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Linkages of macroeconomic indicators and agricultural variables in Malaysia

(Rangkaian penunjuk makroekonomi dan pemboleh ubah pertanian di Malaysia)

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Keywords: agricultural income, agricultural exports, commodity prices, macroeconomic indicators, econometric

Abstract

A study using econometric approach to assess the dynamic interactions between macroeconomic indicators and agricultural income in Malaysia was conducted. It was found that the changes in Malaysia's money supply or credit availability and the interest rates had significant relationships to both our agricultural income and exports. In other words, an expansionary money supply (better credit availability) led to increasing income and exports for agriculture sector, while increasing interest rates resulted in deterioration of income and export. Thus Malaysia's monetary policy, through its impact on interest rates, exchange rates and the supply of money in the economy, should be managed properly to avoid the unintended effects that can hinder the development and competitiveness of Malaysian agriculture.

Introduction

World farm economy has been substantially sensitive to the movements of macroeconomic indicators in this century. Overwhelming economic scenarios such as declining global commodity prices, slower domestic demand and increasing world fuel prices lead to instability world economic sector. These consequences and circumstances would be more challenging to the government in stimulating the economy without endangering macroeconomic stability. Researchers and economists postulated that macroeconomic policy changes often have significant impacts on agricultural economy. The international financial crisis which began in the late 90s has continued affecting agriculture sector, mostly on external trade. In Malaysia, as the global environment deteriorated, the growth of gross domestic products (GDP) for the agriculture sector (including forestry and fishery) was relatively unstable and declined to 3.9% and 0.4% in 1993 and 2009 respectively. The share of agriculture sector to GDP also showed decreasing trend from 1993 (15.9%) to 2009 (7.7%) (*Figure 1*).

According to the United States Department of Agriculture (USDA) baseline projection, Malaysian economy was detriment by the global recession started in 2009 due to its significant dependence on external trade. Malaysia also had much bigger impact than expected due to the steep fall in the world trade and agricultural commodity prices. Both GDP and total agricultural exports are expected to decline. Moreover, Malaysia was identified as one

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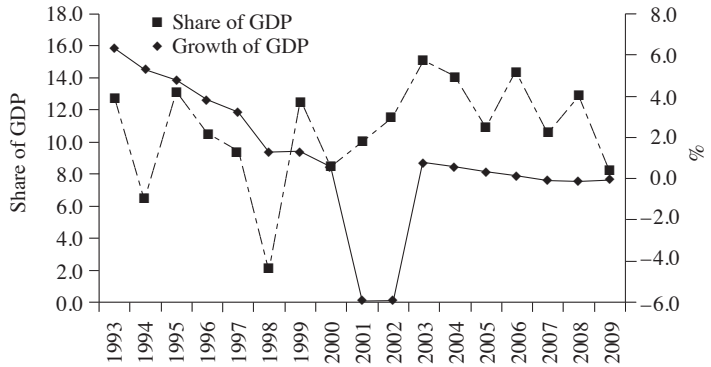

Figure 1. Share and growth of GDP for agriculture (including forestry and fishery, 1993–2009)
Source: Ministry of Finance Malaysia

of the crisis-affected countries, leading to the unexpected currency depreciation. The currency depreciation would raise agricultural prices, increase interest rate and decrease credit availability (i.e. money supply by the Central Bank). Subsequently, macroeconomic indicators have been considered to be one of the significant factors affecting agricultural economy in Malaysia. For example, lower interest rates in Malaysia facilitate in higher farm income and lower production costs without necessarily compensating with a decrease in prices of outputs.

Additionally, developing countries are predicted to encounter slower agricultural growth resulting from the price interventions through trade, exchange rates and other macroeconomic indicators (Schiff and Valdes 1992). Hence, it is important to examine macro-agricultural sector linkages to better understand both the causes and the consequences of changes in Malaysia agricultural wealth. The result of this study would provide useful information and guidelines, particularly for the government and policy makers in structuring policy framework and planning strategies for future agricultural development. The main purpose of this paper is to assess the dynamic interactions between macroeconomic indicators and agricultural income in Malaysia. The impacts of key macroeconomic indicators on the relative performance of agricultural subsectors were elaborated.

