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Article

Agricultural land conversion, land economic value, and sustainable agriculture: A case study from East Java, Indonesia

Mohammad Rondhi[1]*, Pravitasari A. Pratiwi[1], Vivi T. Handini[1], Aryo F. Sunartomo[2] and Subhan A. Budiman[3]

[1] Department of Agribusiness, Jember University; pravita.anjar@unej.ac.id, vivi.trisna@unej.ac.id
[2] Department of Agricultural Extention, Jember University; aryo.faperta@unej.ac.id
[3] Department of Soil Science, Jember University; sabudiman@unej.ac.id
* Correspondence: rondhi.faperta@unej.ac.id; Tel.: +6281291495040

Abstract: Agricultural land conversion (ALC) is an incentive–driven process. In this paper we further investigate the inter–relationship between land economic value (LEV) and ALC. To achieve this goal, we calculated LEV for agricultural and non-agricultural (housing) uses in two areas in East Java, Indonesia. The first area represents suburban agriculture, facing rapid urbanization and experiencing high rate of ALC. The second area represents rural agriculture with zero ALC. Furthermore, we identified factors affecting LEV in both areas for both uses. The resut of this study show that agricultural land yielded higher economic benefit in rural area. Conversely, comparing to agricultural land, housing creates 7 times higher value in urban area. Moreover, agricultural land shown to create higher profit after converted. Ironically, the similar comparison doesn't exists in rural area. Agricultural land only yielded 19% more value, indicate that agricultural land can be easily converted. It is also proven by the growing number of new urban core in the periphery area. There are several factors affecting land economic value, for agricultural use, soil fertility, accessibility, and cropping pattern are important variables. While accessibility and location in urban area increases land value for housing.

Keywords: Agricultural land conversion; land economic value; urbanization; land rent

1. Introduction

Land is one of the most important aspects of life. In agricultural production, the role of land as the main input is irreplaceable. Economically, land is the most efficient wealth-generating asset for farmer[1,2] and also an important factor for economic growth[3]. However, the limited and unrenewable nature of land supply creates a fierce land–use competition, ussually between agricultural and non–agricultural sector. This gives rise to agricultural land conversion (ALC) which significantly reduces the agricultural land availability and threatens food supply. Irronically, the highest rate of ALC occured in developing countries[4], which characterized by massive population and high food consumption[5]. Thus a proper management of ALC is important for stabilizing food supply.In addition to ALC, another important problem of agricultural land (AL) is the degradation of land quality caused by unsuitable cropping pattern. In the effort to maximize economic gains, farmer tend to overexploit land by cultivating high–value crop which basically unsuitable to land characteristics. Although it produces a high economic return to farmer, in the longer term the land qualitiy will be degraded and thus sacrificing the future food production for short–term economic gains.

In Indonesia, the rate of ALC is 187,720 ha/yr and most of the converted land were used for housing and industrial site development[6]. Housing development accounted for 48.96% of

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converted land, followed by industrial (36.50%) and offices building development (14.55%) [7]. The major causes of ALC in Indonesia is the low incentives received by farmers from agriculture [6]. The rapid urban development in suburban area increases the value of AL for housing and thus gives farmers higher incentive to convert their land. Morever, farmers often perceive selling their land as an opportunity to find more promising job and as an effective way to earn quick cash and invest in other sectors [6]. Hence, in 2009 the Indonesian governement issued a statute to protect and control the rate of ALC under *UU No. 41 Tahun 2009*. The major mechanism proposed to control ALC is by giving incentive to farmer for maintaining their agricultural activity. Specifically, the form of incentives are decreasing land tax, improving agricultural infrastructure, funding research and development of high yield variety, ease of access to agricultural information and technology, providing farm input, securing land tenure, and rewarding farmer achievement [8]. The main intention of this mechanism is to increase the economic value of agricultural activity. Since increasing economic value of agriculture will lessen the likeliness of farmer to convert their land for other use.

However, most of the proposed mechanisms are not inclusive for the majority of Indonesian farmers. Consequently, the effort to increase economic value of agricultural activity is not effective. Hence, it is important to reidentify factors which significantly affect land value to make this policy efficient. Thus, the purpose of this paper is to identify factors affecting land value for agricultural and housing–use. Spesifically, this paper compares land economic value in two distinct areas, rural and suburban. Rural area is the representative of an agricultural economy while suburban area is the representative of a transition economy from agricultural to industrial and service based economy. The selection of rural and suburban area is important because both of those land are protected by *UU No. 41 Tahun 2009*. The regulation protects agricultural land in both area to ensure food security, since most of food in Indonesia produced in land–based agriculture, and most of these land located in rural and suburban agricultural region.

Previous studies on land economic value shown that it significantly affect farmer decision to sell or not to sell their land for non-agricultural purposes. In Europe, the Common Agricultural Policy (CAP), through decoupled payments and environment schemes, increases land value because farmers capitalize CAP payment into land value [9–12]. Those payments increase farmland value and makes farmers unwilling to sell it. Furthermore, the increase in farmland value promote a land use conflicts both between farmers (for agricultural use) and between farmers and non-farmer (for non-agricultural uses)[13]. Moreover, increasing land economic value due to urbanization in Bangladesh makes real estate and individual developer speculate and develop building in restricted area including in productive agricultural land [14]. In Indonesia, the rapid urbanization increases demand for housing resulting in high demand for land for housing development, thus increases the value of agricultural land for non-agricultural use. The increasing land economic value for housing translated into massive ALC and creates an area called suburban agriculture [15]. These studies show that land economic value is the main driver of ALC, however very little study stresses mainly on this issue and thus proposing less focused policy implications.

