farmers. This finding is consistent with that in Jin and Jayne (2013), who find that more talented

farmers are more likely to participate in land rental markets both as tenants and as landlords. In contrast, findings from other literature, such as those in Jin and Deininger (2009) and Chamberlin and Ricker-Gilbert (2016), do not find a significant likelihood that talented farmers participate in land rental markets as landlords. The productivity effect is further bolstered by the positive (negative) and the significant coefficient on labor (measured in term of adult equivalents) in the renting-in (renting-out) model, as it indicates that land rental markets transfers land from labor-constrained to labor-rich households and thereby improving efficiency. Also, there is some evidence that supports the contention that land rental market promotes land equity. The negative (positive) and significant coefficient on land holdings in the renting-in (renting-out) model suggests that land rental markets contribute to the equalization of land by transferring land from land-rich to land-poor households.

Table 5 Estimates of household's land rental decision from tobit model

Variables	Rent-in Area		Rent-out Area	
Farming ability	0.256***	(2.61)	-0.024**	(-2.35)
Adult equivalent	0.368***	(4.30)	-0.032***	(-3.67)
Land own	-0.634***	(-22.95)	0.064***	(20.20)
Net farm income from previous year	0.624***	(12.41)	-0.019***	(-3.99)
Agricultural asset value	0.020**	(2.14)	0.001	(1.29)
Age of head of household	16.550***	(3.54)	-0.527	(-1.18)
Age of head of household squared	-2.132***	(-3.61)	0.068	(1.22)
HH head is female (=1)	-0.171**	(-1.99)	-0.031***	(-3.64)
HH head with secondary education (=1)	-0.093	(-0.67)	0.056***	(3.83)
Annual rainfall in current year	-0.155	(-0.92)	0.016	(0.99)
Annual rainfall in previous year	-0.273*	(-1.76)	0.020	(1.30)
Credit constraint (=1)	0.056	(0.35)	0.040**	(2.42)

Note: Numbers in parentheses are *t* statistics

* p< 0.1, ** p< 0.05, *** p< 0.01

Although, higher value of farm assets allows households to rent in more land, its impact on the amount of land rented out is insignificant. As discussed in Chamberlin and Ricker-Gilbert (2016), these assets serve as resources that can be used to pay for up-front cash rental agreements with landlords. In contrast, if the coefficient on value of farm assets in the renting-out model were negative and statistically significant, it would imply that households with lower value of assets are more likely to rent out, possibly in order to attenuate liquidity constraints facing at planting time.

Land rental decision is highly related to farm income in previous year, as indicated by a positive (negative) sign and the statistical significance of the corresponding coefficient in the renting-

in (renting-out) model. Higher farm income in previous year provides an incentive for farmers to rent in more land (or rent out less land). The coefficient corresponding to age of household head, which appear in quadratic form, yields alternative signs indicating that farmers tend to rent in land at younger age until a certain age is reached. An explanation is that, because elderly farmers are less capable of managing farms and probably receive some remittance or transfers from other family members, so there is less incentive to increase farm size by renting in land. The positive and significant coefficient on the dummy variable for household heads having completed middle school in the renting-out specification indicates that more education are more likely to forego an opportunity to cultivate own land and instead rent out land, allowing their labors to be utilized in nonfarm sector. This finding is consistent with that in Jin and Jayne (2013). Female-headed households are less likely to participate in land rental markets both as tenants and landlords. Lastly, credit constraint is not a barrier to rent in land.

Impacts of Land Rental Markets on Household Incomes

Table 6 reports the results of income models for total net income, net farm income, and net nonfarm incomes. The variables that we are mostly concerned of interest are the amounts of land rented in and out, as their coefficients indicate whether or not land rental market participation improve household incomes. Results indicate that renting in land has a positive effect on total net income and net farm income while its positive impact on net nonfarm income is not statistically significant. Specifically, renting in an additional rai raises total net income by 1,359.84 baht and increases net farm income by 1,161.57 baht. These findings suggest that land rental markets increase household incomes. When evaluating at the average of 20 rai of rented-in land per household, it could infer that the renting-in households gain as much as 23,231.40 baht by participating in the rental markets. This is a significant improvement as the average farm income of all household is only 73,051 baht. As expected, the returns from net farm income for landlords are negative because renting out land means less land to cultivate for the household. Specifically, an extra rai rented out is associated with 859.14 baht decline in net farm income. Increasing an additional rai of landholdings raises net farm income by 570.64 baht, which is less than half of the returns through land rental markets. This reflects the benefits of renting in land over cultivating additional unit of own land. It is possible that the land rental markets allow renters to choose the most suitable land for their production, including irrigated land and several parcels of land that are less fragmented.

The coefficient on farm assets is marginally small, indicating an insignificant gain from accumulating both agricultural equipments and livestock. As previously mentioned, farmers typically use hired labors and machineries in several stages of production due to the lack of family labors and high purchase prices of machinery equipments. Although, some farmers may own some light

machines for routine works, the utilization of these equipments does not contribute to a significant improvement in net farm income. As expected, adult equivalents have no impact on net farm income given the prevalence of hired labor. In addition, once hired labors are used, household members with high education can find a nonfarm jobs that pay relatively higher returns. On average, household with female head earn significantly less net farm income than the male-headed households by as much as 22,026.91 baht. This finding suggests that female-headed households are relatively less efficient. Households, whose household head's education attainment is higher than middle school, receive lower net farm income by as much as 23,596.53 baht. It is quite concerning as the reduction in net farm income due to higher education is much smaller than the gain from net nonfarm income (14,413.50 baht).

