QUANTITATIVE MODEL FOR IDENTIFYING FACTORS AFFECTING AGRICULTURAL PRODUCTIVITY IN BẾN TRE PROVINCE

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Agricultural productivity is a decisive factor in improvements in competitiveness and peasants' income, therefore, enhancing quickly the agricultural productivity is the key to development of the agriculture during the international integration process. Looking for scientific measures to improve the labor productivity is a challenge to policy makers. The paper concentrates on three main issues: a quantitative model of related factors, results applied to reality and suggestion about measures to increase the agricultural productivity.

1. Theoretical framework

a. Theoretical model:

Lewis (1955) observes a labor surplus in the agricultural sector. That is why the productivity is poor there. Moving part of idle labor to manufacturing sector will help enhance the productivity and agricultural output, thereby increasing the economic growth.

Torado (1990) notes that during the agricultural development, diversified and specialized farming replaces the monoculture based on comparative advantages. Similarly, a change from extensification to intensification based on increases in labor productivity takes place to achieve agricultural growth.

According to Park S.S (1992), on the way to development, agricultural growth comes from improvement in the productivity of agricultural production, and this growth enhances peasants' income.

Figure 1: Productivity and income of an agricultural laborer
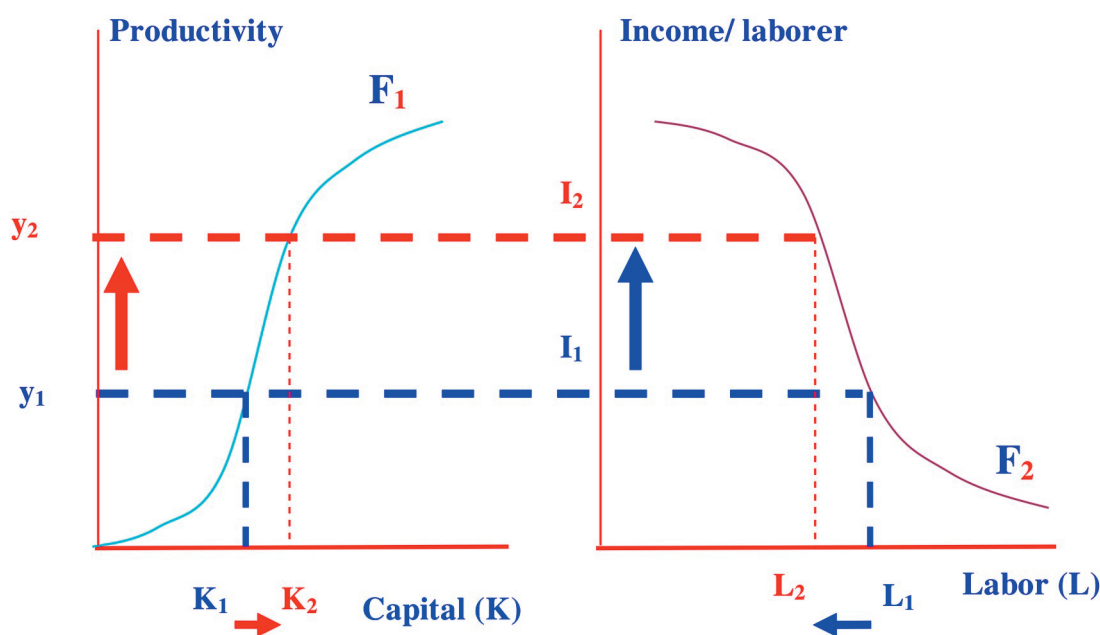
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Figure 1 shows increased capital makes the productivity get higher, and reduces the labor force in the agricultural sector and enhances the income accordingly.

According to Randy Barker (2002), the labor productivity in the agriculture depends on land yield (value of output per hectare) and size of farming land (land area per laborer).

After a survey in the Mekong Delta, Đinh Phi Hổ (2009) discovers that the land yield depends on: ways of diversification of agricultural production, size of investment, and peasants' knowledge of agricultural production, and gender of householders while the size of land depends on level of mechanization and farming area.

