Pertanika 11(3), 451-460 (1988)

Real Money Balances in the Production Function of a Developing Economy: A Preliminary Study of the Malaysian Agricultural Sector

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ABSTRAK

Bukti empirikal berpendapat bahawa baki wang benar boleh dianggap sebagai input yang produktif dalam pengeluaran. Baki wang benar dimasukkan sebagai faktor pengeluaran adalah kerana baki wang benar sebagai alat perantaraan pertukaran memudahkan penyesuaian di antara modal dan buruh untuk tujuan pengkhususan dan dengan itu menambahkan produktiviti. Kajian ini cuba menguji secara empirikal bahawa baki wang benar adalah input dalam fungsi pengeluaran di dalam sektor pertanian di Malaysia. Keputusan empirikal menyatakan bahawa baki wang benar memainkan peranan yang penting sebagai input yang produktif dalam fungsi pengeluaran sektor pertanian di Malaysia.

ABSTRACT

Recent empirical evidence suggest that real money balances can be treated as a productive input in production. The reason for incorporating real money balances as a factor of production is because real money balances as a medium of exchange facilitate adjustments between capital and labour for specialisation purposes and thus increase productivity. This study is an attempt to empirically test the evidence that real money balances is an input in the production function of the Malaysian agricultural sector. The results suggest that real money balances play a significant role as a productive input in the production function of the Malaysian agricultural sector.

I. INTRODUCTION

Traditionally in production, output has been specified as a function of capital and labour. This technical relationship between output and input has been recognised by economists for over half a century. More recently Sinai and Stokes (1972) provided empirical evidence which suggests that real money balances are a third factor input in the production function.

Earlier Friedman (1959, 1969), Bailey (1971), Johnson (1969), Levhari and Patinkin (1968), Moroney (1972) and Nadiri (1969) suggested that real money balances were a factor of production. But, it is Sinai and Stokes (1972) who provided the pioneering empirical work on this issue. Despite their empirical evidence the idea of money balances as a productive input has been criticised by Fischer (1974), Nicolli (1975), Prais (1975a, 1975b), Khan and Kouri (1975), Ben-Zion and Ruttan (1975) and Boyes and Kavanaugh (1979). They argued that incorporating real money balances in the production function is subject to specification bias.

Nevertheless, recent empirical evidence by Simos (1981), Apostolakis (1983), You (1981), Short (1979), Subrahmanyam (1980) and Khan and Ahmad (1985) provide strong support that real money balances act as a productive input in production. The reason for incorporating real money balances as a factor of production is because real money balances as a medium of exchange, facilitates the exchange between capital and labour for specialisation purposes and thus increases productivity. Also, it reduces the transaction cost and therefore, increases the economic efficiency of the money market system (Sinai and Stokes, 1972; Short, 1979; Khan and Ahmad, 1985; Finnerty, 1980).

This study is an attempt to empirically test the evidence that real money balances act as a productive input in the agricultural production of Malaysia. The paper is divided into four sections. Section II provides the literature review, model used and data. In section III. empirical results are presented and discussed, and the final section contains the conclusion.

II. METHODOLOGY

Since the paper by Sinai and Stokes (1972), numerous studies have been done to substantiate the role of real money balances in production. Short (1979), using both the Cobb-Douglas and translog models, came to the conclusion that, the decision to hold real money balances like any other productive input is based on rational, profit maximising considerations. He found that real money balances are positive and statistically significant for both the Cobb-Douglas and translog models. Results from You (1981) were similar to those by Sinai and Stokes (1972). Subrahmanyam (1980) and Simos (1981), both agreed with You (1981), and further concluded that real money balances are substitutes for capital, but complement with labour. The study by Apostolakis (1983), on the other hand, found that, real money balances substitutes for labour and complements capital services.

All the above studies were centered on the developed countries. However, Khan and Ahmad (1985) using a multi-equation framework examined the role of real money balances in the production function of the manufacturing sector in Pakistan. Their conclusion was in accordance with the results of Sinai and Stokes (1972).

The Model

Following Sinai and Stokes (1972), Khan and Ahmad (1985), Short (1979) and Finnerty (1980), the general form of the three-input production function can be written as;

$$Q_t = f(K_t, L_t, M_t)$$

where Q_t is quantity of output produced, K_t, L_t and M_t are the amount of capital, labour and money stock employed in production. Empirical emphasis was on seven Malaysian agricultural subsectors – rubber, oil palm, tea, coconut, forestry, paddy and fishery.

