Willingness to Pay and Willingness to Accept for Farmland Leasing and Custom Farming in Taiwan

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Abstract:

The objective of this study is to analyze and compare the valuation of farmer participation in the farmland leasing market and the custom-farming services market. This study analyzes surveys on 301 rice farmers in Taiwan in 2014 using the contingent valuation method to analyze the willingness to pay and willingness to accept of both markets. The empirical analysis indicated that factors of greater significance causing reduced the WTA for lending farmland, which can reduce supply in the farmland-leasing market include the expectation of farmland diversion, and the existence of transaction costs in the farmland lending market. The analysis also indicates that an increase in the WTA price for lending farmland was a primary factor for the increase in the WTP for custom-farming services, which indicates that the vibrant growth of the custom-farming services market in Taiwan is affected by the WTA farmland lending. The findings show that development of the custom-farming services market cannot be expected to lead to greater farmland liquidation.

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Key words: custom-farming, farmland leasing, contingent valuation, Taiwan

1. Introduction

Agricultural sector reforms in Asian countries have led to a growth in the scale of farming, especially in Japan and Taiwan. The scale of operations increases not only through the buying and selling of farmland, but also through the leasing of farmlands and use of custom-farming services. In Taiwan, full custom-farming called Dai-Geng in Chinese (hereafter "custom-farming") is very common. The literature on custom-farming is scarce, but it has been growing in China in the recent years. Yang et al. (2013) reported that a system similar to custom-farming called agricultural-production outsourcing service has developed rapidly in China after 2004 as a response to increased wage rates. In summary, custom-farming prevailed in small rice farms in Asia and it represents a major agricultural development in the region.

Fujiki (1999) found economies of scale in the cost function of rice production in Taiwan, but not Japan, by using scale-differentiated data from rice production cost surveys in both the countries. The author attributed this finding to the efficiency gains already achieved in the production by Taiwanese small-scale rice farmers because of the prevalence of custom-farming.

However, compared to leased-land farming, custom-farming is inferior in terms of cost saving. Kiminami and Ishida (1995) compared whole custom-farming with leased-land farming. The authors reported that leased-land farming offers more scope for production planning, thus leading to higher revenue and profitability. However, Kiminami and Ishida (1995) also pointed out that leased-land farming fell short of custom-farming in terms of risks involved in yield and hired labor, levee and water management issues, crop rotation problems, and land integration difficulties. Otsuka et al. (2016) mentioned that the provider of the machinery could enjoy economies of scale by getting into a contract with a large number of small farms if the transaction cost of machine service provision is sufficiently low. If it is high, small farms cannot save labor as much as large farms. Several studies indicate that the machine service in Taiwan is not sufficiently low. Chang et al. (2017) found empirical evidence indicating management to be less profit efficient in custom-farming as compared to owned and lease-land farming. Chang (2011) analyzed empirical data by local region and found that the number of local custom-farming centers have no significant effect on management efficiency in the region. Huang and Kudo (1997) pointed out that outsourcing of machinery and machinery operation services achieved high profits in custom-farming. Agricultural-production outsourcing services also support farmers who lack sufficient agricultural machinery via the outsourcing of agricultural machinery services (Zhang, 2015).

Typically, most farmers who receive custom-farming services do not participate in the farmland-leasing

market. Prior studies assert that custom-farming is the precursor to farmland leasing, but they do not consider the possibility that custom-farming is perpetuated through imperfections in the leasing market, nor do they provide any empirical analyses. To analyze the conduct of farmers who participate in the custom-farming services market, but not in the farmland-leasing market, this study uses the contingent valuation method (CVM), which analyzes the willingness to pay (WTP) and the willingness to accept (WTA) the virtual-market price. A valuation mechanism for farmers can be used to identify the factors affecting the markets for farmland-leasing and custom-farming services. Moreover, the analysis substantiates the impact of the farmland-leasing market on the custom-farming market.

