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Effects of socio – economic factors on agricultural land use in Malaysia

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ABSTRACT

A study is conducted to investigate the effects of socio economic factors on agricultural land use in Malaysia. Relevant socio – economic variables for the study were aggregated from the databases of various international and national agencies such as FAO, Index Mundi and Malaysian Departments of Agriculture and Statistics. These data were subjected to statistical analysis using stepwise regression method in SPSS version 18. Findings indicated that, relevant socio – economic factors in agricultural land use in Malaysia are available workforce in the population and their working conditions in the agricultural and non – agricultural sectors. This study has revealed that labour supply and their conditions of service are major factors in agricultural land use in Malaysia. This study further underscores the need for greater application labour saving technology in agricultural practices given the competition between agricultural and non – agricultural uses of available workforce in the population.

Introduction

Malaysia is divided into three main regions: Peninsula Malaysia, Sabah and Sarawak. The approximate locations of the three regions are: Peninsula: 6^0 45^1 and 1^0 20^1 N latitudes and 99^0 40^1 and 104^0 20^1 E longitudes; Sabah: 4^0 00^1 and 7^0 00^1 N latitudes and 115^0 20^1 and 119^0 20^1 E longitudes and Sarawak: 0^0 50^1 and 5^0 00^1 N latitudes and 109^0 35^1 and 115^0 40^1 E longitudes. The neighbouring countries are Thailand and Brunei on the north and Singapore and Indonesia on the South. Figure 1 shows the location of Malaysia in relation to her Asian neighbours.

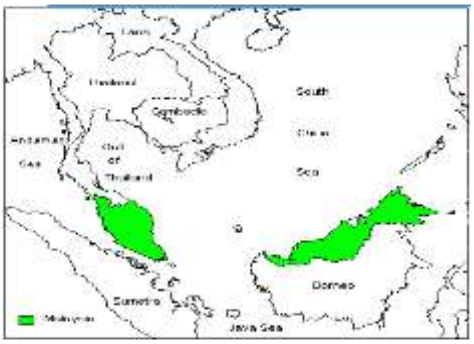

Fig. 1 Geographical location of Malaysia in relation to her Asian neighbours

Climatically, Malaysia, experiences heavy rainfall of about 2,540 to 5000mm per annum (Dale, 1959; Andriesse, l968). The average daily temperatures and relative humidity are 21 - 32°C and 85 percent respectively (Nieuwolt, et al. 1982). Anon (1992) found that the topography of Peninsular Malaysia is characterized by the central mountain ranges running from north to south.

Malaysian soils are acidic and highly weathered Ultisols and Oxisols (International Board for Soil Research and Management - IBSRAM, 1985) of characteristically low pH (3.0 - 4.5); low base saturation; low Nitrogen, Sulphur, Molybdenum and Boron, Copper and Zinc (Nieuwolt, et al. 1982). Malaysia has a land area of 32.98 million ha with approximately 15.56 million ha (47 percent) of the land being arable. Of this arable land, Peninsula Malaysia has 8.10 million ha, Sarawak has 5.31 million ha while Sabah has 2.15 million ha.

However, since 1991, there has been inter crops and inter sectoral competition for land use meaning there have been changing land use between different crops and sectors of the economy to the extent that the future food security of the country is becoming threatened (DoA, 2003; Lim and Chan, 1993).

For, instance, analysis of the land use change by the Department of Agriculture, DoA between 1985 to 2010, as shown in Table 1, indicated that the land use by rubber, cocoa, coconut, paddy, pepper and tobacco has been reducing while the corresponding land use by vegetables and fruits have been increasing. This land use change have been motivated by change in the population's taste, income and improved standard of living (DoA, 2003).

Land use and cover changes cannot take place independently but have certain linkages with the human and natural activities that drives them (e.g., climate change). Understanding the dynamics of land use change has increasingly been recognised as one of the key research imperatives in global environmental studies (Lambin, et al. 1999; Geist, et al. 2001). The monitoring of such changes would be useful when it is accompanied by the understanding of the forces that propel the processes (Lambin, et al. 2000; Serneel, et al. 2001; Wu, et al. 2001). This task could be achieved by a statistical modelling, 'Panel analysis', which links the changes in dependent variables (land use) during a certain interval of time with the changes in independent variables (socio-economic factor) in the corresponding interval of time across a large number of localities (Lambin, 1994; Kok and Veldkamp, 2000; Wright and Samaniego, 2008).