The main contribution of this paper is that it demonstrates that ALC is driven by differing land economic value (land economic value for agricultural use is lower comparing to other uses). Slightly different from the previous findings which stated that ALC is driven by external factors (e.g. government policies, industrialization, urbanization, etc) or internal factors (e.g. soil structure, fertility, etc), this paper stresses that both external or internal factors may promote or prevent ALC depended on whether they increase or decrese land economic value for agricultural use. If they increase land economic value for agricultural use they will prevent ALC and conversely, they will promote ALC if they decrease land economic value for agricultural use whether it is intentionally or not. The important point is that the effort to prevent ALC will be effective if it focused on increasing land economic value for agricultural use. Thus, the other contribution of this paper is by identifying factors affecting land economic value both for agricultural and non-agricultural use.

The rest of the paper is structured as follows; the next section (**Material and Methods)** describes study area, data and sampling design, and analytical procedure. The third section (**Results)**contains

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the findings of our study. The fourth section (**Discussions)** discusses our finding in the context of previous literature. Finally, the last section (**Conclusion**) concludes our findings, states policy implications and mentions future research needs.

2. Materials and Methods

2.1. Study Area

This study was conducted at two different villages in Jember District (*Kabupaten*) which is located in the Province of East Java (Figure 1). Jember is the typical agricultural region in Indonesia. From a total of 3293.34 square kilometer of land, agriculture accounts for 50.1% of total land use. In Indonesia, the agricultural production concentrated in the island of Java and East Java being one of the main agricultural regions. In East Java, rice production mainly concentrated in Jember. However, Jember's economy is experiencing a structural transformation from agricultural to industrial and service based economy. Consequently, the rate oof ALC in Jember is increasing in the past decade.

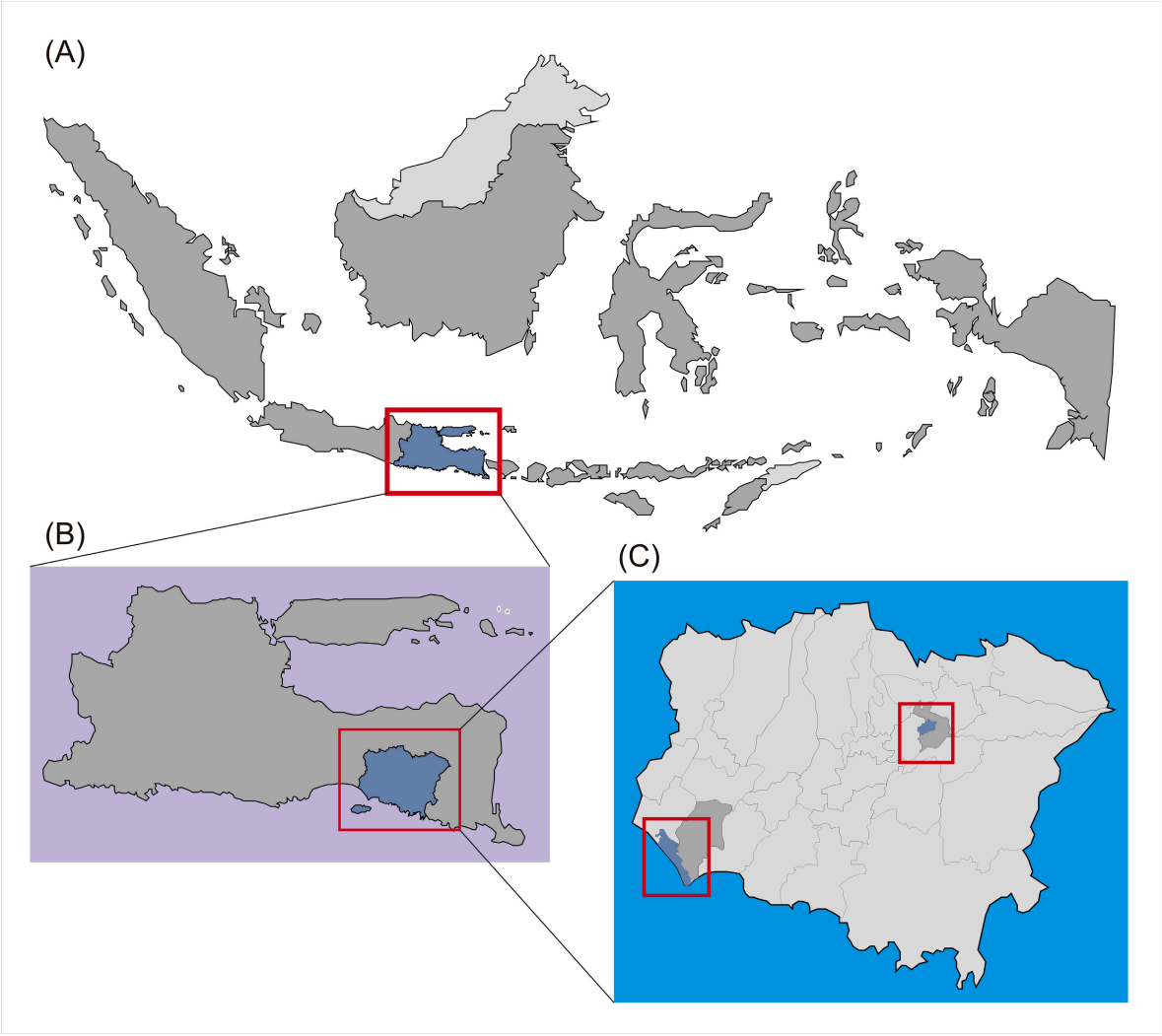

Figure 1 Map of study area, (A) Province of East Java relative to Indonesia, (B) Jember District relative to Province of East Java, (C) Gumukmas (lower) and Sumbersari (upper) Subdistrict.

Between 2009 and 2016, the annual rate of ALC in Jember was 70.77 hectare (0.085%). Most of the converted land were used for housing and industrial development. From 31 subdistricts, ALC occured only in 9 subdistricts, with highest ALC is 8.6036% and the lowest is 0.7687% [16]. However, the pattern of ALC shows some important information. There are 22 subdistricts which do not experienced ALC, however the rate of agricultural growth is zero. It means that there will be

continuing ALC in the next few years. Moreover, Jember municipality area consisted of 3 subdistricts in which the rate of ALC are high, the fact that there 6 others subdistricts which experienced ALC show that there are new urban core. Furthermore, this new urban core were previously an agricultural region. Thus it is important to study land economic value in urban and rural region.