Research team (Đinh Phi Hổ, Nguyễn Hữu Trí et al., 2009) conducted a survey of peasant families in three districts Giồng Trôm, Châu Thành và Chợ Lách in Bến Tre Province with 210 randomly-selected samples. Results show that a linear correlation exists between productivity of agricultural labor and theoretical variables as follows:

Dependent variable:

Y: Value of output per labor (VND1,000 per year)

Independent variables:

DT: Farming area per household (ha)

MC: Mechanization cost (VND1,000/ ha/year)

LS: Loan capital from formal sources (VND1,000/ ha/year)

KL: Agricultural knowledge (point)

DM: Diversification model (Diversified = 1; Non-diversified = 0)

SEX: Gender of householder (Male = 1; Female = 0)

Model (DPH1-2010) assumes that a linear relation between dependent variable and independent ones exists according to the following form:

$Ln Y = B_0 + B_1 LnDT + B_2 LnMC + B_3 LnLS + B_4 LnKL + B_5 DM + B_6 SEX$

It's expected that the independent variables have positive linear relations with dependent one.

Table 1: Correlation between labor productivity of family household and theoretical variables

Dependent variable: Productivity of agricultural labor	Regression coefficient (B_i)	Adjusted R^2	Sig.
Independent variable:			
Farming area (ha)	0.69	0.47	0
Expense on machine (VND1,000)	0.55	0.3	0
Loan capital (VND1,000)	0.27	0.06	0
Agricultural knowledge (point)	0.4	0.18	0
Diversification (Yes = 1, No = 0)	0.7	0.67	0
Gender of householder (Male = 1, Female = 0)	0.04	0.03	0

The Table 1 shows that the agricultural labor productivity has a linear correlation with the following variables: farming area, mechanization, loan capital, agricultural knowledge, diversification of production model, and gender of householder.

b. Quantitative model:

Based on theoretical model of agronomy and results gathered in Vietnam, the quantitative model of factors affecting the agricultural labor productivity of farming households is assumed as follows:

(Y) = F (DT, MC, LS, KL, DM, SEX)

2. Results of application of the model in Bến Tre

To apply the model to reality, the authors select 210 samples in three above-mentioned districts typical of three ways of doing farming: rice monoculture, growing rice and fruits, and coconut and fruits. Samples are distributed rather evenly among the three districts: 34.3% from Giồng Trôm; 35.3% from Châu Thành; and 30.3% from Chợ Lách.

a. Results of multiple regression analysis:

The regression analysis employing the SPSS produces the following results:

Table 2: Regression results

	Unstandardized coefficient		Standardized coefficient	t-value	Sig.	Colinearity statistics	
	B	Std. error	B			Tolerance	VIF
(Constant)	10.269	1.56		6.582	0		
LnDT	0.374	0.11	0.248	3.392	0.001	0.613	1.63
LnMC	0.161	0.049	0.244	3.317	0.001	0.606	1.651
LnLS	0.239	0.095	0.183	2.522	0.013	0.623	1.605
LnKL	0.306	0.18	0.111	1.869	0.043	0.77	1.299
DM	0.611	0.115	0.367	5.315	0	0.69	1.449
SEX	0.018	0.101	0.011	0.18	0.858	0.93	1.076

Dependent variable: LNY

Table 2 shows that five variables (farming area, mechanization, loan capital, knowledge and diversification) ensure statistical significance at a level of 95% (Significance < 0.05).

The variable DT (farming area) has an unstandardized coefficient of 0.374. This means that the labor productivity of the household will increased by 37.4% when the farming area rises by 100%.

Similarly, the labor productivity increases by 16.1% when expense on mechanic services rises by 100% because the unstandardized coefficient of

efficient of KL is 0.306). And a 100% increase in the diversification makes the productivity increase by 61.1% (unstandardized coefficient of DM is 0.611).

The variable DM has the highest standardized coefficient (0.367), which shows that this variable is most important to the increase in productivity (36.7%).

Adjusted R^2 of the model is 0.65. This means that the independent variables in the model explain 65% of changes in the agricultural labor productivity.

Table 3: Analysis of variance (ANOVA)

	Sum of squares	df	Mean square	F	Sig.
Regression	35.83493	6	5.972488	34.33583	0
Residual	17.04644	98	0.173943		
Total	52.88137	104			

the MC is 0.161. A 100% increase in the loan capital makes the productivity increase by 23.9% (unstandardized coefficient of LS is 0.239). A 100% increase in the agricultural knowledge makes the productivity increase by 30.6% (unstandardized co-

The F test is used for assessing fit of the model and its significance is smaller than 0.05, therefore all regression coefficients of independent variables are not equal to zero, which proves that the model is appropriate to reality.