This analysis postulates a linear relationship between the dependent and independent variables and can be expressed mathematically as follows (Kleinbaum, et al. 1976 and 1998; Lambin,1994):

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$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \ldots\ldots\ldots\ldots\ldots 1$$

where :

Y is the dependent variable,

$X_1 \ldots\ldots X_n$ are the independent variables,

β_0 is a constant

βn are regression coefficients and

ε is the random error component.

The adjusted coefficient of R^2 is a measure of the amount of variation in land use type that can be explained by the independent variables (driving factors). The standardized betas (coefficient) of the individual variables indicate the relative importance of a variable in the explanation of the percentage of a land use type relative to the other variables. In empirical land use analysis, spatial autocorrelation (Anselin, 2002; Munroe et al. 2002) due to trends of the underlying factors, land tenure structure, agglomeration effects and imitation among farmers (Verburg, et al. 2004) and multicolinearity between drivers of land use can be minimized by applying stepwise regression analysis and variables that show multicolinearity will be removed from the regression equation (Kok and Veldkamp, 2000).

Few studies have been conducted on land use and its potential driving forces in Malaysia (Othman, et al. 2009; Kamaruzaman, 2009). The existing works were carried out on small study area thereby making the generalization of their findings for entire Malaysia unacceptable. This study is, therefore, conducted to take a country - wide look at the socio - economic variables affecting agricultural land-use in Malaysia in order to gain a better understanding of the factors and thus provide essential knowledge for taking appropriate policy actions in achieving sustainable agricultural land use in the study area.

Literature Review

The studies of land use dynamics make important research in the academic and political circles. For instance, the study of implication of agricultural land use (ALU) change is very crucial in that, if the amount of land to be converted to non agricultural uses under the expected economic and population growth is too high, a threat to food security may occur. (Brown, 1995). Therefore policy makers may ask the urban land planners to create an alternative plan for the foreseen urbanization and population expansion (Xiangzheng, et al. 2009).

Human use of land for cropping, forestry and urbanization affects the structure, functioning and the interactions between ecosystems components and is capable of causing global environmental change and threats to global food security (Vitousek, et al. 1992; Brown, 1995; Turner, et al. 1994).

Modelling of the land use change taking cognizance of the socio-economic drivers provides opportunity for exploring the extent and location of land use and its effects (Verburg, et al. 1999).

Land use is a result of the complex interaction between human and biophysical driving forces that acted over the spatio temporal scales (Verburg, et al. 1999).

While it is easy to measure LU at a given site and relating this to their spatio temporal drivers, it is however, difficult to aggregate these changes at a regional or global scales because aggregated assessments obscure the local variability of geographical situation and lead to underestimation of the effects of LU for certain region (Verburg, et al. 1999).

Drivers of Land Use Change

Several literatures exist on the proximate drivers of land use and land use change processes. (Angelsen and Kaimowitz, 1999; Cunha da Costa R., 2004) arable land conversion (Xie, et al. 2005), pasture expansion (Wassenaar, et al. 2007), methodological challenges (Busch, 2006; Lambin et al. 2001; Burgi et al. 2004) and development of land – use indicators (Farrow and Winograd, 2001). Five major types of driving forces that influence landscape development have been identified by (Hesperger and Burgi, 2007; Verburg, et al. 2004; Geist and Lambin, 2002) as follows:

- natural: soil characteristics and drainage conditions;
- socio-cultural: demography, lifestyle and historical events;
- economic: market structure, accessibilities and consumer demands;
- political: policies e.g. nature conservation and infrastructure development;
- technological: mechanization,

