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# Influence of Land Titling Policy on Land Abandonment in China

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## Presentation Outline

- (1) Land abandonment situation in China
- (2) Land titling policy (*LTP*) in China
- (3) How does the LTP affect land abandonment?
- (4) Data introduction and model-based clustering method
- (5) Results
  - Fractional response model (Papke and Wooldridge, 1996)
  - Nonparametric model (Li and Racine, 2007)
  - Fractional response semiparametric model (GAM model (Härdle et al., 2012; Wood, 2006))
- (6) Conclusions





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*The rural land abandonment rate in China was 9.43% in 2014, but this rate decreased to 3.27% in 2018 — China Labor-force Dynamic Survey (CLDS)*

- What causes rural land abandonment?
- (1) Land fragmentation and low farming income
  - **Small**——Collective assigned farmland area of rural residents is 0.23 hectares. Based on 0.23 hectares farmland, farming income is estimated at US\$17.74/month.
  - **Scattered and land of various categories**——Each peasant household's own farmland is non-contiguous and suitable for only designated use (such as paddy land, farmland that cannot be irrigated, mountainous land)
- (2) Urban work opportunities and high income
  - 65.9% rural laborers migrate to urban to earn money. Urban wage contract averages US\$470/month for rural-urban migrants.





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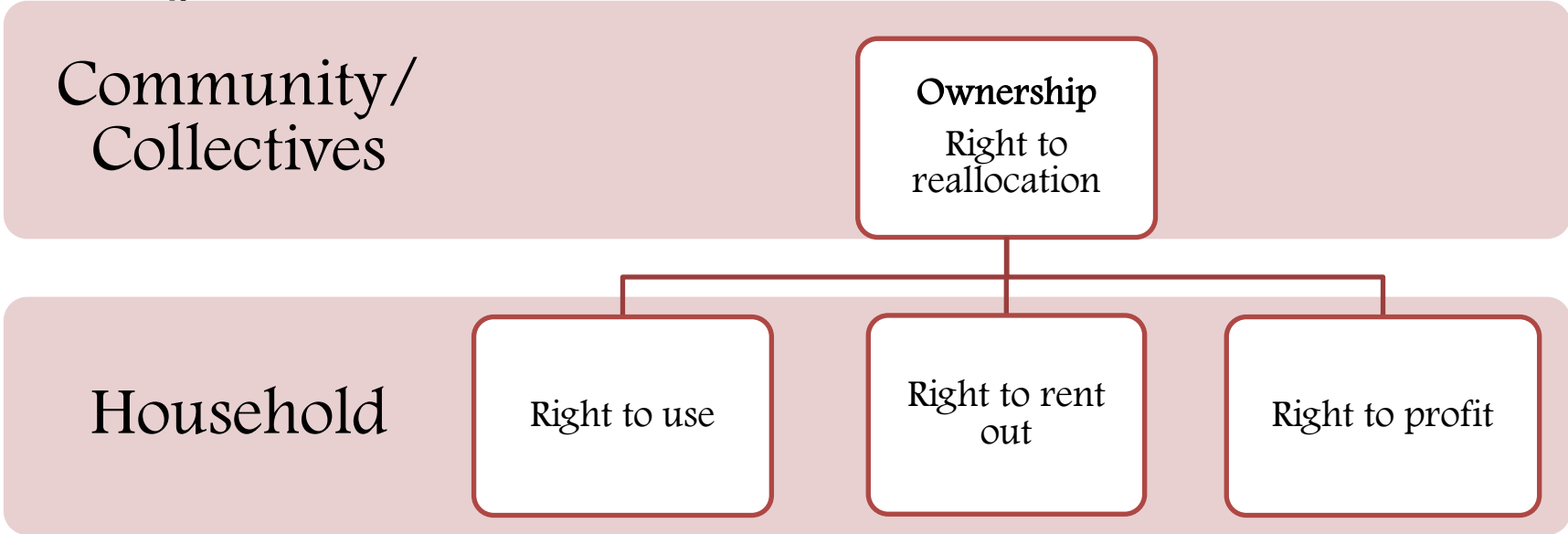
Labor forces in rural areas--  
**Women and elderly: not sufficient  
able rural labor force resulting in  
farmers to leave land fallow  
(abandon)**





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Unstable and insecure land property rights



Collectives reallocate village farmlands according to households’ family population and land use demand every **3-5 years**.

If a household rents out its land, that may be perceived as not having enough household laborer to farm or not having enough interest in farming. Land rent out puts households in a precarious situation of losing land in the subsequent reallocation period.

**Land abandonment may also indicate there is a low demand for farming land. To avoid this perception, some households plant trees to show their land is “under farming”.**





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Y	Total income	A	Total land owned by a peasant household
$l$	Land titling policy	$\underline{A}_f$	Self-cultivated farmland area
I	Fixed investment on owned farmed land	$\underline{A}_t$	Transfer-out farmland area
X	Other inputs than land in the production function	$\underline{A}_a$	Abandoned farmland area
R	Rental rate per mu	$i$	Collective's endowment
$\underline{r}_s$	Investment loss risk in the self cultivated land ( $0 \leq \underline{r}_s \leq 1$ )	$p$	Personal ability
$\underline{r}_t$	Risk of losing transfer land ( $0 \leq \underline{r}_t \leq 1$ )	$T$	Land transfer out duration
$v$	Farmland value per mu		