The first village was Kepanjen and located in Gumukmas Subdistrict (*Kecamatan*). Kepanjen is the representative of agricultural economy. Kepanjen has experienced zero ALC during 2009–2016 and the main crop planted are horticulture and food crop (Figure 2). Kepanjen has an area of 14.78 square kilometer and a population of 10,515 inhabitants, resulting in a population density of 711 person/square kilometer.

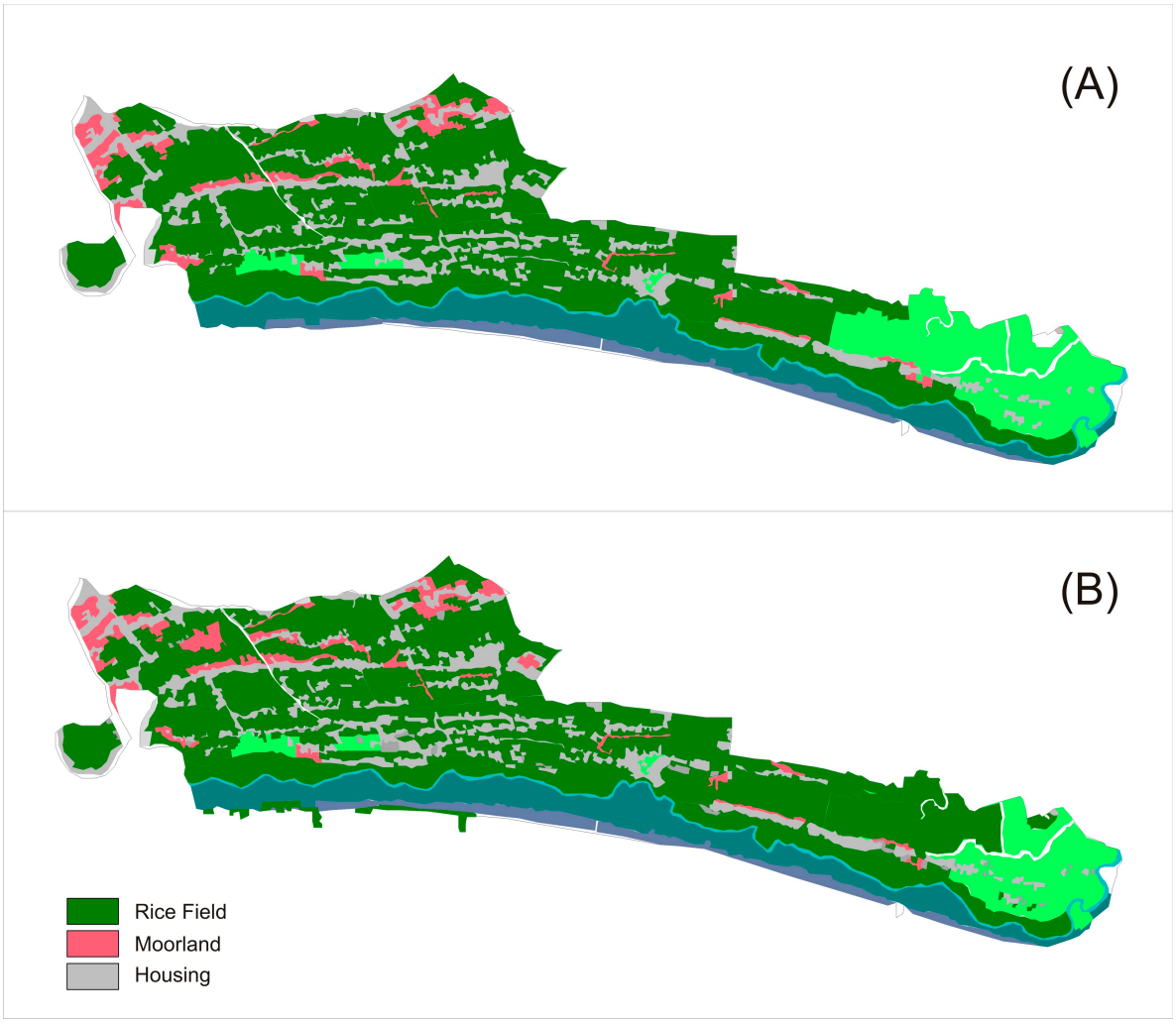

Figure 1 Map of Kepanjen Village, (A) Land use distribution in 2012, (B) Land use distribution in 2017 showing a relatively constant agricultural land and housing.

The second village was Antirogo which located in Sumbersari Subdistrict. Antirogo is the representative of suburban agricultural area. It located 7 km from Jember downtown and has experienced rapid ALC of 8.6% during 2009–2016 (Figure 3). The average rate of ALC in Jember during 2009–2016 was 0.085%, it shows that ALC is concentrated in the suburban area. Antirogo was located 7 km away from Jember dowtown and has population density of 1359 person/square kilometer. The selection of these villages based on practical reason, both villages are agricultural based region, where Kepanjen continue to remain in agriculture while Antirogo demonstrates a significant shift in their economic structure to a more industrialized economy. Both farmer and home–owner in both villages were selected as respondents of this study.

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The sampling procedure used was multi–stage random sampling. In the first stage the population of farmer and home–owner in both villages were enumerated. In the first stage we have identified 6061 home–owners (3011 in Kepanjen and 3050 in Antirogo) and 1839 farmers (783 in Kepanjen and 1056 in Antirogo). In the second stage we randomly selected 50 farmers and 50 home–owners in each village, resulting in total 200 respondents.