The production function in log-linear form was specified as:

$$\begin{aligned}\text{Log } Q_{it} &= \alpha_0 + \alpha_1 \log K_{it} + \alpha_2 \log L_{it} \\ &\quad + \alpha_3 \log (M_j/P)_t + U_{it} \qquad (3)\end{aligned}$$

where i = respective sub-sectors; rubber, oil palm, tea, coconut, forestry, paddy and fishery,

j = alternative measurement of money stocks used in the model; M1, M2 or M3,

P = price level measured by consumer price index, and

U = the disturbance term.

For each of the subsectors, three models one for each measure of real money balances (M1, M2 or M3) were estimated. As suggested by economic theory, we would expect a positive relationship between output, Q and the inputs capital, labour and real money balances. The measure of real money balances would represent real purchasing power over factor inputs, and an appropriate measure for capturing the role of money in the production process (Short, 1979).

Method of Estimation and Data

This study is based on Malaysian time series data over the period 1960–1985. The money variables used in this study are money stock M1 (defined as currency plus demand deposits held by non-bank private sector), M2 (M1 plus saving deposits and fixed deposits held at commercial banks), and M3 (M2 plus saving deposits and fixed deposits at other financial institutions; namely, finance companies, merchant banks, National Saving Bank and Employee Provident Fund). The money stocks variables were deflated by the consumer price index (1967=100) to arrive at real money balances.

All outputs are in metric tonnes except for coconut which is the number of nuts collected per year. Labour refers to the number of workers employed in the production in each subsectors. However, some problems arise in measuring capital, particularly in the developing countries. Although the above production function specified in equation (1) has been used for both the developed countries and the developing countries, the functional form will not be appropriate for some of the developing countries at least for two reasons. Firstly, the role of capital is not as evident as the role it plays in the advanced developed countries. In an economy like Malaysia, producers in the agricultural sector operate their farm on a relatively smaller scale as compared to their counterparts in the more advanced countries. Thus, instances of fixed capital input ownership by the agricultural producers are rare. Secondly, published data on capital services in the developing countries are not available. Therefore, as an alternative, in the actual estimation, area planted was substituted for the measurement of capital inputs since area planted includes all the trees planted, livestock reared, labour building structures and farm implements stationed on the land which is a form of investment (Booth and Sundrum, 1984). Strong and Suhaila (1987) also employed area planted to proxy for capital services in their study on oil palm sector in Malaysia.

Data on financial variables are collected from various issues of *Quarterly Economic Bulletin* published by Bank Negara Malaysia. Data on agriculture were compiled from publications by the Department of Statistics, Ministry of Agriculture and (their respective departments) which include Rubber Statistics Handbook, Oil Palm, Cocoa, Coconut and Tea Statistics, Paddy Statistics, Annual Fisheries Statistics, and Forest Statistics Peninsular Malaysia.

III. EMPIRICAL RESULTS

In this study all estimated regression equations were corrected for autocorelation that might arise due to the nature of time series data. The results of the estimated equations are presented in Tables 1 through 7; for rubber, oil palm, tea, coconut, forestry, paddy and fishery subsectors, respectively. For each subsector, four models were estimated. Model I was estimated without real money balances as one of the regressors. Models II, III and IV were estimated with M1, M2 and M3 respectively. The purpose of estimating Model I is to act as a standard model for comparison between Models II, III and IV. Thus, comparisons can be made with respect to the measure of real money balances.

For the rubber subsector, the results of the estimated regression equations are presented in Table 1. The results show that all estimated coefficients were not significantly different from zero, except for labour in Model I, which has a negative sign, and M1, M2 and M3 in Models II, III, and IV respectively.

Table 2 shows the result for the oil palm subsector. The results clearly show that all variables are important except for labour in Model I, II and III, and capital in Model IV. Real money balances are significant at the one percent level for M1, M2 and M3. With the inclusion of real money balances, the estimated coefficient of capital has reduced from 1.11 in Model I to 0.88 and 0.47 in Models II and III.

The estimated regression equations for the tea subsector are shown in Table 3. The results show that capital and labour are significant at the five percent level in Models III and IV. On the other hand, real money balances are significant at the one percent level in Models II, III and IV. In all cases, the inclusion of real money balances in the production increases the estimated coefficient of both capital and labour in the tea subsector.

The results for the coconut subsector are presented in Table 4. In Models I through IV, the estimated coefficient for capital and labour employed are significant at the one percent level, however, real money balances are not significant. Furthermore, real money balances exhibit negative signs. Therefore, the results suggest that real money balances do not play an important role in coconut subsector.

For the forestry subsector, the results are shown in Table 5. It can be seen that capital and labour are important except for labour in Model IV. Real money balances are only significantly different from zero in Model II. In this model we can see that the estimated coefficient for capital was reduced from 0.097 in Model I to 0.086 in Model II.