## Theoretical model

$$(A1) \quad Y = g(A_f, I(A_f), X) - r_s I(A_f) + RA_t - e^{-rtT} v(A_t)^{10}$$

subject to:

$$(A2) \quad A = A_f + A_t + A_a$$

$$(A3) \quad r_s = r(p, i, l)$$

$$(A4) \quad r_t = r(p, i, l)$$

$$(A5) \quad v(0) = 0$$

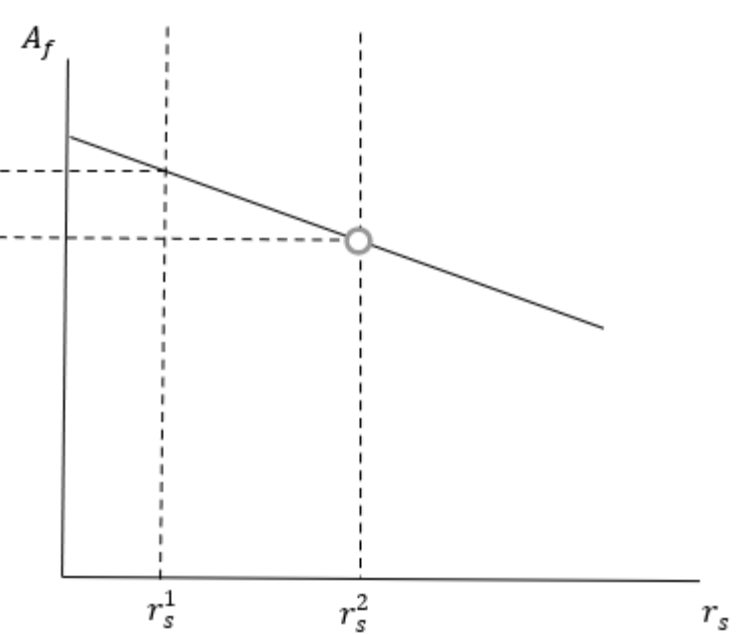
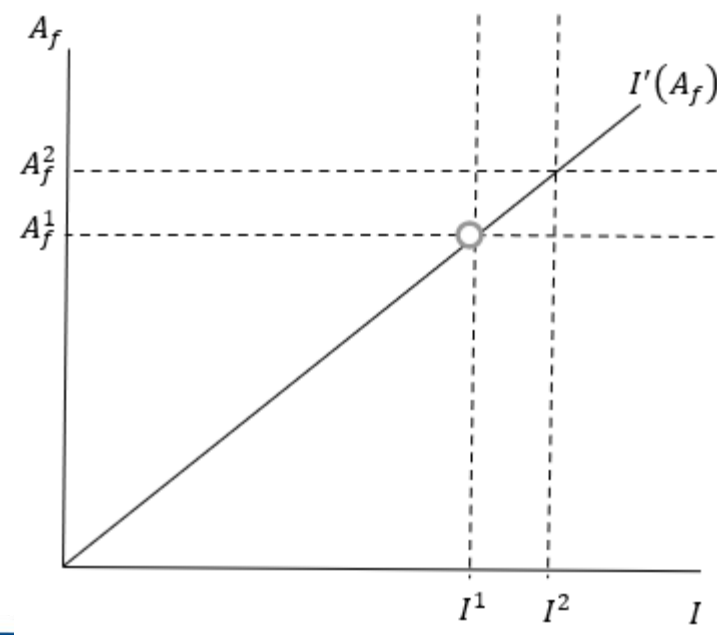
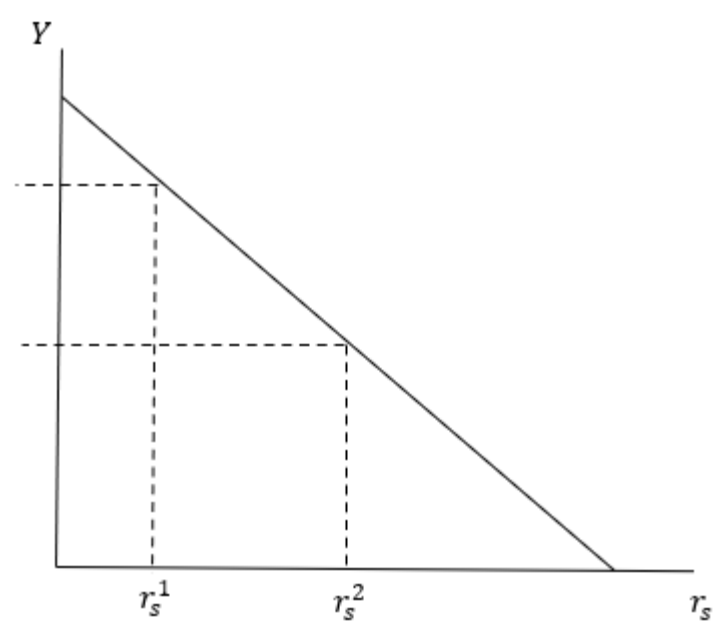
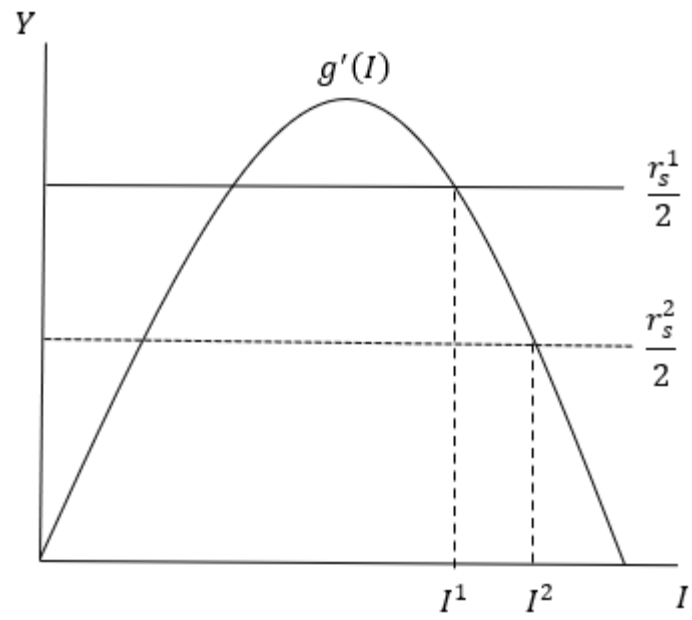
After some derivation  
and algebraic  
manipulation, we get