Macroeconomic linkages to agriculture

Numerous studies have been conducted to examine the impacts of changing macroeconomic variables on agriculture sector worldwide. In the United States, Schuh (1974) argued that tight monetary policy increases rates of interest, inducing capital inflows which cause the exchange rate to depreciate, hence, these circumstances ruin agricultural exports. Baek and Koo (2008) found that exchange rates and interest rates were determined as significant factors affecting the US farm economy. For example, a weakened US dollar (i.e. dollar depreciation) tends to increase US agricultural exports through a decrease in agricultural prices, thus, increases farm's incomes. Snell et al. (1997) discovered that inflation and interest rates highly affected agricultural performance in the US.

Chambers and Just (1981) investigated short-run effects of changes in money instruments such as money aggregate and interest rate on US agricultural commodity trade and found some evidences of a causal relationship between money aggregate, agricultural exports and imports. Other similar studies (Schuh 1974; Chambers and

Just 1981; Chambers 1984; Bessler and Babula 1987; Bradshaw and Orden 1990; Orden 2002; Baek and Koo 2007, 2008) concluded the relationships and interactions between macroeconomic and agricultural performance in the US.

In the Philippines, the macroeconomic environments strongly influenced the overall viability of agriculture (Intal 1985). Agriculture sector performance in Nigeria experienced shrinkage due to macroeconomic policy distortions (Ukoha 1999). In South Africa, an expansionary monetary policy caused falling in real interest rates, depreciation of exchange rates and increasing commodity prices in short run (Dushmanitch and Darroch 1990). Also, Townsend and Thirtle (1998) revealed that macroeconomic variables highly affected agriculture sector, primarily through costs of production which increase the costs through interest rates. Other related research areas discerned that short-run effects on changes of money instruments such as money aggregates and the increased interest rates in supplying money by the Federal Reserve Bank tend to reduce the value of local currency which leads to an increase in total exports (Schuh 1974; Chambers and Just 1981).

Macroeconomic environment in Malaysia

Malaysia agricultural exports negatively correlated to the rates of interest (i.e. base lending rate, which is a minimum interest rate calculated by banking institutions based on a formula which takes into account the institutions' cost of funds and other administrative costs) which indicates the lower rates of interest would significantly increase the total of agricultural export (excluding rubber and palm oil). Previous study found the similar relationship between agricultural export and interest rates and the higher interest rates ultimately have a detrimental effect on agricultural exports (Niles and Orden 2003). However, the exchange rates and money supply have positive relationships, indicating the appreciation of Ringgit Malaysia and the expansion of money supply contribute to the growth of agricultural exports (*Table 1* and *Figure 2*).

Money supply plays the major role in developing agricultural income in Malaysia. The more credit is supplied by the Central Bank of Malaysia, the higher the increase in the agricultural income. The appreciation of exchange rates also contributes to the growing income. The interest rates showed negative correlation to the agricultural income, indicating the lower rates would raise the agricultural income.

The agricultural commodity prices are highly sensitive to the exchange rates and have positive correlation, which indicates the depreciation of the exchange rates will increase the agricultural commodity prices, whereas the other macroeconomic indicators are less significant to the price.

Methodology

Data and integration properties

The agricultural export (X), gross domestic product (Y) and agricultural commodity price (P) were the selected agricultural variables; while the macroeconomic indicators include real money supply (MS),

Table 1. Correlation coefficients of agricultural export, agricultural income, commodity price and macroeconomic indicators

Macroeconomic indicators	Agricultural export		Agricultural income		Commodity price	
	Coefficient	Sig. (2-tailed)	Coefficient	Sig. (2-tailed)	Coefficient	Sig. (2-tailed)
Interest rate	–0.587**	0.006	–0.605**	0.005	0.279	0.233
Exchange rate	0.590**	0.006	0.650**	0.002	–0.741**	0.000
Money supply	0.987**	0.000	0.971**	0.000	–0.260	0.267
Inflation rate	0.017	0.943	–0.078	0.744	–0.685**	0.001