The results for the paddy subsector are presented in Table 6. However, in the paddy subsector, estimations were made without including labour due to the unavailability of data on workers employed in this subsector. The results show that all variables are significantly different from zero. However, with caution the results suggest that real money balances play an important role in the paddy subsector.

Lastly, Table 7 show the results for the fishery subsector. In this subsector, due to unavailability of data on capital, only labour and real money balances are included in the final estimation. Only Model IV gave the 'best' results in terms of the significance of the variables. However, as in the paddy subsector, with caution we can

TABLE 1
Regression coefficients and related statistics for the Rubber sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	5.8948 (0.91680)	5.2017 (0.93214)	6.2713 (1.1132)	7.1007 (1.2252)
K	0.49035 (0.56584)	0.12910 (0.16926)	−0.13581 (−0.17182)	−0.22353 (−0.27012)
L	−0.47091 (−2.5498)**	−0.04786 (−0.22035)	0.09963 (0.38556)	0.06757 (0.25143)
(M1/CPI)		0.34766 (2.9202)***		
(M2/CPI)			0.30585 (2.8250)***	
(M3/CPI)				0.27196 (2.5497)***
R-square	0.9783	0.9853	0.9839	0.9833
D.W.	2.1125	1.7904	1.5793	1.6459
Rho	0.9220	0.9137	0.9234	0.9214
SER	0.0607	0.0528	0.0532	0.0546
d.f.	23	22	22	22

Notes: [a]Independent variable = rubber produced in metric tonnes, K = area planted in hectares, L = number of workers employed. R-square = coefficient of multiple determination, D.W. = Durbin-Watson statistics, SER = standard error of regression, d.f. = degrees of freedom. All other variables are as previously defined in the text.

***Statistically significant at the one percent level
**Statistically significant at the five percent level
*Statistically significant at the ten percent level.
Figures within brackets are 't-statistics'.

TABLE 2

Regression coefficients and related statistics for the oil palm sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	−0.63747 (−2.0214)*	−0.88306 (−6.4452)***	−0.57959 (−5.3551)***	−0.76110 (−6.2661)***
K	1.1082 (6.1299)***	0.87807 (4.1033)***	0.47125 (2.1512)**	0.38522 (1.6292)
L	0.20155 (0.69516)	0.04225 (0.14554)	0.44760 (1.6461)	0.54764 (1.9239)**
(M1/CPI)		0.64731 (5.0362)***		
(M2/CPI)			0.64757 (6.2602)***	
(M3/CPI)				0.64621 (5.7361)***
R-square	0.9532	0.9965	0.9968	0.9958
D.W.	2.2608	1.8296	1.9615	2.0087
Rho	0.7279	0.0002	0.0904	0.1822
SER	0.0934	0.0818	0.0694	0.0707
d.f.	23	22	22	22

Notes: [a]Independent variable = palm oil produced in metric tonnes, K = area planted in hectares, L = number of workers employed. All other variables are as previously defined in Table 1.

***Statitically significant at the one percent level

**Statistically significant at the five percent level

*Statistically significant at the ten percent level

Figures within brackets are 't-statistics'.

TABLE 3

Regression coefficients and related statistics for the tea sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	11.589	4.7573	3.3318	3.3404
	(7.2553)***	(2.0183)*	(1.3913)	(1.3901)
K	−0.25495	0.45350	0.60785	0.59621
	(−1.2188)	(1.6811)	(2.2382)**	(2.2078)**
L	−0.00074	0.17730	0.24898	0.27182
	(−0.00748)	(1.5822)	(2.1930)**	(2.3324)**
(M1/CPI)		0.30120		
		(3.0286)***		
(M2/CPI)			0.26929	
			(3.5580)***	
(M3/CPI)				0.25442
				(3.6254)***
R-square	0.9920	0.9940	0.9945	0.9949
D.W.	1.9217	1.6150	1.6227	1.6863
Rho	0.5827	0.8479	0.8545	0.8290
SER	0.0659	0.0568	0.0538	0.0535
d.f.	23	22	22	22

Notes [a]Independent variable = green leaves harvested in metric tonnes, K = area planted in hectares, L = number of workers employed. All other variables are as previously in Table 1.

***Statistically significant at the one percent level

**Statistically significant at the five percent level

*Statistically significant at the ten percent level

Figures within brackets are 't-statistics'.