$$\Omega^1 = \frac{R - e^{-rt(l)T} v'}{2I'(A_f)} + \frac{r_s(0)}{2}$$



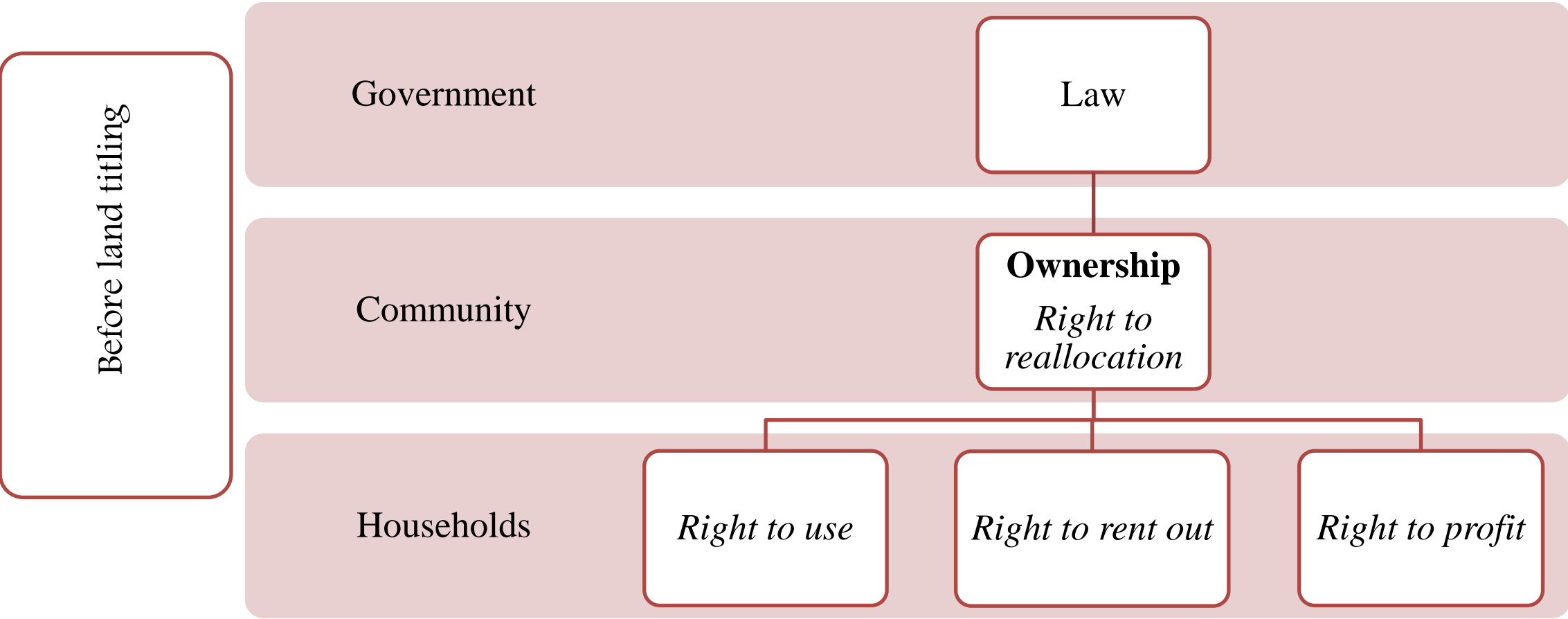


Relationship among total income ( $Y$ ), fixed investment in land ( $I$ ), self-cultivated land ( $A_f$ ), and the risk of farmland loss ( $r_s$ )





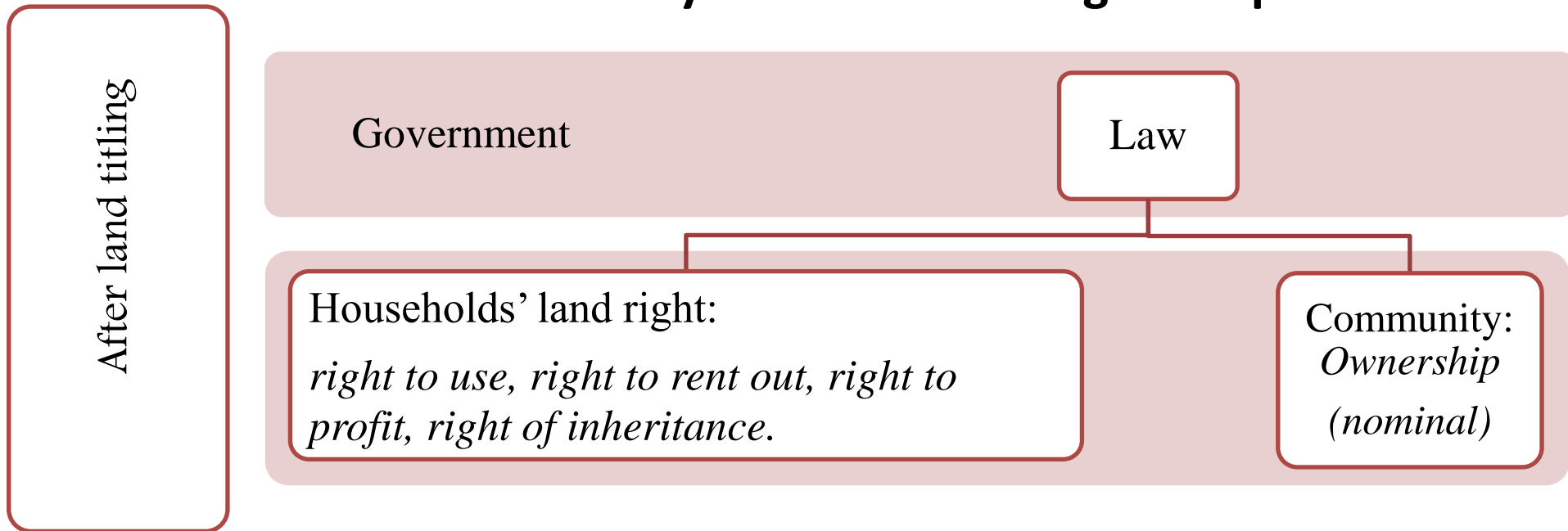
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## After the land titling policy, the **government directly endowed land rights to peasant households**