For landlord households, renting out an additional rai increases net nonfarm income by 979.93 baht. As expected, the amounts of landholdings and farm assets have no impact on net nonfarm income. The estimated coefficient on adult equivalents is equal to 21,258.99 baht and statistically significant, indicating that adding one more adult member to a household will increase net nonfarm income by 21,258.99 baht. Thus, despite having no impact on net farm income, more adult equivalents raise net nonfarm income significantly. Lastly, gender and education of household heads have no impact on net nonfarm income. It is possible that the nonfarm jobs that these households facing do not differentiate their wages by gender and education, which is often the case for several (low) job positions in manufacturing and construction sectors. This hypothesis is supported by the fact that almost 90% of household heads in the sample having completed only primary school. Hence, their nonfarm wages should not vary significantly.

Table 6 Effects of household's rental decision on net incomes

Variables	Coefficient		
	Total Net Income	Net Farm Income	Net Nonfarm Income
Size of rent-in land	1359.84 ***	1161.57 ***	199.96
	(5.99)	(7.5)	(0.9)
Size of rent-out land	-367.27	-859.14 ***	979.93 **
	(-0.83)	(-3.13)	(2.27)
Size of own land	261.49	570.64 ***	-216.25
	(1.19)	(3.58)	(-1.01)
Adult equivalent	18898.13 ***	-2596.36	21258.99 ***
	(6.95)	(-1.4)	(8.02)
Agricultural asset value	0.042 ***	0.027 ***	0.016
	(3.71)	(3.4)	(1.43)
Annual rainfall	6.80	32.00 ***	-24.64 ***
	(0.71)	(4.89)	(-2.64)
Credit constraint (=1)	6415.11	3237.49	3261.64
	(0.72)	(0.53)	(0.38)
HH head is female (=1)	-11884.17	-22026.91 ***	10224.33
	(-1.03)	(-2.79)	(0.91)
HH head with secondary education (=1)	-9327.64	-23596.53 **	14413.50
	(-0.56)	(-2.07)	(0.89)

Note: Numbers in parentheses are *t* statistics

* p< 0.1, ** p< 0.05, *** p< 0.01

Conclusion

This study examines the determinants of household's land rental market participation in Thailand, and the impacts of renting land on household incomes. Analysis is based on a balanced-panel data on 384 rural farm households in four provinces obtained from the Townsend's Thai Project covering annual survey from 2000-2013. Each household is classified into one of three rental regimes, namely renting-in, renting-out, and autarky. The analysis highlights five main findings. First, the renting-in households have the smallest amount of land endowments (14.46 rai on average) but rent in more land than other households (20 rai on average). It should be remarked that the renting-out households have gradually reduced the size of their land endowments; from 63.28 rai in 2000 to 42.26 rai in 2013. The interpretation from this preliminary finding that land rental market transfers land from land-rich to land-constrained households should be taken with caution, as the results also indicate that most of the land rented out come from landlords not sampled in the survey, possibly urban households (Deininger and Jin, 2008).

Second, land rental markets enhance efficiency by transferring land from less-efficient to more-efficient households and from labor-constrained to labor-abundant households. Third, efficient famers participate in the land rental markets both as tenants and landlords. Fourth, land rental markets promote the transfer of land from land-rich to land-poor households, and thereby enhancing land equity. This finding contrasts the notion that land market may lead to land consolidation among the relatively rich and large landholders (Jin and Jayne, 2013). In addition, there is some evidence of inverse farm size-productivity. The fifth and probably the most important finding of the study is that participation in land rental markets statistically increases net incomes to the following extent. Renting in an additional rai raises total net income by 1,359.84 baht and increases net farm income by 1,161.57 baht. The latter is equivalently to an increase of net farm income per household by as much as 23,231.40 baht when calculated at the average of rented-in land of 20 rai. This is a considerable increase compared to the average net farm income of only 73,051 baht.

In Thailand, the linkage between poverty and land inequality have persistently deterred the development of rural economy. The promotion of land rental markets can potentially overcome such problems by improving land equality and enhancing farm productivity. However, land conflicts and some local restrictions on land rental can prevent the full functioning of land rental markets. These barriers include the 1981 Land Lease for Agriculture Act arguably discouraging landlords from renting out land and legal restrictions on land rental in certain areas, such as buffer-zone of forest reserve or government-restricted agricultural land. Therefore, mechanisms to reduce these barriers are needed. Furthermore, because the development of land rental market is linked to net gains from crop production on rented

land, hence, farm productivity improvement through inputs cost reduction is likely to stimulate such process. Lastly, the imminent of aging farmers and migration of farm labors to nonfarm sector will likely to affect the supply of farmland in the future. Hence, land rental markets are expected to play an important role for the development of Thai rural economy.

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