TABLE 4
Regression coefficients and related statistics for coconut sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	7.4170 (16.718)***	7.7655 (14.930)***	7.7449 (15.123)***	7.7665 (15.170)***
K	0.39741 (8.2316)***	0.37920 (7.6328)***	0.38266 (7.7840)***	0.38346 (7.8639)***
L	0.26322 (6.1967)***	0.21791 (3.8920)***	0.20574 (3.2857)***	0.19702 (3.0082)***
(M1/CPI)		−0.02936 (1.2248)		
(M2/CPI)			−0.02261 (−1.2376)	
(M3/CPI)				−0.02385 (−1.3131)
R-square	0.9912	0.9926	0.9919	0.9917
D.W.	1.8403	1.8657	1.8723	1.8731
Rho	−0.1891	−0.1983	−0.1900	−0.1876
SER	0.0452	0.0447	0.0447	0.0445
d.f.	23	22	22	22

Notes: [a]Independent variable = number of nuts collected, K = area planted in hectares, L = number of workers employed. All other variables are as previously defined in Table 1.

***Statistically significant at the one percent level

**Statistically significant at the five percent level

*Statistically significant at the ten percent level

Figures within brackets are 't-statistics'.

TABLE 5

Regression coefficients and related statistics for the forestry sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	−1.5132	4.6087	4.7242	4.5109
	(−3.0107)***	(3.1831)***	(3.1839)***	(3.2423)***
K	0.09738	0.08656	0.09296	0.09241
	(2.8589)***	(1.8339)*	(2.0100)*	(2.0041)*
L	0.87813	0.34496	0.35826	0.38023
	(14.668)***	(1.6896)	(1.7803)*	(1.9728)*
(M1/CPI)		0.36523		
		(1.7751)*		
(M2/CPI)			0.22599	
			(1.6515)	
(M3/CPI)				0.20015
				(1.6050)
R-square	0.9744	0.9864	0.9830	0.9821
D.W.	1.9539	1.8642	1.8078	1.7935
Rho	0.3019	0.6411	0.5258	0.5092
SER	0.0738	0.0875	0.0882	0.0886
d.f.	20	19	19	19

Notes: [a]Independent variable = sawlogs produced in cubic metres, K = area logged in hectares, L = number of workers employed. All other variables are as previously defined in Table 1.

***Statisitcally significant at the one percent level

**Statistically significant at the five percent level

*Statistically significant at the ten percent level

Figures within brackets are 't-statistics'.

TABLE 6
Regression coefficients and related statistics for the paddy sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	−1.5855 (−1.3284)	−0.67679 (−1.6124)	−0.57526 (−1.2945)	−0.64135 (−1.3483)
K	1.4495 (7.5944)***	1.1644 (16.085)***	1.1643 (15.322)***	1.1691 (14.358)***
(M1/CPI)		0.19926 (9.6571)***		
(M2/CPI)			0.13893 (9.3078)***	
(M3/CPI)				0.13243 (8.6894)***
R-square	0.9368	0.9640	0.9650	0.9633
D.W.	2.4801	1.7643	1.8515	1.8841
Rho	0.9349	−0.0924	−0.0250	0.0252
SER	0.0689	0.0532	0.0525	0.0537
d.f.	23	22	22	22

Notes: [a]Independent variable = paddy harvested in metric tonnes, K = area planted in hectares. All other variables are as previously defined in Table 1.
***Statistically significant at the one percent level **Statistically significant at the five percent level
*Statistically significant at the ten percent level Figures within brackets are 't-statistics'.

TABLE 7
Regression coefficients and related statistics for the fishery sector

Variables[a]	Model I	Model II	Model III	Model IV
Constant	6.0595 (2.6020)**	1.9762 (0.92056)	1.2369 (0.65579)	0.73393 (0.40111)
L	0.04942 (0.09262)	0.51584 (0.93887)	0.72740 (1.4968)	0.83075 (1.7524)*
(M1/CPI)		0.51874 (3.2826)***		
(M2/CPI)			0.37600 (4.3628)***	
(M3/CPI)				0.35062 (4.4198)***
R-square	0.9284	0.9270	0.9326	0.9316
D.W.	1.7104	1.7674	1.6271	1.5915
Rho	0.8939	0.6002	0.4990	0.4775
SER	0.1254	0.1296	0.1245	0.1254
d.f.	23	22	22	22

Notes: [a]Independent variable = fish landing in metric tonnes, L = number of fishermen. All other variables are as previously defined in Table 1.
***Statistically significant at the one percent level **Statistically significant at the five percent level
*Statistically significant at the ten percent level Figures within brackets are 't-statistics'.

conclude that real money balances are productive inputs.

IV. CONCLUSION

The objective of this study has been two-fold. Firstly, to formulate the aggregate production function model with respect to the agriculture sector in Malaysia. Secondly, to determine whether the data support the hypothesis that real money balances influence production. The factors of production considered in this study were capital, labour and real money balances. The production of each agricultural subsector; rubber, oil palm, tea, coconut, forestry, paddy and fishery was considered in this study. With caution, the results of the individual sectors suggest that except for the coconut subsector, real money balances play an important role as a productive input.

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(Received 26 September, 1987)