Reallocation for households would no longer happen.

Households may rent out their land without reallocation worries.

***Hypothesis: The LTP can improve land rent out and reduce land abandonment.***





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- 5998 peasant household heads were interviewed from 9 Chinese provinces in 2015

# Study Area





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# Clustering

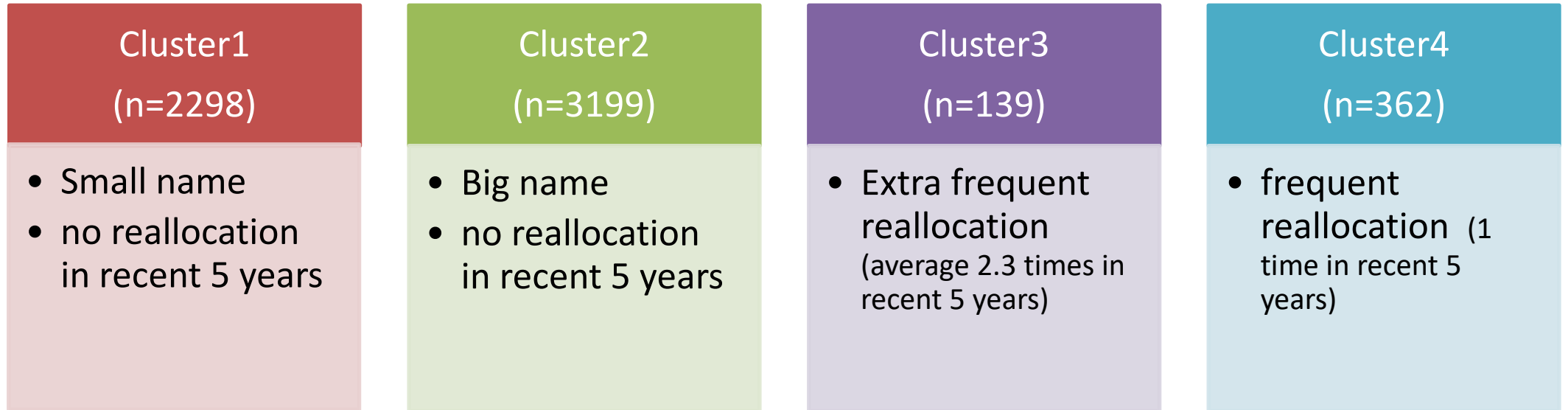
- Why clustering?
  - Policy has heterogeneous effects on households and clustering helps to distinguish the effect across different groups.
  - Commonly used in price discrimination and *consumer* segmentation.
- **Model-based clustering**
  - Assumes the data as coming from a distribution that is mixture of two or more clusters.
  - Uses a soft assignment, that each data point has a probability of belonging to each cluster.





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# Clustering Result



“Big name” reflects social capital in a village.

E.g. 90% residents have the family name *Liu* in one of the coauthors’ village, 10% have other last names.





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# Variable Definition

Variable	Definition
<b>Dependent Variables</b>	
<i>tsf</i>	The rate of farmland rent out
<i>abd</i>	The rate of farmland abandonment
<i>sct</i>	The rate of farmland self-cultivation
<b>Variable of Interest</b>	
<i>LTP</i>	=1 if the lands of the household had tilted, 0 otherwise
<b>Human Capital Characteristic</b>	
<i>hc_flr</i>	rate of household laborers worked farm
<i>hc_nflr</i>	rate of household laborers worked off-farm
<i>hc_er</i>	rate of household laborers over high school education
<b>Social Capital Characteristic</b>	
<i>sc_bn</i>	=1 if the popularity of household's family name is rare in the village, 2 moderates, 3 very popular
<b>Farmland Characteristic</b>	
<i>frag</i>	=pieces of farmlands divided by the area
<b>Economic Characteristic</b>	
<i>fi</i>	=1 if the number of annual family income under 10000 RMB, 2 between 30000-50000 RMB, 4 between 30000-50000 RMB, 5 over 100000 RMB
<b>Village Characteristic</b>	
<i>tc_tc</i>	Time (hours) to drive to county
<i>tc_tt</i>	Time (hours) to drive to town
<i>ad_p</i>	Times of the partial adjustment of farmland within five years in the village