2. Survey

This study involved a face-to-face survey, conducted from April 19, 2014 to May 31, 2014, of 495 farmers who sell rice to a certain rice dealer in a township in Changhua County. The sample covers all farmers who sell rice to the dealer. The township has 4,900 farm households cultivating 2,400 ha of agricultural land and producing 27,000 tons of rice each year. In Changhua County, which is a major rice-producing region of Taiwan, 66,320 farm households are involved in custom-farming, which accounts for 77.6% of the total 85,423 farm households in this region, exceeding the national average of Taiwan. Among the 66,320 farm households that use custom-farming services, 65,908 households cultivate rice as their main crop. Among these rice farmers, 51,443 farm households (78.1%) outsource all the main machine work, including raising seedlings, ground leveling, rice transplanting, and harvesting. In other words, approximately 80% of the rice farmers in Changhua County work only for levee management, mowing, fertilization, and water management.

The survey focused on the first cropping season of 2013 because most of the rice farmers choose to cultivate in the first cropping season and not the second. The effective sample consisted of 301 farmers who answered all the survey questions about production costs (see Table 1). In the “Rice production cost survey in Taiwan,” the unit value of the machine is includes the wage for machine services and the operation time, which cover the machine cost and the machine labor cost. Following the definition, for self-farming, this study uses the machinery working hours which multiplied by the unit value of the machine as the cost of machinery in self-farming. For custom-farming, this study considered the real costs of custom-farming directly, which included the costs of the machines and the machine workers, as most of the farmers do not have their own large machines.

The survey design involved two markets: farmland-leasing and custom-farming services and asked four questions. 1) If it were necessary to lend farmland, how much would you be willing to accept? 2) If it were necessary to borrow farmland to produce rice, how much would you be willing to pay? 3) If it were necessary to outsource the entire rice production (whole custom-farming) to a third party, how much would you be willing to pay? 4) If you were to provide custom-farming services, how much would you be willing to accept?

The "double-bound dichotomous choice with open-ended follow-up" method was applied as the analytical method. In this method, an initial valuation price is proposed depending on whether the answer is "Yes" (1.5 X NT dollars) or "No" (0.5 X NT dollars). Moreover, the respondent is asked to state a price at the end directly. The question sheet included three random starting prices of X NT dollars. The farmer was asked to provide individual attributes and various personal data related to rice production. Under the double-bound dichotomous choice method, the farmer was presented with two rounds of yes-no questions. If the response is "yes" to the first amount, then a higher amount is quoted, and if it is "no," then a lower amount is quoted. The additional follow-up question of maximum WTP or minimum WTA was asked at the end of the questionnaire.

3. Econometric Analysis

We can construct a model using the questionnaire from section 2 by transforming the WTP price into a linear function according to the dichotomous model. The estimation method for double-bounded dichotomous choice is an extension of the single-bounded dichotomous choice method. More information about the detailed technique and the use of Stata is provided by Lopez-Feldman (2012). Table 2 presents the analysis results based on the simple "yes" and "no" answers. The analysis of this survey revealed that the lending price was 4,526 NT dollars per 0.1 ha, while the renting price for farmland was 2,794 NT dollars per 0.1 ha. The stated prices of the farmers also followed a similar trend, with the averages being 4,537 and 2,710 NT dollars per 0.1 ha, respectively. This indicates that the WTP price obtained by the double-bounded dichotomous choice and the stated price of the farmers were generally the same. Therefore, both are utilized in the later analysis. Further, the evaluation of the farmlands indicated a discrepancy of 1.6 to 1.7 times between lending and renting. The price difference for the same object is presumably due to an effect in which the price of the property one owns seems worth more than it actually is. This endowment effect presumably represents a special characteristic of farmlands, namely, the

attachment to farmlands passed down from generation to generation and the qualities of the assets that can be owned. On the other hand, in the custom-farming services market, the discrepancy between the maximum price the service receiver is willing to pay and the minimum price the provider is willing to accept is approximately 1.3 times, which is clearly smaller than the corresponding amount for farmland leasing.

With regard to the WTP price, individual characteristics such as age and education of the farmer could possibly affect the valuation. Typically, it is possible to estimate bid price functions that include such attributes. The following subsection discusses further analysis performed using a model incorporating these factors of the WTP price.

In addition to using the survey data of the double-bounded dichotomous choice when performing factor analysis through a bid price functions model, the logarithmic form of the stated price of the farmers was calculated and multiple regression analysis with the stated price as the explained variable was carried out.

Table 3 presents these results in columns (1), (2), and (3) for Scenario 1 and columns (4), (5), and (6) for Scenario 2. Those with a positive coefficient have a positive effect on the WTA and WTP prices; conversely, those with a negative coefficient have a negative effect. Moreover, the coefficient for the logarithmic form was also estimated.