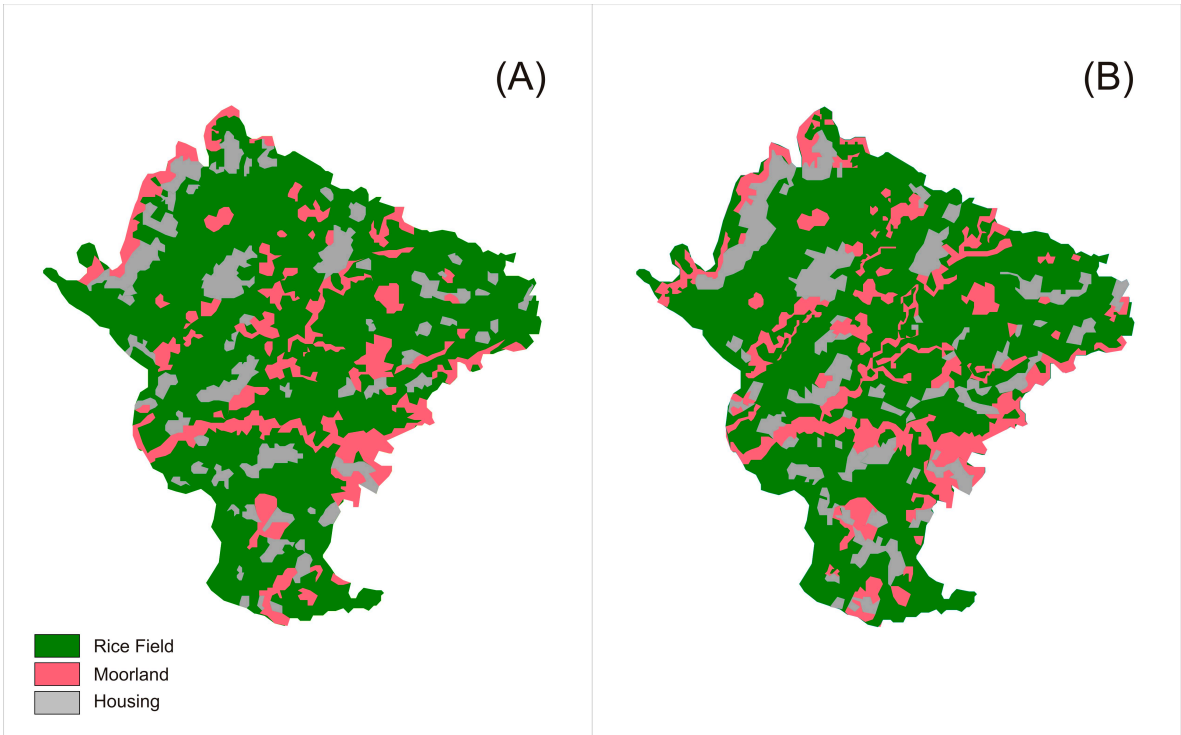

Figure 3 Map of Antirogo Village, (A) Land use distribution in 2012, (B) Land use distribution in 2017, showing a growing land for housing.

2.2. Data

The data used in this study were collected from 100 farmers and 100 home–owners from each villages. The survey was performed between January and June 2018. The survey has two parts, the first part focused on measuring land economic value both for agricultural and housing use while the second part focused on eliciting farmer and home–owner characteristics.

We measured land economic value as the economic rent it produced for a period of one year. Economic rent for agricultural land calculated as profit obtained from farm production in a year. Similarly, economic rent of housing calculated as the amount of rental fee obtained by home–owner from leasing their house for a period of one year after deducted by house operational and maintenace costs.

There are eight variables used to explain farmland characteristics namely, land basic information (land area, land tenure, location), accessibility (distance to irrigation, distance to nearest market, and distance to road), cropping pattern and soil fertility. Cropping pattern in both villages varied, there are 10 patterns in Kepanjen and two in Antirogo. Cropping pattern in Kepanjen are mostly food and horticultural crops and food and seasonal plantation crop in Antirogo. All of these pattern grouped into food crops (dummy value 0) and mixed crops (dummy value 1). Soil fertility determined by directly asking farmer knowledge about their land. The use of self–reported soil fertility level has been found useful since soil fertility level is commonly know by farmer. Soil fertility were grouped into fertil land (1) and less fertile land (0).

The descriptions of farmland data used in this study—full sample, rural and urban area—are shown in Table 1. Although the average differs slighly, rural farmer has wider land possession than their counterpart. It is also shown that agricultural land has easier access to irigation with only 42 m in average, comparing to land in urban area which located 2,053 m away from in average. Both

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distance to nearest market and to road tend to not significantly different, as many farmers both in rural and urban area tend to sell their harvest to collecting trader directly at their plot. Most of land are owned by farmer, 88 percent farmers in both villages cultivate their own land. However, most of them cultivate only food crops all year long, only 33 percent farmers doing mixed cultivation. In realtion to soil fertility, most farmers (82 percent) regarded their land as fertil.

Table 1. Descriptive statistics for farmland.

Variable	Code	Unit	Full Sample				Kepanjen	Antirogo
			Mean	S.D.	Min.	Max.	Mean	Mean
Land area	L.area	m^2	4,005	2,515	1,000	10,000	4,211	3,800
Distance to irrigation	Irrigation	m	1,047	1,681	0	5,000	42	2,053
Distance to nearest market	Market	m	4,250	1,305	2,000	8,000	4080	4420
Distance to road	Road	m	113	147	1	1,000	123	104
Land tenure	Tenure	owner (1), other(0)	0.88	0.32	0	1	1	0.76
Cropping pattern	Crop	mixed (1), food (0)	0.33	0.47	0	1	0.26	0.40
Soil fertility	Fertility	fertile (1), less fertile (0)	0.82	0.38	0	1	0.88	0.76
Location	Location	Urban (1), rural (0)	0.5	0.5	0	1	0	1
Observation			100				50	50

There are six variables used to describe housing conditions in both villages. Information regarding housing land characteristics are summarized in Table 2.