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# Fractional Response Model

	Cluster 1			Cluster 2			Cluster 4		
	<i>tsf</i>	<i>abd</i>	<i>sct</i>	<i>tsf</i>	<i>abd</i>	<i>sct</i>	<i>tsf</i>	<i>abd</i>	<i>sct</i>
Intercept	-0.234*** (0.319)	-0.178*** (0.424)	0.244*** (0.274)	-0.203*** (0.236)	-0.203*** (0.226)	0.234*** (0.179)	-0.106 (0.482)	-0.281*** (0.555)	0.136* (0.392)
LTI	0.044*** (0.12)	-0.028*** (0.139)	-0.015 (0.100)	0.063*** (0.111)	-0.026*** (0.107)	-0.034** (0.085)	0.030 (0.250)	-0.062** (0.276)	0.020 (0.201)
hc_flr	-0.144*** (0.247)	-0.038** (0.28)	0.172*** (0.200)	-0.171*** (0.224)	-0.075*** (0.229)	0.237*** (0.172)	-0.111* (0.467)	-0.107** (0.605)	0.201*** (0.390)
hc_nflr	0.254*** (0.196)	0.051*** (0.23)	-0.305*** (0.165)	0.247*** (0.187)	0.072*** (0.185)	-0.316*** (0.146)	0.155*** (0.42)	0.194*** (0.475)	-0.336*** (0.352)
hc_er	0.019 (0.388)	0.012 (0.465)	-0.036 (0.344)	-0.006 (0.452)	0.043 (0.437)	-0.041 (0.356)	-0.079 (1.028)	-0.120 (1.080)	0.207 (0.852)
sc_bn2	-0.010 (0.389)	-0.048 (0.663)	0.047 (0.364)				-0.066** (0.223)	-0.01 (0.263)	0.075** (0.190)
sc_bn3	0.019 (0.232)	-0.015 (0.39)	-0.012 (0.215)				0.049 (0.228)	-0.016 (0.229)	-0.032 (0.180)
fi	0.000 (0.051)	-0.005 (0.062)	0.006 (0.044)	-0.007 (0.044)	-0.005 (0.046)	0.012** (0.035)	-0.024 (0.11)	0.003 (0.119)	0.024 (0.090)
frag	-0.018*** (0.04)	0.008*** (0.027)	0.001 (0.028)	-0.019*** (0.034)	0.009*** (0.019)	-0.001 (0.018)	0.002 (0.060)	0.004 (0.060)	-0.006 (0.048)
tc_tc	-0.028** (0.107)	0.002 (0.115)	0.024* (0.087)	-0.034** (0.116)	0.016** (0.098)	0.014 (0.085)	-0.006 (0.226)	0.012 (0.257)	-0.010 (0.181)
tc_tt	-0.092** (0.286)	0.015 (0.257)	0.064* (0.224)	-0.108*** (0.281)	0.046*** (0.212)	0.032 (0.200)	-0.210** (0.691)	0.095* (0.595)	0.070 (0.488)

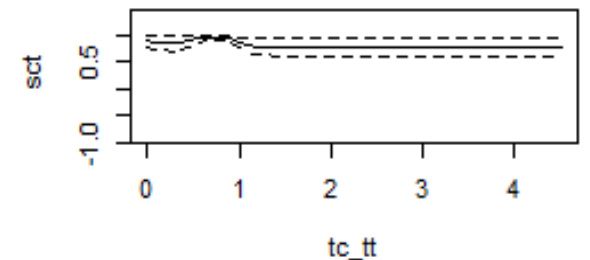
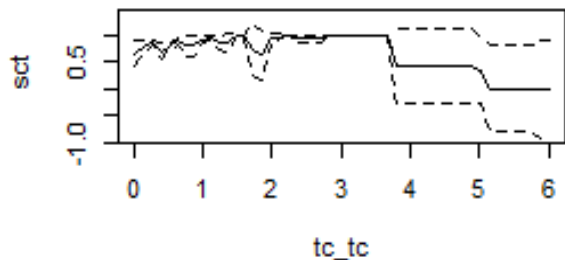
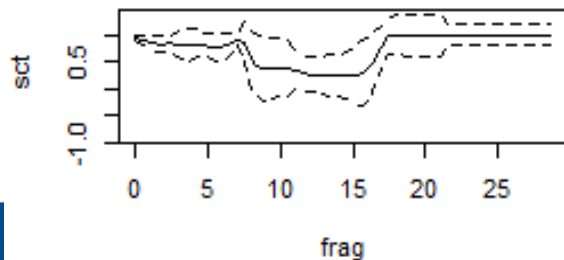
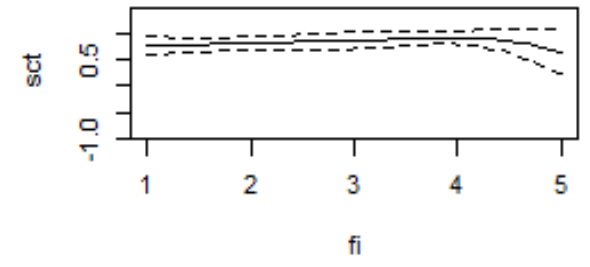
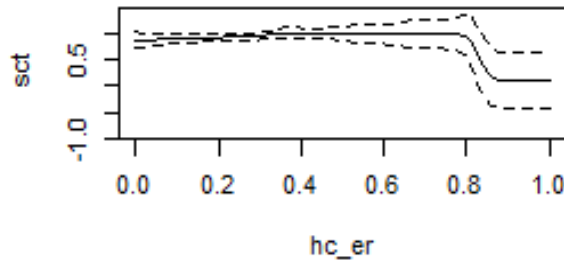
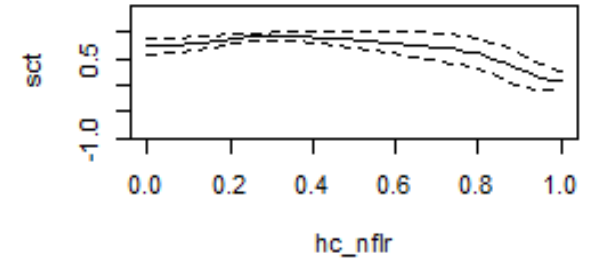
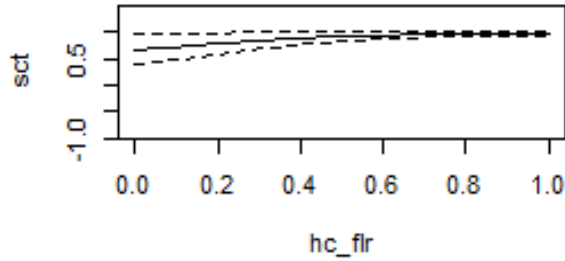
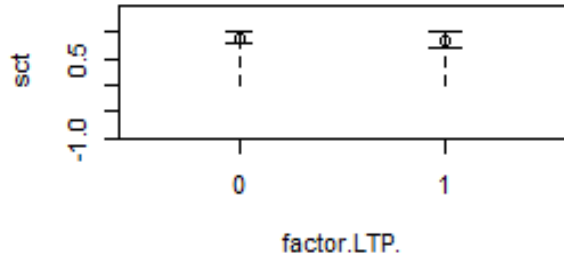