Population Growth

Population distribution and associated demographic is considered important factors affecting land use distribution. Population growth has been cited severally as the proxies of drivers of land use and land cover changes ((Bilsborrow and Okoth Ogondo, 2005; Turner, et al. 1993; Heilig, 1994). The need to supply food, infrastructures and housing to the teaming population will lead to the development of new townships in fallow land around the existing cities (Mahapatra and Kant, 2005) and its main effect is to cause cropland encroachment on forestland and related resource degradation (Yin and Li, 2001). Population parameters are commonly expressed in form of age, location and activities distribution, the rate of change by age, location and activities over time, mortality and fertility rate, level of education, dependency ratio etc

Agricultural Growth

Growth in agricultural production in developing countries are either accomplished by expansion of the agricultural areas or intensification. Barraclough and Ghimire, 1995; DoA, 2003; Wunder, 2000; have identified commercial agriculture, farm settlement schemes, cattle ranching and shifting cultivation as the major sources of agricultural expansion to new areas in Malaysia. Investment in agriculture has also been argued to be an important variable in agricultural land use because agricultural investment is a proxy for the value of agricultural land. (Firman, 199; Seto and Kaufmann, 2003). This variable is captured by specifying the amount of land use per agricultural activities relative to non – agricultural uses, the physical condition and chemical characteristics of the sites occupied by agricultural activities etc.

Economic Growth

Theories have been postulated that economic growth is capable of having either positive or negative influence on ALU. For instance, if the economy is stagnating, people tend to explore land resources wantonly for survival (Limey, 1997; Myrdal, 1957 and Brundtland, 1987) and conversely, economic growth tends to create land intensive activities (Angelson, 1999), therefore, increase in income will reduce pressure on land use (Rudel and Roper, 1997) or otherwise, increasing income can increase the demand for agricultural and forest products (vegetables and fruits – due to change in taste) for domestic and industrial uses (Kant and Redntz, 1997), and hence lead to the expansion of the agricultural land (Mahapatra and Kant, 2005). Therefore there is the need to study the specific situation to be able to explain the effect of growing or stagnating economy on agricultural land use change. Economic growth in land use analysis is usually expressed by the GDP or GNI per capita and the percentage change of GDP and GNI per capita over time.

Labour Dynamics

Urbanization can be perceived as a break from Malthusian dependence on natural resources to that of less dependence on natural ecosystem and the start of modern economic growth (Lucas, 2000). This further entails a variety of contemporaneous changes, such as rising productivity, sectoral shifts in employment, output, expenditure, and demographic transition (decrease in mortality and fertility and the age structure of the population) (Kuznets, 1973; Williamson, 1988). Economic growth initiates urbanization which further results to the release of worker from farm activities to non-farm activities. Therefore, as the national economy progresses, there is a movement of workers from agricultural sector to non agricultural sectors and this has great implication for a land use dynamics. Therefore, in land use analysis labour related variables are captured in form of the ratio of labour engaged, the return per unit labour and the rate of change of labour engaged in farm and non - farm activities.

Road Development

Road development has been considered as an important factor in land use and land cover change because of its direct and indirect effects on land cover changes. The opening of a new area for new roads results to increased accessibility, reduction in transportation cost and land speculation and hence the development of land areas around and along the fringes of the roads which might hitherto undeveloped (Schneider, 1995). Road density (km road per km2 land mass) is commonly used measure to capture this variable in a land use study.