As the WTA price for lending and WTP price for renting farmlands presented in Table 3 are viewed as the rent price of land, the prices that affect the rent price (rice price and the price of machinery services and the managed land area) are used as variables. Moreover, the attribute variables used are displayed in Table 1. Table 3 indicates that the first bid price has a significant and positive effect in both Scenarios 1 and 2 despite the small coefficients. This means that when the randomly selected initial proposed price is high, the valuation price is slightly higher. However, the results do not change much in the absence of the first bid price as an explanatory variable. The following paragraphs discuss the results of the analysis of the factors that affect the WTA lending price of farmlands in Scenario 1. With a rise in the price of machinery services, which directly affects farmers, the willingness to lend farmland decreases, and the WTA price for lending farmland rises significantly as indicated in columns (1), (2), and (3).

When the price of machinery services rises, lending farmland is more advantageous than self-cultivating it because the rise in machinery productivity increases land rent. Moreover, for managed farmland, the dummy for farmland improvement over 50% has a significant effect on the WTA price for lending farmland as indicated in columns (1), (2), and (3). As farmland improvement advances, it has a negative effect on the WTA price for lending farmland, which is counter-intuitive to the assumption of self-

valuation generally rises with farmland improvement when lending farmland. This is presumably because of farmland diversion, which may lower the WTA price for farmland lending in comparison to areas with lenient diversion regulations. In Changhua County, over 60% farmland improvements were finished before 1971 and the rest were mostly done in the 1980s. Although land improvement is likely to be carried out in places where the land rental price is higher, it is hardly endogenous in the case. According to Chang (2012), the sale price for farmland is expected to fall as zoning regulations become stricter. In the case, the zoning is mostly decided before 1980s, which is based much on the farmland improvement project before 1980s. However, farmland quality is still important to the land price for the agriculture- based township. Although the use of a location dummy for convenience stores or supermarkets within five minutes by car could grasp the effect of urbanization, the WTA price for lending farmland apparently dropped when the region was more urbanized as indicated in columns (1), (2), and (3). The effects of urbanization, if they were only expectations of farmland diversion, would presumably be positive, but the falling value of land rent due to decline in farmland quality because of urbanization apparently had a stronger effect. The dummy indicating that the farmer is already participating in the lending market has a very significant negative effect on the WTA price for farmland lending as indicated in columns (1), (2), and (3). Although farmers already participating in the lending market form a small proportion of the sample, their willingness to lend is clearly high. This is presumably because the transaction cost of trading in the farmland lending market is cancelled out when the farmer is already participating in it. In other words, there is a participation barrier in the farmland lending market. Other important factors, aside from attachment toward farmland handed down from generation to generation and asset quality includes search costs to locate a farmer wishing to rent farmland and the need to obtain consent from multiple owners. In other words, these factors reflect the existence of information asymmetry with respect to the time and cost involved.

The results of the analysis of the factors affecting the WTP price for renting in Scenario 2 are presented below. The price of rice has a significantly positive effect on the WTP price for renting as indicated in columns (4), (5), and (6). With a rise in the price of rice, the renting farmers' willingness to expand the scale of operation and the rent price for farmland leases increases in the farmland market. The price of machinery services also has a significant and positive effect on the WTP price for renting as indicated in columns (4), (5), and (6). When the price of machinery services rises, farmers manage operations using their own machinery, and the value of rented farmland rises because of the increased productivity of the machines. The land area of managed farmlands has a significant and positive effect on the WTP price for

renting as indicted in columns (4), (5), and (6). This reflects the fact that the larger the managed farmland, the greater the farmer's willingness to expand the managed farmland. Moreover, the dummy for cultivating only once a year has a significant and positive effect on the WTP price for renting as indicated in column (4). Farmers who cultivate only once a year receive a production adjustment subsidy, which is regarded as a policy that impedes farmland lending in Taiwan. However, Scenario 1 in Table 3 indicates that it has no significant effect on the WTA price for lending farmlands. A possible explanation is that although the policy provides production adjustment subsidies to farmlands, the actual recipients of the subsidies are the landowners. Therefore, farmland lending is not considered a reason for stopping the landowner from continuing to receive production adjustment subsidies and thus, it does not affect the owner's willingness to lend the land. Moreover, farmers who cultivate only once a year to improve rice quality and increase productivity by avoiding pests and diseases and the effect of typhoons could possibly have a higher willingness to rent.