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# Nonparametric Model





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## Nonparametric regressions results

Note: “*nl*” represent “*non-linear*”

	Cluster 1			Cluster 2			Cluster 4		
	<i>tsf</i>	<i>abd</i>	<i>sct</i>	<i>tsf</i>	<i>abd</i>	<i>sct</i>	<i>tsf</i>	<i>abd</i>	<i>sct</i>
<i>hc_flr</i>									
<i>hc_nflr</i>	<i>nl</i>		<i>nl</i>						
<i>hc_er</i>			<i>nl</i>						
<i>fi</i>									
<i>frag</i>		<i>nl</i>	<i>nl</i>		<i>nl</i>	<i>nl</i>		<i>nl</i>	<i>nl</i>
<i>tc_tc</i>	<i>nl</i>		<i>nl</i>				<i>nl</i>		
<i>tc_tt</i>	<i>nl</i>	<i>nl</i>		<i>nl</i>		<i>nl</i>		<i>nl</i>	



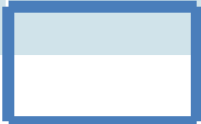


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Null hypothesis of the tests:

- (1) parametric model better than nonparametric
- (2) parametric model better than semiparametric

	Cluster1			Cluster2			Cluster4		
	tsf	abd	sct	tsf	abd	sct	tsf	abd	sct
parametric versus nonparametric	12.666***	6.071***	14.84***	14.227***	8.412***	17.274***	4.973***	3.673***	5.208***
parametric versus semiparametric	26.936***	17.143***	35.461***	0.280	10.518***	3.083***	-1.737*	3.404***	-1.727*





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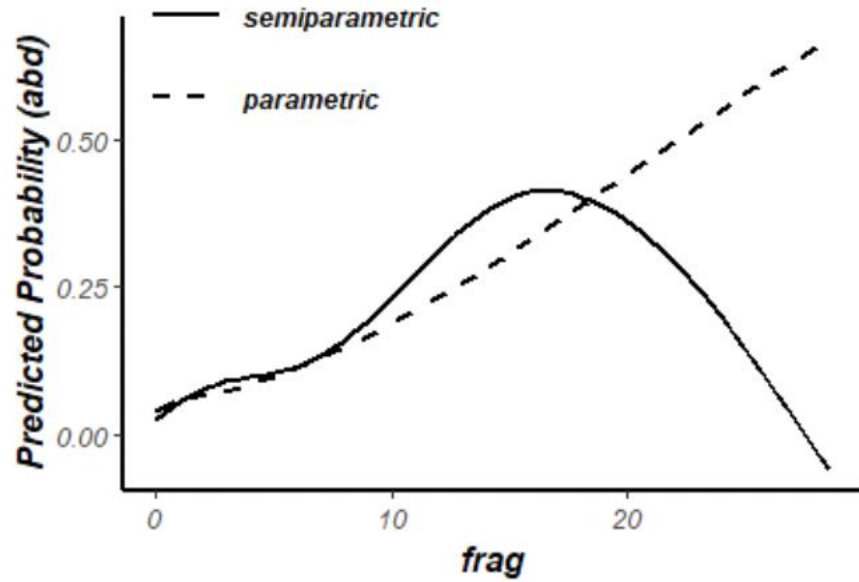
Semiparametric model