Table 2. Descriptive statistics for housing characteristics.

Variable	Code	Unit	Full Sample				Kepanjen	Antirogo
			Mean	S.D.	Min.	Max.	Mean	Mean
Building area	B.area	m^2	71	26	27	198	74	68
No. of room	Room	m	3	1	2	8	3	3
Distance to road	Road	m	117	170	1	1,000	184	50
Distance to downtown	Downtown	m	6,135	1,670	3,500	10,000	6350	5920
Water availability	Water	sufficient(1), insufficient(0)	0.95	0.26	0	1	1	0.94
Location	Location	Urban (1), rural (0)	0.5	0.5	0	1	1	0
Observation			100				50	50

Both urban and rural house has 3 rooms in average, like typical house in Indonesia. The slight difference exists in water availability, 100 percent rural houses have sufficient water, meanwhile

there 4 percent houses in urban area which do not have access to sufficient water. It shows that urban development not only resulting in agricultural land conversion but also started to degrade water quality. Urban area has easier access both to road and to downtown area, since both of this infrastructures are the result of economic development.

2.3. Econometric Model and Estimation Procedures

As previously mentioned, we calculated land economic value as the rent created by that land when used for agricultural or housing purposes. The economic rent created from agricultural land calculated by Equation 1.

$$l_{at} = \frac{\left[\left(q_{it} \times p_{it}\right) - c_{it}\right]}{L_a} \quad (1)$$

Where l_{at} is agricultural land rent for year t, q_{it} is quantity harvested at season i on year t, p_{it} is the price of harvested crop at season i on year t, c_{it} is the total farming cost at season i on year t, while L_a is land area. While economic rent created from housing is calculated by Equation 2.

$$l_{ht} = \frac{\left[R_t - c_t\right]}{L_h} \quad (2)$$

Where l_{ht} is economic rent from housing at year t, R_t is the rental fee of house for year t, c_t is house operational and maintenance cost for year t, while L_h is the house building area.

After calculating land economic value we then determine factors affecting it. We employed multiple linear regression. There two equations estimated in this stage. The first equation is attempted to determine factors affecting land economic value both in rural and urban area (Equation 3).

$$l_{ai} = \alpha_0 + \sum_{n=1}^{n} \alpha_n x_{in} + \sum_{m=1}^{m} \beta_m D_{im} + u_i \quad (3)$$

Where $i = 1...100$, l_{ai} is agricultural land value, x_n is quantitative variables, D_m is qualitative variables, and $\alpha_0, \alpha_n, \alpha_m$ are regression intercept, coefficients for quantitative and qualitative variables respectively. The description of each variable and their summary statistics are shown in Table 1. The second equation were used to estimate factors affecting land economic value for housing and shown in Equation 4.

$$l_{hi} = \alpha_0 + \sum_{n=1}^{n} \alpha_n x_{in} + \sum_{m=1}^{m} \beta_m D_{im} + u_i \quad (4)$$

Where $i = 1...100$, l_{hi} is land economic value for housing, x_n is quantitative variables, D_m is qualitative variables, and $\alpha_0, \alpha_n, \alpha_m$ are regression intercept, coefficients for quantitative and qualitative variables respectively. The description of each variable and their summary statistics are shown in Table 2. The data used in this study has been tested for autocorrelation, heteroscedasticity, and multicollinearity. The estimation of these equation were based on ordinary least square estimation and the estimation processes were conducted with SPSS Software (version 25; SPSS Inc., Chicago, IL, USA)

3. Results

3.1. Land Economic Value

Land rent analysis revealed that urban area has lower value for agriculture but higher value for housing (Table 3). The average agricultural land value in urban area is Rp 4,447/m²/year ranging between Rp −416/m²/year and Rp 10,975/m²/year. Meanwhile, in rural area it averaged at Rp 6,047/m²/year ranging between Rp 1,600/m²/year and Rp 19,504/m²/year. Conversely, the average housing land value in urban area is Rp 39,904/m²/year with a wide range of Rp 7,917/m²/year and Rp 142,188/m²/year, it is 7 times higher in average comparing to the conditions in rural area. In rural area, housing value only averaged at Rp 5,059/m²/year ranging between Rp 278/m²/year and Rp 14,908/m²/year. There is a negative value in urban agriculture, it means that there is farmers who choose to remain in farmland even at the expense of farming profits. While urban housing yielded 7 times higher value, the similar condition doesnt exists in rural agriculture where agricultural land yielded only 19% higher value.

Table 3. Land economic value for agricultural and housing purpose in the study area

Land use	Unit	Rural Area			Urban Area			Full Sample
		Mean	Min.	Max.	Mean	Min.	Max.	Mean
Agriculture	Rp/m²/year	6,047	1,600	19,504	4,447	−416	10,975	4,997
Housing	Rp/m²/year	5,059	278	14,908	39,954	7,917	142,188	22,312

Although most farmers cultivating food crops all year long, we found various cropping pattern and each cropping pattern has different economic value (Table 4). In rural area, non food crop pattern are mixed with horticular crops, while in urban area non food crop pattern only mixed with seasonal plantation crop which is tobacco. The land value reveal that non food cropping pattern yielded higher value. However, only 26 percent farmers in rural area and 40 percent in urban area who cultivated non food crops. Both horticultural and seasonal plantation crops require high farming costs and also have greater production and price risks. Thus only wealthier farmers who able to bear greater farming costs and risks. On the other hand, the growing number of commercial farmer in rural area who cultivated horticultural crops are bringing potential problem. Motivated by high economic gains, they tend to overexploite land by cultivating horticultural crops which basically unsuitable to land characteristics. Although generated high value, this practices will degrade soil quality in the long term.