The size of farmlands owned has a significantly negative effect on the WTP price for renting. In contrast, with regard to the size of managed land, as the size of land owned by the farmer increases, the farmer's WTP price for renting falls along with the willingness to rent. From the results of the analysis of Scenario 2, the WTP price for renting in Scenario 2 usually increases when the revenues from crop production or scale expansion are expected to increase.

Finally, the ratios of the stated prices of both scenarios in column (7) were analyzed with the variables of the same attributes to identify the factors causing the discrepancy between the WTA and WTP prices for renting farmlands. From the analysis, the following variables had significant effects: rice price, farmland improvement over 50%, the location of convenience stores or supermarkets within 5 minutes by car, number of family members used for rice production, having participated in the lending market, and size of owned farmland. Apart from rice price and size of farmland owned, all the other variables were significant for Scenario 1. This means that the reasons behind farmland lending were essentially the factors causing the discrepancy in willingness between the lending and renting sides of the transactions, as indicated in columns (1), (2), and (3).

Columns (8) and (9) indicate the survey results for Scenarios 3 and 4 in the custom-farming market. The first bid price has a significant and positive effect in both Scenarios 3 and 4, despite the small coefficient. The sign of the results do not change without using the first bid price as an explanatory variable. The WTP and WTA price for custom services are not significantly affected by the explanatory variables for the size of managed farmland. Liu et al. (2016) found that machine ownership is positively correlated with farm

size in Vietnam, which means custom-farming is more likely to help small-scale farms overcome small-farm disadvantages associated with machine use. However, the effect is not found in Taiwan. Instead of the variables related to custom market, the variables related to farmland rental market has a significant effect on the WTP price of custom-farming, such as farmland improvement of over 50%, the dummies for cultivating only once a year, and leased-land area. The dummies for self-cultivation have negative effects on the willingness to accept the price for custom-farming, as present in column (9), which indicates that the farmers who did not receive custom-farming might have a different decision-making framework. In column (10), the ratios of the stated prices of scenario 3 and 4 were analyzed as the dependent variable and only the following variables had significant effects: rice price, dummy for farmland improvement over 50%. All the other variables were significant for Scenario 3, but not for Scenario 4.

Based on all the above, these variables are strongly related to farmland and affect the WTP price for receiving custom services, which calls for further analysis. In Table 4, Scenario 3 is analyzed with respect to the subsample of farmers with and without custom-farming by using the stated willingness price for renting and lending farmland as explanatory variables.

In column (1) of Table 4, the WTP for renting farmland is positive and it has a significant effect on the WTP for custom-farming. It implies that the farmland renters also provide custom-farming service to other farmers; hence, they have a higher valuation for it. A similar result is presented in column (3) for the farmers who do not receive custom-farming. For the self-cultivating farmers in column (3), the effect on the WTP for providing custom service was negative for the price of rice, the dummy for farmland improvement over 50%, and the dummy for only cultivated single crop in a year.

For the farmers who received the custom service market, in column (3), the WTA price for lending farmland has a positive effect on the WTP for custom-farming services with a significance level of 5%. The higher the farmer values the WTA price for lending farmland or, in other words, the larger the number of farmers with low willingness to lend, the greater is the expectation of increased demand for custom-farming services. Moreover, they are actually using the custom-farming service in the end. It could result in an inflationary effect on the custom-farming services market. Accordingly, the WTP for custom services rises, causing the price of custom-farming services in Taiwan to remain high. This is consistent with the current situation in the custom-farming services market in Taiwan. On the other hand, no significant effects were found for other variables related to farmland liquidation, which indicated that the effects were resolved by the farmland rental market in column (2).

4. Conclusion

The argument that the farming services stage is a precursor to eventual participation in the land-lease market has been discussed extensively in prior research. However, no empirical research has analyzed the various factors behind the growth in custom-farming services. The results of the empirical analysis of the WTP and WTA prices in a virtual market using the CVM method indicates that the increase in the WTA price for lending farmland was clearly a primary factor behind the increase in the WTP for custom-farming services. This study indicates that the vibrant growth of the custom-farming services market in Taiwan is affected by the farmland-leasing market. In addition, the empirical results reveal that the reduced supply in the farmland-leasing market is due to factors of greater significance: increase in the theoretical price of farmland due to expectation of farmland diversion in areas where farmland improvement is low and diversion regulations are lenient, quality improvement, and participation barriers in the farmland lending market. While these factors continue to exist, the demand for custom-farming will increase, and thus, the price for machinery services will continue to be high.