	Cluster1			Cluster2			Cluster4		
	<i>tsf</i>	<i>abd</i>	<i>sct</i>	<i>tsf</i>	<i>abd</i>	<i>sct</i>	<i>tsf</i>	<i>abd</i>	<i>sct</i>
Intercept	-0.202*** (0.213)	-0.132*** (0.292)	0.153*** (0.183)	-0.234*** (0.212)	-0.184*** (0.217)	0.241*** (0.164)	-0.026 (0.537)	-0.236*** (0.627)	0.055 (0.448)
LTP	0.048*** (0.117)	-0.031*** (0.141)	-0.016 (0.100)	0.062*** (0.101)	-0.029*** (0.106)	-0.033*** (0.081)	0.024 (0.246)	-0.082*** (0.283)	0.026 (0.201)
hc_flr	-0.081*** (0.218)	-0.033** (0.281)	0.100*** (0.179)	-0.171*** (0.204)	-0.076*** (0.224)	0.236*** (0.161)	-0.124** (0.465)	-0.105** (0.578)	0.205*** (0.386)
hc_nflr		0.050*** (0.234)		0.248*** (0.170)	0.070*** (0.181)	-0.317*** (0.137)	0.137** (0.417)	0.201*** (0.470)	-0.342*** (0.349)
hc_er	-0.017 (0.364)	0.009 (0.470)		-0.003 (0.411)	0.046 (0.428)	-0.039 (0.336)	-0.061 (1.019)	-0.148* (0.997)	0.244 (0.847)
sc_bn2	-0.024* (0.110)	-0.017** (0.140)	0.035** (0.096)				-0.100** (0.340)	0.028 (0.366)	0.092* (0.279)
sc_bn3	-0.040 (0.515)	-0.067 (0.942)	0.133* (0.509)				-0.088** (0.313)	0.006 (0.379)	0.095* (0.268)
fi	0.010* (0.050)	-0.005 (0.062)	-0.008 (0.044)	-0.008* (0.040)	-0.005 (0.044)	0.013** (0.033)	-0.024 (0.109)	0.002 (0.112)	0.026 (0.089)
frag	-0.016*** (0.038)			-0.019*** (0.031)			0.001 (0.060)		
tc_tc		0.002 (0.114)		-0.031** (0.104)	0.016** (0.095)	0.011 (0.079)		0.002 (0.264)	-0.007 (0.182)
tc_tt			0.056* (0.212)		0.046*** (0.208)		-0.244** (0.701)		0.058 (0.485)

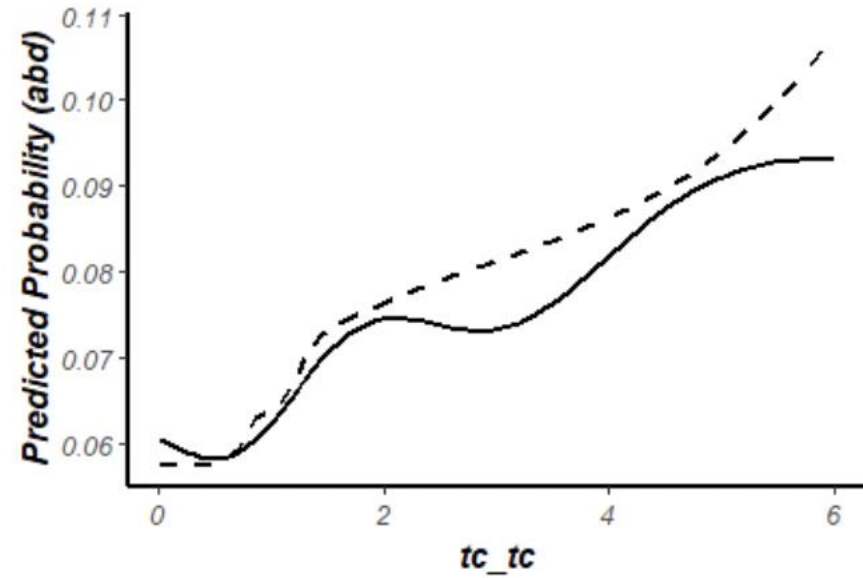


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Cluster1



Land fragmentation and land abandonment



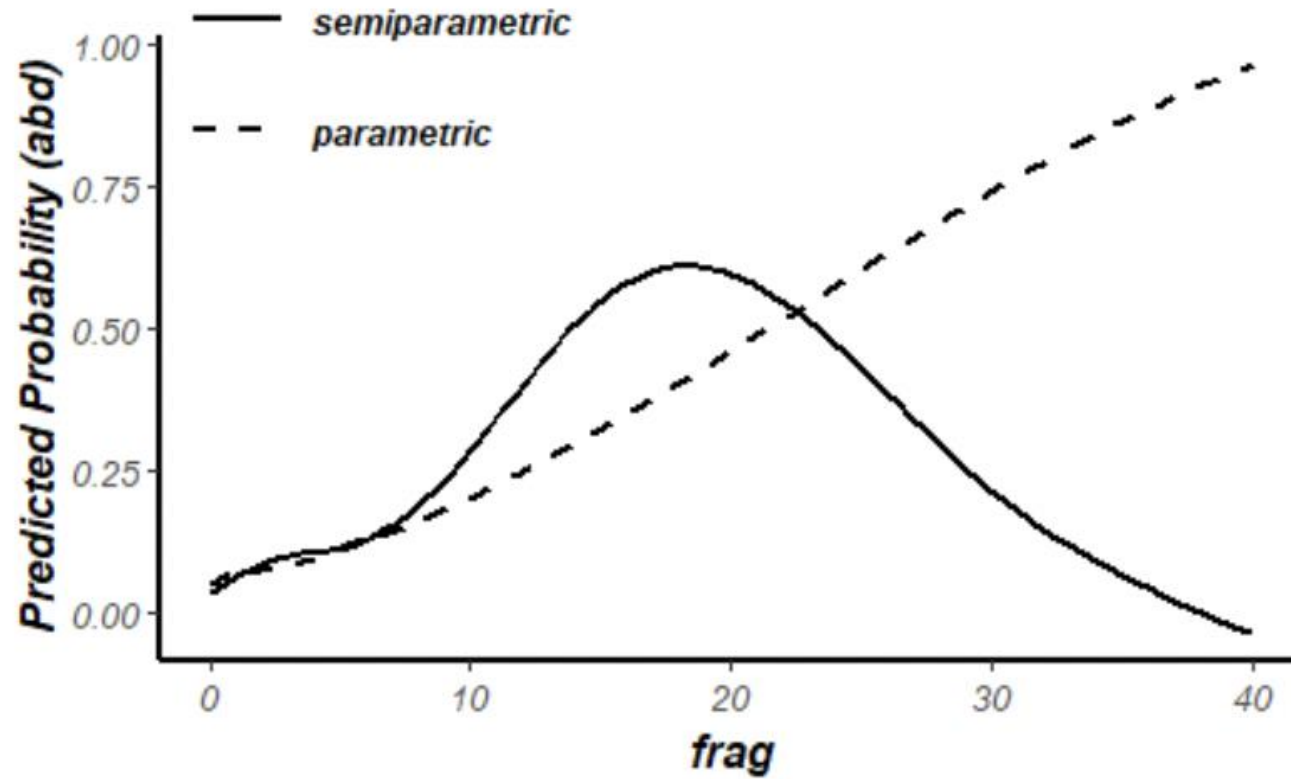
driving hours to local county center and land abandonment