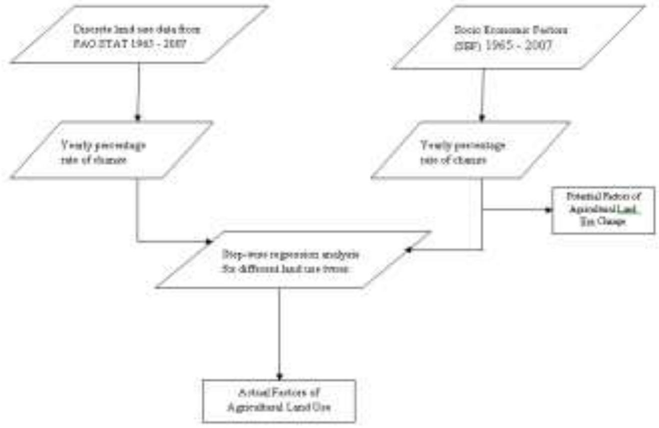
Methodology

The method adopted in the research is shown graphically in Figure 2. The country-level land use data (dependent variable) and the corresponding socio-economic data (independent variables) from 1965 to 2007 were aggregated and imputed into SPSS version 18, a software for multivariate analysis. Taking into account different land use as dependent and socio-economic data as independents variables, within a confidence level of 0.05. Data on various land use types in Malaysia were obtained from on-line databases of the FAO Statistics Division (FAOSTAT, 2004), the Global Forest Assessment database (FAOSTAT, 2001), and the Global Land Cover Facility (GLCF, 2002). Studies on land use and land cover changes have applied the variable as both quantitative (absolute land area under different uses – discrete variable) and qualitative variable (as a percentage of every land use type over total landmass - continous) but the use of percentage of each use type/total land mass can be a better because this make the variable to be comparable over time. Therefore, land-use patterns were derived from these data by converting all the data into percentages of total area and these were constructed into 8 land-use types: built-up land, permanent crops, permanent pasture, nonpermanent arable land, timber plantations, natural forest, nonarable land, and water surface. Non - arable land was calculated as the remainder of total land area and land types.

Socio - economic data were aggregated from the Malaysian Department of Statistics 1965 to 2007. The list of socio – economic data employed in this study is shown in Table 2.

Kolmogorov-Smirnov test was used to evaluate the null hypothesis that SEF has no effect on ALU. The hypothetical socio-economic (SEF) drivers of agricultural land use (ALU) are investigated with multiple regression methods. First, the most important land use drivers (independent variables) for different land use types (dependent variables) are selected from a set of hypothetically important variables by means of stepwise regression. The selected significant variables are then used to construct multiple regression models.

Figure 2: Research Framework



multiple regression models was built to interactively minimize collinearity among the independent variables in the final model. The initial regression models included all independent variables. Independent variables with the least significant regression coefficients (largest P-values) were then successively removed. Collinearity was evaluated when all remaining regression coefficients were significant. If collinearity was present, multiple regression models was compared for all possible combinations of the collinear independent variables and selected the final model to minimize collinearity (all condition indices < 15) and maintain the adjusted squared multiple R. Of these models, the adjusted coefficient of determination is a measure for the amount of variation in the type of land use that can be explained by the respective independent variable. The standardized betas of the individual variables indicate the relative importance of a variable in the explanation of the land use type relative to the other variables.

Discussion of the Results

The results of the multiple linear regression of the land use on the independent variables are presented in the Table 3. The result clearly indicated that there is very high correlation between agricultural land use (ALU) and the socio economic factors. For all the land use types (LUT) considered, the adjusted R^2 is between 0.691 and 1.000 indicating that the independent variables considered adequately explained the dependent variables.

From Table 3, agricultural land use (ALU) is shown to be negatively correlated with workers on rubber plantation. This shows that the ALU is majorly impacted by labour scarcity and this equation suggest that labour are being released from rubber plantation into other agricultural practices particularly now when the cultivation of rubber is not popular with Malaysian government. In order to underscore the importance of labour scarcity in plantation agriculture, report from Malaysian Department of Agriculture DoA, (1998) indicated that about 400,000 hectares of agricultural land were idle and about 300,000 hectares of rubber holdings were untapped and 30,000 hectares of oil palm were not fully harvested between 1998 – 2010. The reason for this because a unit labour has a higher economic returns in the manufacturing sector than in the agricultural sector. For instance, it had been documented that labour productivity in agriculture is only about 60 per cent of the labour productivity in the manufacturing sector (DoA, 1998).

Y_1 = 8641.379 – 19.135 X_1……………………………………….…….(2) (0.933)

Furthermore, the regression estimate of permanent crop shows that permanent crop is positively correlated with agricultural area. Indicating that the permanent crop will occupy 70.1% of every new agricultural area cultivated. There is the need to address this trend of growing permanent crops to the detriment of food crops. This trend has been identified as the cause of rising food import bill, DoA, (1998). Though it has been found that it is economical for Malaysia to import food (rice) however, it will be dangerous for a country to over – depend on importation for her food supply particularly that the global supply is limited with competition among buyers and uses.