**Significant at 0.01 level. The correlations are based on Pearson Correlation

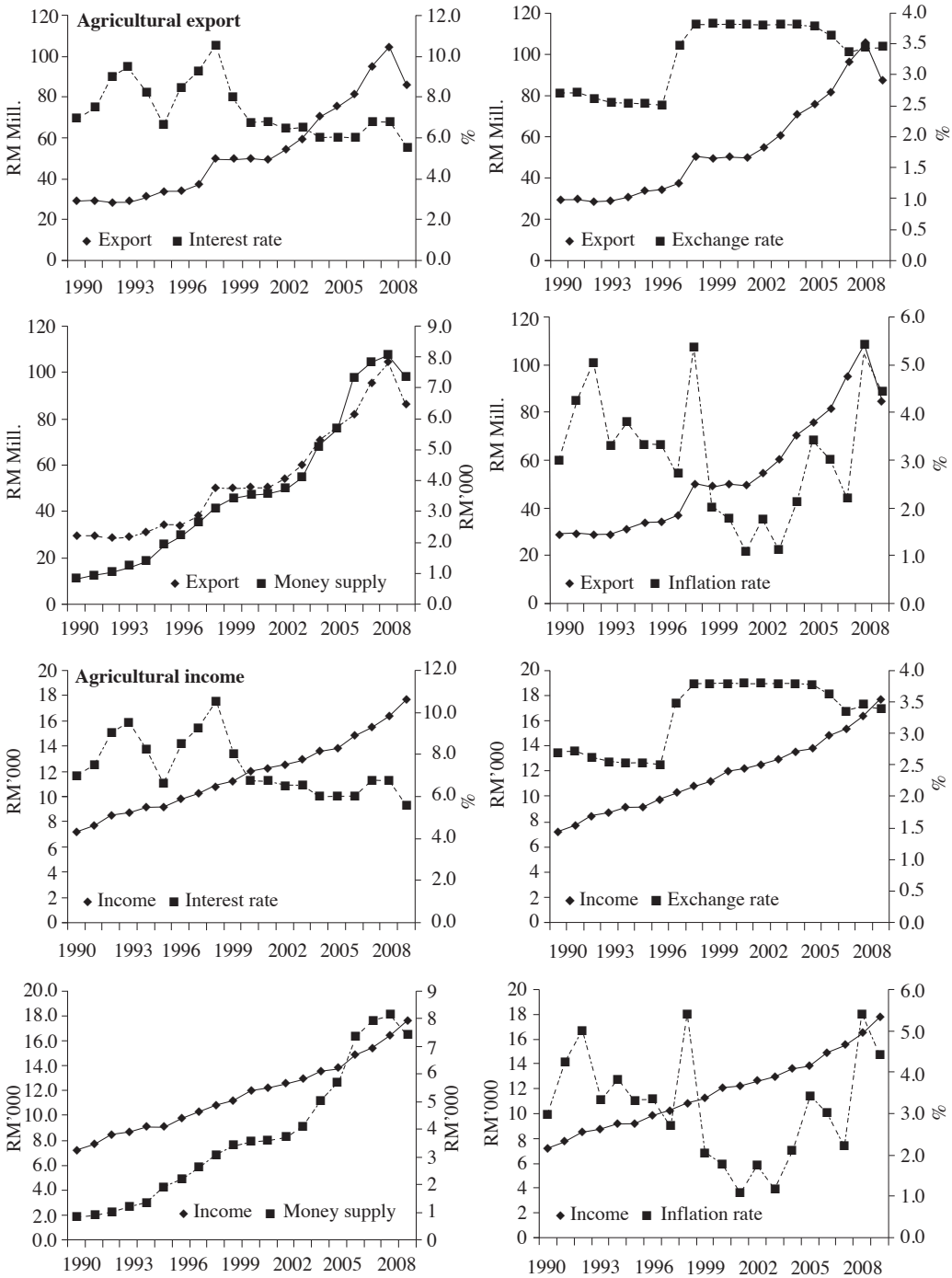

Figure 2. The relationships between agricultural variables and macroeconomic indicators