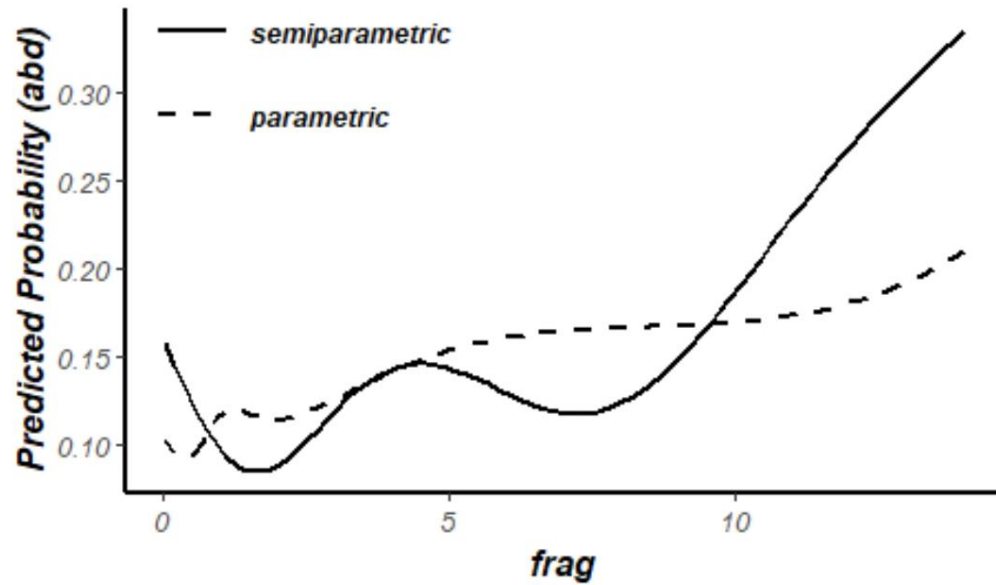
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Cluster2

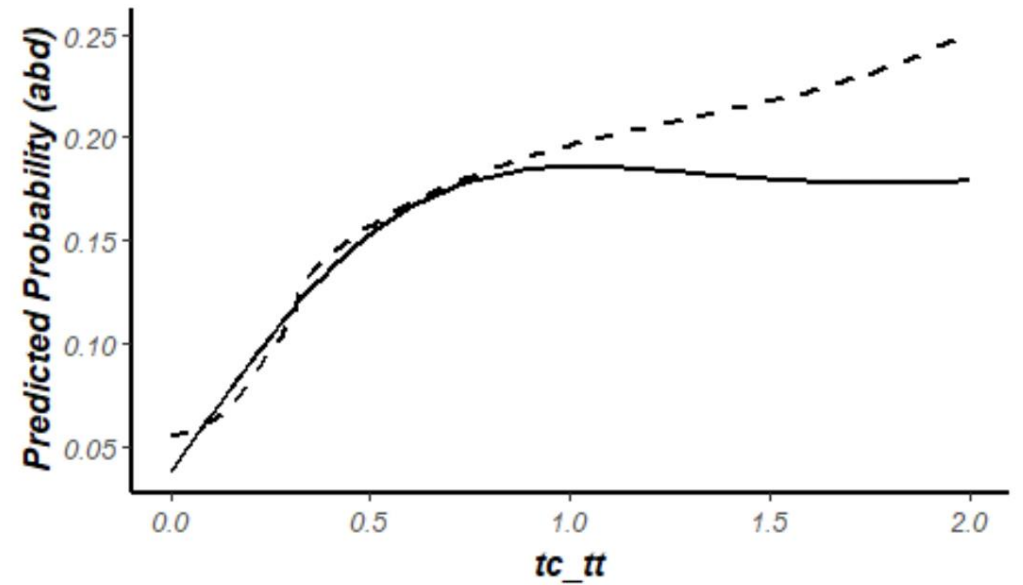


Land fragmentation and land abandonment





Land fragmentation and land abandonment



Driving hours to local town and land abandonment





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## CONCLUSIONS

- (I) Land titling policy significantly reduce land abandonment rates by **2.9%** to **3.1%** in generally. Specially, this influence for the **cluster with unsecure property rights** of land could up to **8.2%**.
- (II) the non-farm employment of households' laborers reduced land abandonment rates by **5% to 7%**. **For the cluster with unsecure land property**, the effect was **20.1%**.
- (III) The extremely fragmental lands reduced land abandonment, but **if the land property rights were unsecure, the fragmental lands had a higher probability of abandonment.**
- (IV) the distance to local business center (town/county) has positive effect on land abandonment rate because of the high transaction cost.