Y_2 = 239.542 + 0.701 X_2…………………………………… (3) (0.999)

The regression estimate of forestry shows that forestry is positively correlated with workers on rubber plantation. This is an indication of the successful practice of agro – forestry between rubber and forestry and lately there is a consensus among the scientific communities that categorises some tree crops such as rubber plantation as a forest.

Y_3= 5417.212 + 9.968 X_1…………………………………… (4) (0.786)

The regression estimate of oil palm plantation is positively correlated with the age strata of the population (above children category that is the working class category) implying that working class of the population is a crucial factor in oil palm land use.

Y_4 = -1.09E7 + 843.995 X_3…….…………………..…(5) (0.983)

The regression estimate for cocoa plantation showed that cocoa cropping is positively correlated with workers on cocoa plantation an indication that labours force play a crucial role in cocoa farm land use. Although it is recognized that labour force participation generally declines as age increases. Yet, the economic activities of the present elderly still mirror the past, in which agriculture was the major sector providing the greatest number of jobs and 62 per cent of older persons worked in the agricultural sector MDoS, (1991).

Y_9= 1508.251 + 6.699 X_6 …………………………....(6) (0.963)

The regression estimate of coffee output shows that coffee output is positively correlated with improved condition of service by workers in the country. This relationship cannot be easily explained

Y_7= - 4.767E7 + 194674.401X_4………………….....……(7) (0.871)

The regression estimate of rubber plantation shows that rubber cultivation is negatively correlated with improved standard of living of the populace. This is an indication that as far as other potential users/competitors for labour are ready to offer better working conditions, there will continue to be reduction of labour engaged in rubber cultivation and hence reduction in rubber plantation farm land use. DoA, (1998) identified that labour productivity in agriculture is only about 60 per cent of the labour productivity in the manufacturing sector implying intense competition between agriculture and the manufacturing sectors for labour demand.

Y_5= 1249.825 - 2.700X_4……...................................(8) (0.993)

The regression estimate of rice output shows that rice output is positively correlated with ratio of women work force in total available labour is an indication women labour dominates rice farming in Malaysia and future land use in rice cultivation is greatly depend on available women in the agricultural labour.

Y_{10} = -4982786.79 + 1.771E7 X_7………………..….(9) (0.925)

The regression estimate of coconut output shows that coconut output is negatively correlated with the size of arable farmland is an indication of competition between coconut farm and arable farming with forestry plantation.

Y_6= 867589.767 - 551.914 X_5……….…………...(10) (0.920)

The regression estimate of tobacco cultivation shows that tobacco output is negatively correlated with the size of rubber plantation is an indication of competition between rubber farm and tobacco farming for farmland.

Y_{11} = 304686.6 – 33.819X_8 ....….(11) (0.926)

The regression estimate of oil palm shows that oil palm output is positively correlated with the age distribution of the population is an indication that most people in oil palm plantation are in the last category of age of age group in the population.

Y_8= -7834528.7 + 194674.401X_3 …..……………...(12) (0.993)

The economic activities of the present elderly cohort still mirror the past economic structure of Malaysia, in which agriculture was the major sector providing the greatest number of jobs and 62 per cent of older persons worked in the agricultural sector (1991 Census).

When all the selected socio – economic variables by stepwise regression analysis are imputed into the equation simultaneously as shown in the second section of Table 4, the result indicated that labour availability were identified a major factor in ALU in Malaysia as expressed in this relationship

Y_{17} = 0.181 + 0.002 X_{15} + 0.007 X_{16} – 0.409 X_{17}...…(13) (1.00)

The above result clearly indicates that ALU in Malaysia will continue to be a function of availability of labour but the return per every labour input in agricultural production (productivity per labour in terms of RM/labour) will still influence the readiness of labour to be engaged in agricultural production given the competing non – agricultural labour use.

The regression analyses of the change in rubber farm show a negative relationship with road density.