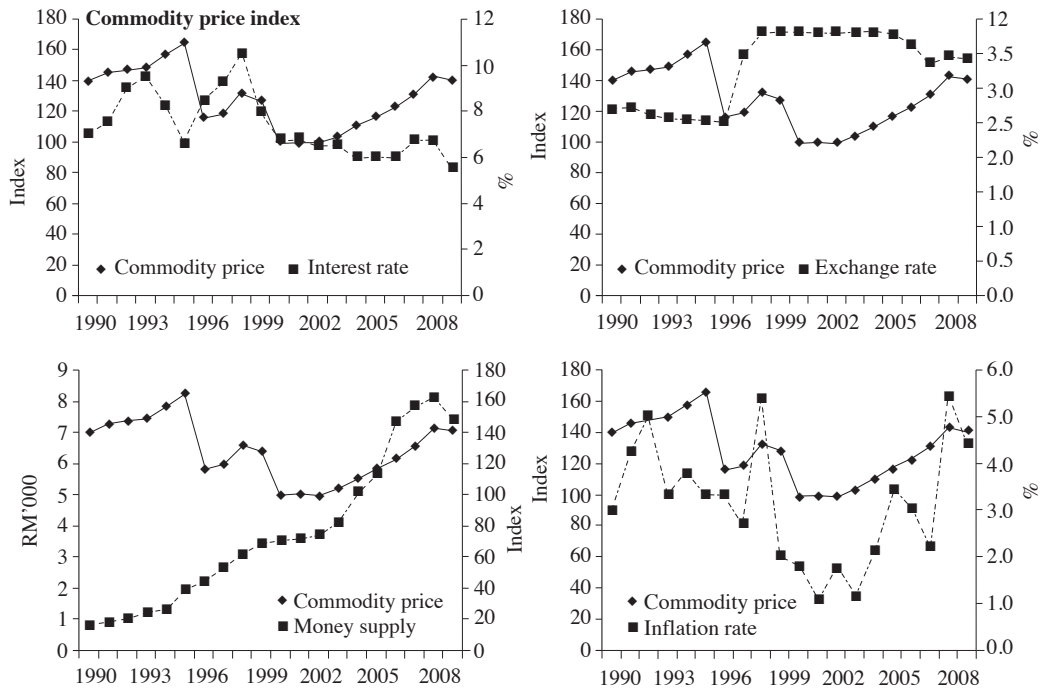

Figure 2. The relationships between agricultural variables and macroeconomic indicators (cont.)

real interest rates (IR) and exchange rates (ER), and the rates of inflation (IF). The data of agricultural exports and GDP were collected for all agriculture subsectors except palm oil and rubber. Since palm oil and rubber are the major agricultural export and income in Malaysia, the analyses would be biased and the results could not be generalized for the agriculture sectors. Thus, the agriculture subsectors involved in this study were livestock and dairies, fisheries, rice and cereal, vegetables, fruits and industrial crops.

However, the data of producer price index (PPI), which was used as a proxy for agricultural commodity prices, were obtained for the group of food and live animals (i.e. primarily for food). For the money supply, the data of M2 component which comprises M1 (Currency in Circulation + Demand Deposits) and Narrow Quasi-Money (saving deposits + fixed deposits + NIDs + Repos + Foreign Currency Deposits) (Central Bank of Malaysia 2010). Since loans and deposits for farmers or producers are allocated in the component of M2, this component was considered and represented money supply variable in this study.

The base lending rates were considered for the interest rates, and the exchange rates were based on the value of Ringgit Malaysia against the USD. The time series data contain 80 quarterly samples, from the first quarter of 1990 to the fourth quarter of 2009. The choice of variables and all considerations were referred to several previous studies (Bessler 1984; Orden and Fackler 1989; Townsend and Thirtle 1998; Saghaian et al. 2002; Awokuse 2005; Kaabia et al. 2005). The data were collected from various sources including Central Bank of Malaysia, Department of Statistics, Ministry of Agriculture and Agro-based Industry, Economic Planning Unit (EPU), and Malaysia External Trade Development Corporation (MATRADE).

Model specification

The major approach of this study is the co-integrating regression model which is the most favoured approach and the most widely used in similar studies (Bessler 1984; Orden and Fackler 1989; Devadoss et al. 1990; Dorfman and Lastrapes 1996; Saghaian, Hasan and Reed 2002; Saghaian, Reed and Marchant 2002). This econometric model requires prior tests, including the testing of unit root and trace test for all variables. The unit root tests (mean stationary tests) are very initial stage to test the existence of unit root and the degree of the integration for the seven variables (X_t, Y_t, P_t, MS_t, IR_t, ER_t, IF_t).