Table 4: Pearson correlation coefficient matrix

	LnNSLĐ	lnDT	lnMC	lnLS	lnKL	SEX	DM
LnNSLĐ	1	0.6	0.6	0.5	0.2	0.1	0.7
lnDT	0.6	1	0.5	0.4	0.2	0	0.5
lnMC	0.6	0.5	1	0.5	0	0	0.4
lnLS	0.5	0.4	0.5	1	0.2	0	0.3
lnKL	0.2	0.2	0	0.2	1	0.3	0.3
SEX	0.1	0	0	0	0.3	1	0.1
DM	0.7	0.5	0.4	0.3	0.3	0.1	1

Correlation between independent variables is small (< 0.6). This result, along with VIF < 10 (shown in the Table 2) allows us to affirm that the regression model is free from colinearity.

Table 5: Test for heteroskedasticity

		ABSRES
lnDT	Correlation coefficient	0.23
	Significance (two-tail)	0.06
lnMC	Correlation coefficient	0.33
	Significance (two-tail)	0.07
lnLS	Correlation coefficient	0.26
	Significance (two-tail)	0.51
lnKL	Correlation coefficient	0.05
	Significance (two-tail)	0.6
DM	Correlation coefficient	0.06
	Significance (two-tail)	0.97

Table 5 shows that all Spearman's rank correlation coefficients have significance greater than 0.05. This means that there is no change in variance of error.

b. Conclusion:

The tests conducted prove that factors that affect the labor productivity are: farming area of the household, level of mechanization, size of loan capital, householder's agricultural knowledge, and application of diversification model. Thus, the model of agricultural labor productivity is as follows:

$$LnNSLĐ = 10.269 + 0.374LnDT + 0.161LnMC + 0.239LnLS + 0.306LnKL + 0.611DM$$

(DPH1-2010)

3. Policy suggestions

Based on agricultural subsidies in the WTO Green Box and factors affecting the agricultural labor productivity in Bến Tre, we suggest paying full attention to five groups of policies to: (1) encourage changes in economic structure to enhance the land yield; (2) increase the supply of credit to peasants; (3) improve peasants' agricultural knowledge; (4) accelerate the mechanization in agricultural production; and (5) facilitate the accumulation of land among peasants.

- To encourage changes in the economic structure with a view to enhancing the land yield, full attention must be paid to: (1) developing high-tech parks in intensive farming provinces as an attraction for foreign investors with new technologies; (2) forming management boards of innovation of agricultural structure including representatives of government, peasants, businesspersons and scientists. These boards will be responsible for mobilizing and making the best use of existing resources and facilitating transfer of technology to peasants.

- To extend more credit to peasants, banks can supply loans at market rate of interest with maturity and volume appropriate to effective production models based on comparative advantages; and help improve the socioeconomic climate in rural areas by offering simple repayment procedures free from administrative regulations, and legalizing peasants' assets.

- To enhance peasants' agricultural knowledge,

top priorities can be given to: (1) the system of agricultural extension agencies by providing them with necessary funds, facilities and competent officials needed for technology transfer; (2) policies to encourage companies to enter into contracts with peasants to transfer technology and purchase produce, especially products that can be exported to developed countries.

These policies can offer tax incentives to R&D projects, fiduciary loans, to low-cost training programs companies that make contracts with peasants or farmers.

At present when agricultural development in most countries is based on large-scale farms, Vietnam may meet with difficulties in improving competitiveness and peasant's income if it fails to develop such large-scale farms or other forms of cooperation. Stimulating, encouraging and supporting development of farms and other forms of cooperation appropriate to ecological sub-regions with a view to expand the production scale is one of policies that is worth a top priority.

Besides the above-mentioned policies, the agricultural development also requires other supporting policies to build the infrastructure and develop non-farming businesses in order to facilitate flows of labor from the agricultural sector, and improve income and quality of human resource in rural areas. The Government should pay attention to: (1) allocation of financial sources from international institutions, such as ODA, WB, IMF, ADB and NGOs, to projects to develop rural infrastructure, encourage small and medium enterprises in labor-intensive industries and service sector, and training human resource for education and health

care services in rural areas; and (2) special preferential treatment to organizations that create new jobs in rural areas or help develop communities in remote and/or depressed regions■

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