Indicating that the change in rubber farm is affected by the road density in the country as expressed in the relation below:

Y_{12} = 67.875 - 0.001 X_9 ……....…………………(14) (0.782)

The regression analysis of the change in oil palm land use is positively related to the male population labour force.

This clearly indicates that the change in oil palm farm is affected by the work force ratio of the population as expressed in the relation below:

Y_{13} = 0.000 + 33.049 X_{10} ……………………….……….(15) (0.855)

The regression analysis shows a negative correlation between changes in ALU with dependent age category. This shows that as category in dependent age group increases, the ALU decreases as expressed in the relation below:

Y_{14} = 0.402 - 0.258 X_{11} ………...…………………(16) (0.592)

In the past, durning the colonial era, the colonial masters had to organised a massive inflow of immigrant labour in order to meet production schedules in mining and plantation agriculture (Bussink, 1980).

The regression analysis of the change in non - ALU indicates a negative relationship with ALU.

This is an indication of a serious competition between agricultural and non – agricultural land uses as expressed in the relation below:

Y_{15} = 0.158 – 1.906 X_{12} ………………………….(17) (0.951)

The regression analysis of the change in ALU indicates a negative relation with non - ALU as expressed in the relation below:

Y_{16} = 0.121 – 0.509 X_{13}…...……..…………………(18) (0.952)

Conclusions

The socio – economic factors SEF affecting agricultural land use ALU in Malaysia has been investigated with the use of regression analysis. The study underscores the importance of availability of labour in ALU in Malaysia and intensive cultivation of tree crops at the expense of food crops. The new approach for increased agricultural and food production in Malaysia is through intensification of production and application of science and technology.

Moreso, efforts should be geared at increasing the productivities of the smallholders farmers by encouraging group farming. Application of technology for the successful cultivation of marginal Lands.

The efforts at encouraging migrant labour from neighboring countries should be concretized and permanent food production zone should be identified and gazzetted while the introduction of Agro-Technology Parks such as mechanized operations, precision control of inputs should be accelerated.

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Table: 1Agricultural Land Use Change in Malaysia from 1985 – 2010 (‘000ha)

Period	1985 – 1990	1990 – 1995	1985 – 1995	1995 – 2000	2000 – 2005	2005 – 2010	1995 - 2010
Rubber	-1.2	-1.8	-1.5	-1.5	-2.2	-3.2	-2.3
Oil Palm	6.5	4.6	5.5	4.3	2	1	2.4
Cocoa	6.6	-14.6	-4.6	-3	-0.5	0	-1.2
Paddy	0.8	-0.2	0.3	-5	-1.8	-1.	-2.6
Coconut	-1.1	-4.6	-2.9	-3	-2	-1.9	-2.3
Pepper	16.3	-2.4	6.6	-2	-1.6	-1	-1.5
Vegetables	2.1	3.7	2.9	2.7	5.7	6.2	4.9
Fruits	6.4	4.7	5.6	2.5	2.5	2.5	2.5
Tobacco	-8.8	0.6	-4.2	-2.4	-3.5	-4.5	-3.5
Others	0.1	0.9	0.5	1.4	0.9	3.1	1.8

Source: Economic Planning Unit, Ministry of Agriculture (cited by Tunku, M., Tunku, Y.B., 2010)

Table 2: Potential Socio – Economic Factors Affecting ALU.

Independent variables		Measured by
Agric area		% agric area of total land mass
Arable farm land use		% arable area of total agric area
Rubber, Forestry, Cocoa, Oil Palm, workers		
Rubber, Forestry, Cocoa, Oil Palm, efficiencies		
Cars per 1000 persons (condition of service)		
% change in agric land use		
% change in non agric land use		
% of forest land use		
% change in population of age group 0 -14 years old		
% change in population of age group 15 – 64 years old		
% change in population of age group 65years and above old		
% change in fishery workers		
% change in non – agric workers		
% workers in primary industry		
% workers in secondary industry		
% workers in tertiary industry		
Age category		
Road density		
Population density		
Change in gross farm product per agric worker		
Change in gross farm product per unit farmland		
GDP	GDP/capita	
GNI	GNI/Capita	
Total Expenditure/year		
Government expenditure/year		
Private expenditure/year		