Table 4. Land economic value of agricultural land under different cropping pattern

Location	Cropping Pattern	Number of farmers	Cropping season			Yearly average
			1st	2nd	3rd	
Rural	paddy, paddy, paddy	7	2,049	1,825	1,649	5,477
	paddy, paddy, maize	22	1,786	1,711	1,442	4,893
	paddy, maize, maize	5	2,428	2,068	1,912	6,336
	no crop, paddy, paddy	1	0	1,521	1,455	2,907
	no crop, paddy, maize	2	0	1,585	566	2,111
	paddy, maize, chili	4	1,434	1,196	715	3,303
	paddy, maize, bittermelon	2	2,164	1,637	7,273	10,988
	paddy, bittermelon, bittermelon	2	3,288	4,438	4,438	12,072
	no crop, paddy, chili	3	0	2,932	2,704	5,603
	paddy, chili, chili	1	1,024	332	332	1,600
	paddy, bittermelon,chili	1	2,445	6,723	10,399	19,503
Urban	paddy, paddy, maize	30	1,421	1,590	706	2,738
	paddy, paddy, tobacco	20	1,106	1,336	4,694	6,777

In rural area, the houses are located only in land previously intended for housing purpose. Conversely, there are houses built in converted land previously used for agricultural production. The result of analysis reveal that agricultural land yielded higher economic value after converted (Table 5). In average converted agricultural land yielded Rp. 7,917/m²/year ranging between Rp. 7,917/m²/year and Rp. 42,230/m²/year. It is significantly higher than when it was retained as agricultural land. Thus, it is logical for farmer to convert their land since it give higher benefit than remaining in agriculture.

Table 5. Land economic value for converted agricultural land

Land origin	Economic value (Rp/m²/year)		
	Mean	Minimum	Maximum
Converted agricultural land	7,917	7,917	42,230
Housing	45,063	45,063	142,188

3.2. Factors Affecting Land Economic Value

Ordinary least square estimation revelead that many variables affect economic value of land used for agricultural and non agricultural purposes. Table 6 presents estimation results of Equation (3) and (4). The F test for the overall fit of both model are shown in Table 4. It tests the null hypothesis that all coefficients in the models are 0. Since the F test p value for both models are $p < 0.05$; $p = 0.000$, the null hypothesis that all variables coefficients are 0 is rejected. Thus, it can be concluded that the model is better at estimating land economic value for both agricultural and housing use. The explained variance of dependent variable can be measured with R^2 value. The R^2 value of the first model is 0.656 indicates that 65.6% of agricultural land value variation can be explained by the model. The R^2 value of the second model is 0.640 indicates that 64% of housing land value variation can be explained by the model.This percentage is satisfactory since the models didn't violate the normality, multicollinearity, homoscedasticity and linearity assumptions.

Table 6. Estimation results

Agricultural land			Housing		
Variables	Coefficients		Variables	Coefficients	
Intercept	8,890.691	***	Intercept	4858.626	ns
L.area	−0.151	*	B.area	−108.330	ns
Irrigation	−0.338	**	Room	3206.109	**
Market	−1.052	***	Road	−0.166	ns
Road	−4.145	***	Downtown	−8.975	***
Tenure	186.858	ns	Location	83696.221	***
Crop	1,950.186	***			
Fertility	987.133	*			
Location	−0.151	*			
R^2	0.656		R^2	0.640	
F test	21.648	***	F test	33.450	***
Observation	100		Observation	100	

note, ***= *p<0.01*, ** = *0.01>p>0.05*, * = *0.05>p>0.1*, *ns = p>0.1*

The first model shows that 7 out of 8 variables estimated have significant p values. As expected land area has a negative coefficient, thus the larger the land the lower its economic value. Since a larger land will require largest farming cost, promoting cost–minimizing behaviour, resulting in lower productivity. Accessibility variables provide result as expected, the further the farmland from irrigation, nearest market, and road the lower land value is. Although much of the selling of harvested crop occured in farmland, the seller ussually charges larger transportation cost. Cropping pattern significantly affect land value, where non food crops in average generated Rp

1,950.186/m²/year higher value comparing to food crops pattern. Soil fertility also reported to increases land economic value by Rp 987.133/m²/year in average. Furthermore, as expected, farmland located in urban area generated less value comparing to those in rural area. However, land tenure doesnt significantly affect land value. The explanation for this result is that all farmers from rural area cultivated their own land, resulting in little variation in the data.

The second model shows that 3 out of 5 variables estimated have significant effect to housing land value. Number of room and accesibility to downtown area shown to be significantly affect land value. Most house renter in studied area prefer the number of room than the size of building, since most of them rented house in group. Thus, the greater the number of room the greater economic value it generated. Furthermore, people in prefer nearest location to downtown area since most of their activity conducted there. Furthermore, as expected, house located in urban area generates Rp 83696.221/m²/year higher value comparing to those located in rural area.

4. Discussion

4.1. Land Economic Value and Agricultural Land Conversion

The main purpose of this study was to calculate land economic value in rural and suburban area. The point of conducting this study in these areas was to compare land economic value in an area with zero ALC (rural) and area with high ALC (suburban). Our result demonstrates that there is a significant different in land economic value in these areas. In rural area, land creates more value when used for agricultural purposes. While in urban area, it creates higher value when used for housing purpose. However, although creating higher value, agricultural production has only 19% higher value comparing to housing use. Significantly different with the condition in urban area, where housing use has 790% higher value.This significant difference indicates that there is a strong pressure for agricultural land in suburban area. Furthermore, it also indicates how likely the land use will evolve in the future. It suggests that ALC rate in suburban area will continue to increase and remove agricultural use completely as has happened in Italy (See Table 3 and 5) [17].