Taiwan is witnessing large-scale growth in the use of machinery services due to the various custom-farming services. However, with the high cost of production, partly due to machinery service costs, farmers will not be able to cope with the international deregulation of rice. A fundamental solution for the achievement of agricultural structural adjustment targets would be to remove the factors that hinder farmland liquidation in the farmland-leasing market and avoid promoting custom-farming services.

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Table 1. Data Overview

Post-analysis variable	Variable	Sample size	Average	Std. deviation
A	Area (0.1 ha)	301	15	21
P	Price of output	301	16	4
Pm	Cost of machinery and machinery services per unit area	301	3,026	2,333
Age	Age	296	59.42	11.67
eduy01	Years of education	301	3.60	4.10
dispersion	Number of farmland paddies	259	1.85	1.54
improvementh50	Farmland improvement more than 50% =1	301	0.88	0.33
minutes	Convenience stores or supermarkets within 5 minutes by car = 1	295	0.48	0.50
familyforrice	Family members working for rice	301	1.78	0.96
onlysinglecrop	Cultivation once per year = 1	294	0.15	0.36
lenddummy	Farmland lending = 1	301	0.06	0.23
selfdummy	Self-farming = 1	301	0.35	0.48
rentdummy	Farmland renting = 1	301	0.44	0.50
arent	Leased-land area (0.1 ha)	301	5.89	17.62
ownlands	Owned-land area (0.1 ha)	289	9.81	14.74

Note: Area unit: 0.1 ha; price unit: NT dollar; calculation of machinery cost and labor cost by area is partly based on the “Rice production cost survey in Taiwan.”

Table 2. Estimation Using the Double-Bounded Dichotomous Choice Model

Scenario		WTP or WTA	Std. Err.	Stated Price	Std. Err.
Scenario 1	Lending land	(WTA) 4526	1770	4537	1513
Scenario 2	Renting land	(WTP) 2794	1250	2710	969
Scenario 3	Receive custom-farming	(WTP) 3458	1120	3071	982
Scenario 4	Provide custom-farming	(WTA) 4638	2350	3970	1428

Table 3. Factor Analysis Using Double-Bounded Dichotomous Choice Model for the Land Rent Market