Table 3: Result Of Multivariate Analysis Of Socio – Economic Factors (SEF) Of Agricultural Land Use (ALU) In Malaysia

Dependent variables	Final independent variables	Constant	Parameter Estimate	Std Error	Std coeff	df	F	Pr > F	Adj R^2
Agric Land Use	Rubber workers	8641.379	-19.135	1.002	-0.97	1	364.637	0.000	0.933
Permanent crops	Agric area	239.542	0.701	0.01	1.000	1	4953.421	0.000	0.999
Forest (ha)	Rubber worker	5417.212	9.968	2.266	0.910	1	19.351	0.012	0.786
Oil palm (ha)	Age >/= 15yrs	-1.097E7	843.955	3.860	0.996	1	477.902	0.000	0.983
Rubber (ha)	Workers condition of service	1249.825	-2.700	0.101	-0.997	1	714.137	0.000	0.993
Coconut output	Arable farm land	867589.767	-551.914	1.064	-0.965	1	54.739	0.002	0.920
Coffee output	Workers condition of service	-4.767E7	194674.401	3.295	0.947	1	34.891	0.004	0.871
Oil palm output	Age above sixty five	-7834528.7	19511.8	8.037	0.997	1	589.363	0.000	0.990
Cocoa output	Cocoa area	1508.251	6.699	2.725	0.985	1	132.693	0.000	0.963
Rice output	Female employed/labour force	-4982786.790	1.771E7	3.423	0.933	1	26.755	0.007	0.925
Tobacco output	Rubber farm land	30468.6	-33.819	1.930	-0.974	1	74.952	0.001	0.926
Change in rubber farm	Road density in Malaysia	67.875	-0.001	0.000	-0.909	1	18.960	0.012	0.782
Change in oil palm farm	Male labour force	-	33.049	7.116	0.937	1	36.244	0.002	0.855
Change in agric land use	Change in pop of 0 - 14	0.402	-0.258	0.099	-0.821	1	8.252	0.045	0.592
%change in non- agric LU	% change in agric LU	0.158	-1.906	0.192	-0.985	1	98.644	0.002	0.951
% change in agric land use	% change in non agric area	0.121	-0.509	0.051	-0.985	1	98.644	0.002	0.952
Change in Agric Land Use including all the variables into the equation at once	% change in fishery workers	0.181	0.002						1.000
	% change in RM/workers		0.007						
	% change in non – agric workers		-0.409						

Table 4: Actual Socio – Economic Factors (SEF) Affecting Agricultural Land Use (ALU) In Malaysia

Dependent variables	Independent variables	Regression Method
Y_1 = Agricultural land use	X_1 = Rubber workers	stepwise
Y_2 = Permanent crops land use	X_2 = Agric area	“
Y_3 = Forest land use	X_1 = Rubber worker	“
Y_4 = Oil palm	X_3 = Age category	“
Y_5 = Rubber	X_4 = Cars per 1000 persons (condition of service)	“
Y_6 = Coconut output	X_5 = Arable farm land	“
Y_7 = Coffee output	X_4 = Cars per 1000 persons (condition of service)	“
Y_8 = Oil palm output	X_3 = Age category	“
Y_9 = Cocoa output	X_6 = Cocoa area	“
Y_{10} = Rice output	X_7=Female employed/labour force	“
Y_{11} = Tobacco output	X_8 = Rubber farm	“
Y_{12} = Change in rubber farm	X_9= Road density	“
Y_{13} = Change in oil palm farm	X_{10} = Male labour force	“
Y_{14} = Change in agric land use	X_{11} = Change in working population	“
Y_{15} = %change in non- agric area	X_{12}= % change in agric area	“
Y_{16} = % change in agric area	X_{13}= % change in non agric area	“
Y_{17} = Change in agric area	X_{15} = % change in fishery workers	enter
	X_{16} = % change in RM/workers	
	X_{17} = % change in non – agric workers	