The main purpose of testing the unit roots is to determine whether a time series variable is non-stationary using the co-integrating model and the null hypothesis of the test is the existence of a unit root (Dickey and Fuller 1979). The null hypothesis will be rejected if the test statistic is greater than the asymptotic critical values. The test can also determine whether the trending data should be regressed at the first differenced or deterministic functions in rendering the data stationarity so that the number of co-integration relationships can be determined. The co-integration rank will be tested (i.e. trace test) to determine the number of co-integrating relationships among the variables. After completing both tests, the model of co-integration regression will be conducted to analyse the dynamic relationships between macroeconomic and agricultural variables. This model will be regressed in log-log linear forms. The basic equations of each agricultural variable can be written as:

$$X^* = g(ER, IF, IR, MS) \quad (1)$$
$$Y^* = g(ER, IF, IR, MS) \quad (2)$$
$$P^* = g(ER, IF, IR, MS) \quad (3)$$

Equations (1), (2) and (3) are then specified in log linear forms as follows:

$$\ln X_t \ln Y_t \ln P_t = ß_0 + ß_1 \ln ER_t + ß_2 \ln IF + ß_3 IR_t + ß_4 MS_t + e_t \quad (6)$$

Where:

X = Agricultural exports (RM)
Y = Total agricultural income (RM)
P = Commodity price indices
MS = Money supply (RM)
ER = Exchange rates (RM per USD)
IR = Interest rates (%)
e = Residuals
t = Specified period

Empirical results

The unit root tests are conducted using the Dickey-Fuller generalized least squares (DF-GLS) (Dickey and Fuller 1979). The agricultural income, commodity price index, and interest rates are statistically significant at 10% (0.10), indicating stationary (means and variance of the variables do not change over time), while the inflation rate is significant at 1% at the level of the test. However, at the first difference, all variables are highly significant at 0.01 levels, while the agricultural export is significant at 0.05 significant levels, indicating the existence of unit root or stationary. Also, this indicates that the variables are integrated at the first order (*Table 2*). The DF-GLS test statistics are estimated from a model that includes a constant and a trend variable.

The results of unit root suggest that the null hypothesis is rejected at the first difference which indicates the mean and

Table 2. Results of DF-GLS unit root tests

Variables	Level	First difference
	DF-GLS statistics	DF-GLS statistics
X_t	–0.22	–2.52**
Y_t	1.89*	–3.08***
P_t	–1.62*	–4.28***
IR_t	–1.66*	–4.99***
ER_t	–1.13	–3.20***
MS_t	–1.06	–3.49***
IF_t	–2.80***	–6.53***

***, ** and *denote rejection of the null hypothesis of a unit root at the 0.01, 0.05 and 0.10 levels respectively

variance in the data set do not change over time. Thus, all variables are accepted in further analysis. The rejection of the null hypothesis of the unit root requires a trace test (Johansen 1988, 1991) to analyse the long run movement among variables.

The trace test is applied to determine the number of co-integrating relationships among the seven variables. The results show that the trace tests rejected the null hypothesis, which is inexistence co-integrating vector (r = 0) at 0.05 level of significance. However, the tests fail to reject the null hypothesis of three co-integrating vector (r ≤3) (*Table 3*), implying the existence of a long run linkages among X_t, Y_t, P_t, IR_t, ER_t, MS_t, IF_t.

The test of co-integration rank revealed that the variables are co-integrated, and the co-integrating regression can identify the significant co-integrated variables. The co-integrating regression was analysed for each agricultural variable, including agricultural income, agricultural exports and agricultural commodity prices.