Previous studies oftenly relate ALC to rapid urbanization and economic development in urban area [18–22]. A common view is that urbanization means more people living in the urban area, increasing the demand of land for housing. As a plain land, agricultural land has always been converted to meet this demand. The suburban area in our study demonstrates a similar conditions. As Jember economy continue to growth and transform into an industrial and service based industry, it promotes rapid urbanization. However, the benefits rendered by this growth yielded a negative impacts, specifically to farmers. Farmers oftenly converted their land because of incentive received from agricultural sector is much less than in other sector. Moreover, high land price for housing motivate farmer to sell it for cash. Although farmers receive high compensation from selling land, they are actually facing difficulty in managing it for investments [23]. In addition, although currently rural area record zero ALC, the narrow difference in land economic value indicates that ALC can be happen anytime in the future. Since farmers tend to not willing to sell their land only when they receive high economic value from it [9,10,10–12].

4.2. Factors Affecting Land Economic Value

The next result of our study on factors affecting land economic value supports the findings of previous studies. We found that land area decrease land value both for agricultural and housing use. This result is in line with the finding of [24–28], the economic value decrease with the increase in land area. Both wider agricultural or housing use require higher input and cost, thus offsetting the revenue. Furthermore, in urban area, farmer with more land tend to use family labor to minimize labor cost, this resulted in lower productivity. While in rural area, farmer with more land tend to cultivate low risk low revenue crop such as rice and maize. Conversely, farmer with smaller land tend to maximize their income by cultivating high value crop such as horticultural crop. While for housing, larger house require higher maintenance cost. In addition, the demand for larger house is

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not as high as demand for smaller house since the house tenants tend to be a small family who prefer lower rental cost than large sized house.

The accessibility variables (distance to irrigation, to nearest market, and to road) show negative effect. This result is in line with the results from [27–30]. Distance to market tend to put a negative effect on land value [31–34]. Similarly, distance to irrigation and to road has a negative impact on land value [35–37]. Specifically, irrigation at the study area required greater fee for plots located far from irrigation canals. Similarly, distance to road increase the transportation cost of farm production as well as increasing the difficulty of access.

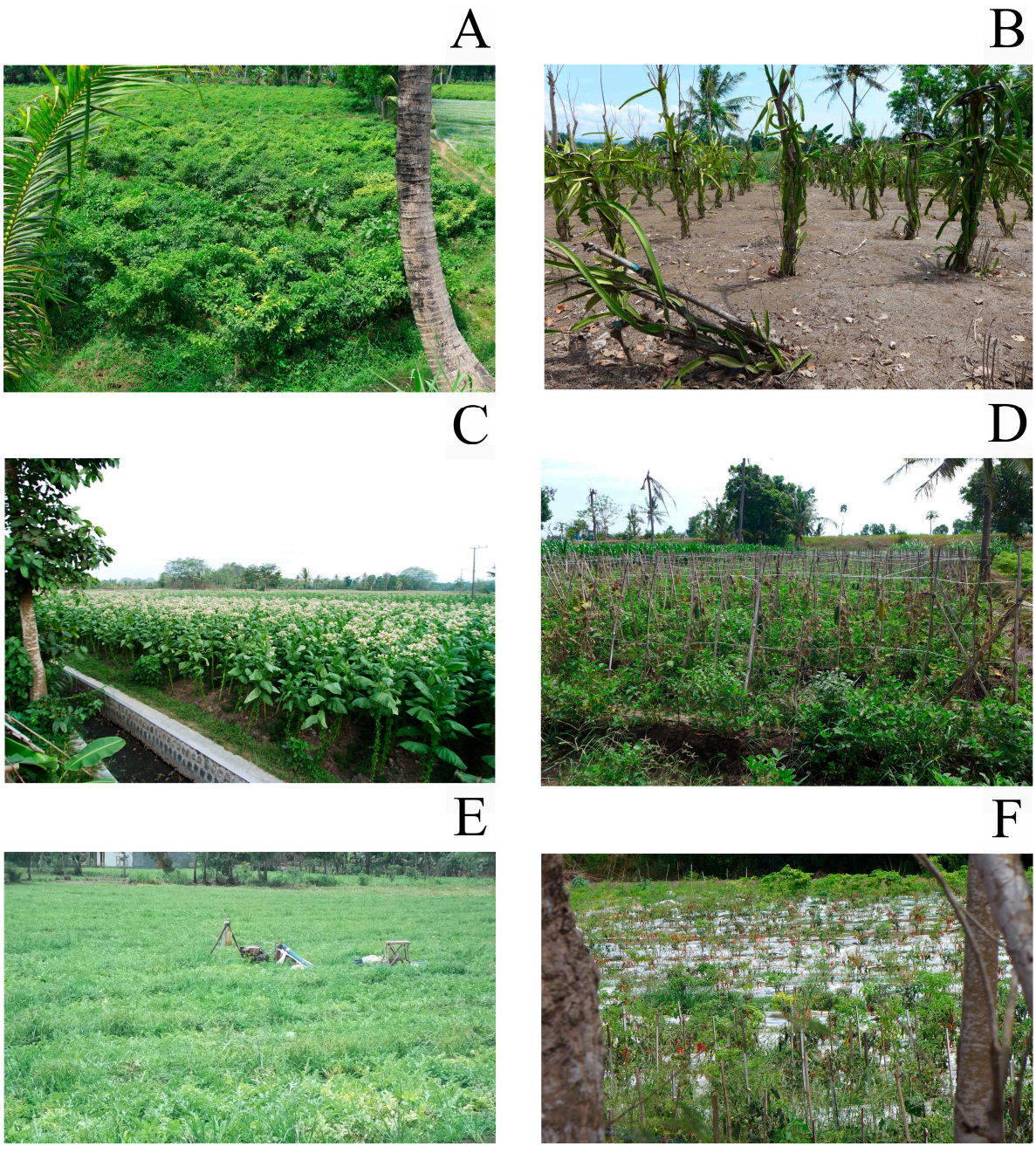

Figure 4 Horticultural and seasonal plantation crops, (A) Cayenne pepper in Kepanjen, (B) Dragon fruit in Kepanjen, (C) Tobacco in Antirogo, (D) Bittermelon in Kepanjen, (E) Water melon in Kepanjen, (F) Chili in Kepanjen