	Scenario 1: Lend farmland				**Scenario 2: Rent farmland**			**Difference b/w WTA & WTP**		**Scenario 3: Receive custom-farming**		**Scenario 4: Provide custom-farming**	**Difference b/w WTA & WTP**
	Double bound		ln(Stated price)	Stated price	Double bound	Double bound	Stated price	ln(Stated price)		Double bound		Double bound	ln(Stated price)
	(1)		(2)	(3)	(4)	(5)	(6)	(7)		(8)		(9)	(10)
	wtalend		***Ln*wtalend**	**wtalend**	**wtprent**	***ln*wtprent**	**wtprent**	***ln*(wtalend/wtarent)**		**wtpcus**		**wtawcus**	***ln*(wtpcus/wtawcus)**
1st Bid price	0.7**	--	0.00**	0.3**	0.2**	--	0.00**	0.1	--	0.6**	--	0.9**	--
***Ln*p**	303.1	-6.5	-0.02	-89.1	815.2**	695.8*	0.47**	1235.5**	-0.47**	-396.2	-633.7*	-589.2	0.15
***Ln*pm**	301.7†	424.3**	0.07**	319.1**	282.0**	323.6**	0.13**	366.8**	-0.05	133.5	239.0*	167.6	0.12**
***Ln*a**	40.3	-52.1	0.00	-4.5	243.6†	213.5	0.10**	233.5**	-0.08	165.4	84.5	-49.6	0.07
***ln*age**	451.8	527.0	0.11	617.2	-210.1	-204.2	0.04	247.6	0.15	-164.8	-186.9	274.4	-0.06
***ln*eduy01**	11.44	29.5	0.01	37.1	10.6	16.0	0.01	26.9	0.00	-17.0	-3.8	-0.2	-0.01
***ln*dispersion**	-12.8	162.7	-0.06†	-193.7	-237.1	-176.0	-0.05	-179.7†	-0.01	-183.0	-37.9	-18.5	-0.03
improvement h50	-810.8**	-699.9*	-0.16**	-647.9**	-87.1	-41.5	0.10†	216.0	-0.27**	-435.4*	-353.9	148.1	-0.22**
minutes	-514.8**	-537.9**	-0.06**	-315.8*	161.5	158.1	0.01	1.3	-0.11**	-158.4	-149.8	-287.4	0.05
***ln*familyforrice**	386.7†	349.0	-0.02	-32.8	-5.6	-25.3	-0.02	43.7	-0.03	54.8	-11.2	-90.8	-0.08
onlysinglecrop	177.7	-153.9	0.02	132.8	445.5*	333.9	0.05	171.2	-0.05	-172.8	-454.3*	-863.9	0.04
lenddummy	-1277.7**	-1193.5**	-0.19**	-667.7*	322.0	364.0	0.01	122.7	-0.18†	-360.4	-234.1	-376.5	-0.04
selfdummy	-6.5	186.6	0.05	235.1	120.3	189.4	0.02	78.6	0.05	323.7	487.0	1293.4**	-0.05
rentdummy	-683.3	-944.8	-0.04	-47.8	-506.4	-604.5	0.06	-83.6	-0.06	-871.9	-1030.7	-1118.5	-0.16
***ln*arent01**	114.3	193.9	0.02	63.8	166.5	195.6	-0.02	31.8	0.03	173.4*	223.3*	208.1	0.03
***ln*ownlands**	-26.7	25.8	0.02	117.7†	-149.3**	-130.1*	-0.03*	-54.7	0.06**	-85.7	-36.4	60.9	-0.02
_cons	-2114.8	306.5	7.43**	-917.8	-1793.9	-873.5	4.81**	-5496.1*	2.05	1964.1**	4808.1	-149.0	-1.11†
Number of obs	*242*	*242*	*205*	*205*	*242*	*242*	*202*	*202*	*179*	*242*	*242*	*242*	*198*
Log likelihood	*-284.48*	*-295.25*	--	--	*-223.73*	*-226.29*	--	--	--	*-160.25*	*-176.95*	*-293.58*	--
Prob > chi2	*0.00*	*0.07*	--	--	*0.00*	*0.01*	--	--	--	*0*	*0.08*	*0.00*	--
Prob > F	--	--	*0.01*	*0.01*	--	--	*0.00*	*0.00*	*0.00*	--	----	--	*0.05*

Note: **, *, and † indicate significance levels at 5%, 10%, and 15%, respectively

Table 4. Factor Analysis Using a Double-Bounded Dichotomous Choice Model for Willingness to Pay for Custom-farming

	The effect of stated price of land rental market on the willingness to pay for custom-farming		
	(1)	(2)	(3)
	All farmers in the survey	The farmers who is using custom faming (**selfdummy**= 0)	Self-cultivating without custom-farming (**selfdummy**=1)
*ln***wtalend**	331.20	772.70**	-647.27
*ln***wtprent**	523.05*	-687.74**	2237.90**
*ln***p**	-643.26	-30.74	-1418.93*
*ln***pm**	6.49	3383.27**	-196.89
*ln***a**	-60.59	162.66	190.95
*ln***age**	-489.48	-682.26†	-1301.41
*ln***eduy01**	14.76	-0.02	135.45
*ln***dispersion**	130.08	22.66	-138.45
improvementh50	-510.42*	634.49	-957.50*
minutes	8.27	-34.75	766.07†
*ln***familyforrice**	129.97	40.43	-448.30
onlysinglecrop	-663.00**	-412.42†	-1387.56**
*ln***arent01**	-27.01	-6.17	-67.92
*ln***ownlands**	-17.56	-43.78	-291.77†
_cons	*928.1*	*-22696.6***	*3185.0*
Number of obs	*179*	*113*	*66*
Log likelihood	*17.93*	*-36.78*	*-58.71*
Prob > chi2	*0.21*	*0.08*	*0.04*

Note: **, *, and † indicate significance levels at 5%, 10%, and 15%, respectively