Table 3. Result of co-integration rank tests

Null hypothesis	Eigenvalue	Trace statistics
r = 0	0.90	99.86 [*p* = 0.00]**
r ≤1	0.74	59.24 [*p* = 0.00]**
r ≤2	0.66	34.78 [*p* = 0.01]**
r ≤3	0.44	15.36 [*p* = 0.05]*
r ≤4	0.24	5.00 [*p* = 0.05]

r denotes the number of co integrating relationships
**denotes rejection of the hypothesis at the 5% sig. level

From the four macroeconomic variables, money supply (MS) showed positive interaction to agricultural income (Y), indicating the increase in credit availability for farmers or producers by the Bank Negara Malaysia strongly influences the agricultural income in Malaysia. The negative sign of interest rates (IR), implies the declining agricultural income values when the rates of interest are increasing. The higher interest rates influence farmers' decision to get credit which limit their operations in farm production. These consequences lead to declining agricultural productivity and agricultural income, as well (*Table 4*).

The performance of agricultural exports (X) is highly sensitive to the macroeconomic policy indicators. However, the most responsive variable is the money supply (MS) which indicates the expansionary money supply leads to increasing agricultural exports. The other variables including interest rates and inflation rates showed negative reactions to the export. The lower interest rates and the higher rates of inflation discourage the agricultural export in Malaysia. Also, the appreciation of Malaysian currency (i.e. strengthen Ringgit Malaysia) in the global market contributes to the higher prices for agricultural commodity, resulting less competitive agricultural products in export markets (*Table 4*).

The agricultural commodity price (P) highly relies on the circumstances of the exchange rates (ER) and inflation rates (IF). The weakened Malaysian currency tends

Table 4. Co-integrating regression coefficients of agricultural income, agricultural exports and agricultural commodity prices

Variable	Agricultural income			Agricultural exports			Agricultural commodity prices		
	Coefficients	t-statistics	Prob.	Coefficients	t-statistics	Prob.	Coefficients	t-statistics	Prob.
ER	0.014	0.103	0.920	–0.397	–2.134	0.051*	–0.540	–3.384	0.005***
IF	0.039	1.133	0.276	0.178	3.728	0.002**	0.203	4.965	0.000***
IR	–0.196	–1.196	0.076*	–0.523	–3.706	0.002**	–0.093	–0.771	0.454
MS	0.304	8.227	0.000***	0.461	9.026	0.000***	0.017	0.390	0.703
Constant	7.251	19.729	0.000***	14.419	28.368	0.000***	5.317	12.201	0.000***

***, ** and *denote significant at 1%, 5% and 10% respectively

to lower commodity prices, resulting more competitive Malaysian agricultural products in foreign markets. However, the higher aggregate rates of inflation favour the higher price of agricultural commodities (*Table 4*).

Conclusion

Despite the empirical literature on the linkages between macroeconomic indicators and agricultural variables is apparent in the worldwide, relatively little attention has been given to the direct effects of changing in macroeconomic policy indicators on agriculture sector. This study found that the macroeconomic policy changes have affected Malaysian agricultural economy greatly in recent years through their impacts on money supply, exchange rates, interest rates and inflation. However, money supply and the rates of interest play a crucial role in influencing agricultural performance in this country.

In addition, the exchange rates and inflation are the major factors which lead to the variability of agricultural commodity prices. Therefore, it is becoming increasingly important that farmers and agribusinesses understand the linkages between the macroeconomic indicators and agricultural variables. These findings further suggest that movements of macroeconomic variables have had and will continue to have a greater influence on the resiliency and sustainability of Malaysian farm economy as Malaysian producers rely more heavily on domestic and international market forces for profits and market opportunities.

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Abstrak

Kajian yang menggunakan pendekatan ekonometrik untuk mengenal pasti perkaitan antara indikator utama makroekonomi dengan sektor pertanian telah dijalankan. Dapatan kajian menunjukkan perubahan polisi kewangan kerajaan, terutamanya kadar agregat kewangan dan kadar faedah oleh bank komersial mempunyai hubungan yang signifikan terhadap pendapatan dan eksport pertanian negara. Ini menunjukkan polisi 'expansionary money supply' akan meningkatkan pendapatan dan eksport sektor pertanian, manakala peningkatan kadar faedah akan mengurangkan pendapatan dan eksport sektor pertanian negara. Oleh itu, polisi kewangan Malaysia yang memberi impak kepada bekalan wang dalam ekonomi negara, kadar faedah dan pertukaran wang asing perlu diurus dengan sewajarnya untuk mengelakkan kesan tidak sengaja yang boleh melemahkan pembangunan dan daya saing sektor pertanian negara.