This study identified three cropping seasons annually and most farmers apply crop rotation, only 1% of farmers do not apply crop rotation. Crop rotation found to be positively affect land value, which means that land cultivated with various types of crops in one year (horticulture or

plantations, see Figure 4) has higher economic value those cultivating only food crops. The difference in types of crops significantly affects land value, because it is directly related to the output produced as well as the price of output [32,38]. We found more cropping pattern in Kepanjen than in Antirogo. Land suitability is the major cause of this difference, Kepanjen has more crops suitable for a variety of cropping. Furthermore, more farmer in Kepanjen tend to maximize their farm income by cultivating high–value crops. Variable closely related to cropping pattern is land fertility. Measured based on farmer knowledge, land fertility has positive effect on land value, just as has been shown by previous studies [25,32,36,38,39]. Moreover, agricultural land in rural area tend to be more fertile than those in the urban area.

Location dummy (whether the plots located in urban or rural area) also has positive impact on land value. The previous result presented that agricultural land in rural area has higher value. To find out whether it is true that location of agricultural land will statistically affect land value, location was entered as a dummy variable. The results show that statistically, location significantly influence land value. The negative sign strengthens the results that the agricultural land in rural has higher value. This result is different from the study of [32] and [25] which stated that agricultural land close to downtown Buenos Aries and Walles is of higher value. This is caused by the difference characteristics of land located in urban and rural areas. These characteristics are cultivated plants.. Horticultural commodities cultivated in rural area have high selling value, moreover, the land in this area are fertile (90% of the respondents stated the land in the fertile region), this causes higher income. While agricultural land in urban area according to 24% of the farmers are infertile, even though they planted with tobacco, the yield per unit of land is not too high.

4.3. Policy Implications

Finally, although this study was conducted at the village level, the result can be generalized to the conditions of other area. The similarity of results with the findings of previous studies in all over the world show that this study can be generalized to the extent of the generated result. There is a strong basis to support the hypothesis that ALC is driven by the significant difference in land economic value for different purpose. We predict that in the future ALC in urban area will continue to increase since the the demand for housing is not showing any sign of decrease. In addition, we stated that in rural area, although currently experiencing zero ALC and also agricultural production playing a central economic role, there is a possibility that ALC will occur in the future. The slight difference in land value in rural area shows that the resistance to convert agricultural land to non agricultural use is weak.

However, there are two exceptions to this. First, in urban area, the minimum value for agricultural land has negative sign. It means that there are farmers who choose to preserve their land even at the expense of profit. As shown by [40] that there are a growing number of farmers who choose to remain in farming and do not participate in land speculation and real estate market (urban farmer). The importance point of this farmers is that they tend to retain their farmland and thus preventing ALC. A systematic identification of this farmers and a targeted incentive for their farming activity will surely increase their motivation in farming. Second, in rural area, although the economic value generated by farming is only a little higher than housing use, farmer started to cultivate high value crop. It shows that there is a shift of motive in farming at rural area from subsistence to commercial farming. If the number of commercial farmer increase, the possibility of ALC in rural area will be significantly low.

In the context of Indonesian National Policy, agricultural sector faces a difficult problem in relation to ALC. As a developing contries, Indonesian economic and demographic structure experiencing rapid transformation into a more industrialized and modern society. Consequently, the need for land whether for housing or industrial purpose is high. On the other hand, there is strong need to preserve agricultural land to support food security. Thus, preventing ALC and preserving agricultural land require a properly planned policy. Based on the result of this study we suggest three options that can be used to control ALC in rural and urban area in the farmework of land economic value.

1. The current incentive mechanism contained in *UU No. 41 Tahun 2009* should be focused on farmer in urban area, specifically to those who choose to remain in farming even at the expense of profit (urban farmer). Since the current incentive mechanism require proactive and highly motivated farmer.
2. There should be an effort to encourage farmer to cultivate crop which is suitable to land characteristics. Although cultivating high value crop actually increase land value, however, land quality (fertility) will be degraded if the land is forced to produce crop which is basically unsuitable to its characteristics [41,42]. This is one of the major causes of land quality degradation. Since land fertility is proven to be positively affect land value both theoretically and empirically, uncontrolled land quality degradation will sacrifice the sustainability of agriculture itself. Thus, it is important to conduct a detailed analysis on land suitability for cropping pattern especially in rural area. This should be a main agenda in the framework of increasing agricultural land economic value in rural area.
3. The growing number of commercial farmer in rural area should be supported with access to timely information regarding market conditions and farm technology. Commercial farmer tend to be more responsive to new information and technology. Thus, improving their access to technology will further improve their farming productivity [43,44].

5. Conclusions

This study attempted to measure the economic value of land in rural and urban area both for agricultural and non–agricultural use. The main thesis of this study is that land value is the main driver of agricultural land conversion. The higher the value of agricultural land for agricultural use will prevent land conversion and vice versa. The result of this study support the previous thesis. In urban area where the demand for housing is high, land value for housing use increases rapidly, thus promoting agricultural land conversion. While in rural area, where agriculture is the main economic activity, agricultural land has higher value. We also found the emergence of urban farmer who choose to remain in farming and retain their farmland even at the expense of profit. In rural area, there is a growing number of commercial farmer who easily rotate their cultivated crop with high value one, although receiving high economic return, they tend to neglect land suitability resulting in the potential degradation of land quality.

Finally, we propose further research direction based on the result of this study. This research direction will provide information in an effort to increase land economic value for agricultural use to prevent and control ALC. The required further research are,

- It is required to systematically identify the characteristics of urban farmer and explore thoroughly what motivate them to remain in farming and retain their farmland.
- It is needed also to identify the characteristics of commercial farmer in rural area and trace how they acquire information regarding market conditions and technology that they used in making farm decision.
- Finally, it is important to identify agricultural land suitability analysis and measure the economic benefit to cultivate crop which suitable with land characteristics.

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