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DETERMINING THE LINKAGES OF MACROECONOMICS INDICATORS AND AGRICULTURAL VARIABLES IN MALAYSIA

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ABSTRACT

This study examines the consequences of macroeconomic policy indicators on agricultural sector in Malaysia by assessing the interaction of both sectors. Previous studies revealed that the changes of macroeconomic policy instruments had substantial effect to agricultural sub sector; however, major players often have little concerns in outlining and structuring policies. The selected variables include both primary macroeconomic policy instruments and agricultural variables comprising money supply, exchange rates, interest rates, producer price index, and gross domestic product of agricultural sector (excluding palm oil and rubber) which referred to several previous studies. All the data was analyzed using econometric analyses including unit root test, trace test, co integrating regression Durbin Watson and cointegrating regression model of Fully Modified OLS (FMOLS). The result showed that commodity prices, money supply (monetary aggregate) and interest rates play a crucial role in affecting the farm income in Malaysia.

Key Words: co integrating approach, agricultural income, macroeconomic policy, agricultural sub sectors, econometric framework

INTRODUCTION

World farm economy has been more sensitive to the changes of macroeconomic circumstances this century. Falling global commodity prices, slower domestic demand, and base-effect of increasing world fuel prices in 2008 have become more challenged for government in stimulating the economy without endangering macroeconomic stability. Moreover, the international financial crisis which began in 1997 continues affecting agricultural sector, mainly on external trade. Researchers and economists believed that macroeconomic policy changes often have substantial impacts on agricultural economy worldwide. In the United States, the changes of macroeconomic indicators are highly affected through interest rates and inflation. Having thought this issue becomes more essential, numerous studies have been conducted to examine the influences of macroeconomic variables on agricultural sector (Schuh, 1974; Chambers, 1981 and 1984; Bessler and Babula, 1987; Bradshaw and Orden, 1990; Orden, 2002; Baek and Koo, 2007 and 2008). The findings include changes in interest rates and inflation could affect cost of production, agricultural land prices, agricultural input prices, and commodity prices. In the Philippines, the macroeconomic environments strongly influenced the overall viability of agriculture (Intal, 1985). Agricultural sector performance in Nigeria was shrinking due to macroeconomic policy distortions (Ukoha, 1999) and South African agriculture was decelerated, mainly due to macroeconomic indicators, particularly changes in both exchange rates and interest rates. Schuh (1974) and, Chambers and Just (1981) discovered that increases in money supply tend to reduce the value of local currency resulting increase in total exports. Notwithstanding policies have been trying to formulate, they often have unintended and unpredictable effects on agricultural sector, and major players usually have little considerations in structuring and forming the policies. Additionally, developing countries are predicted to face a slow down in agricultural growth resulting from the price intervention through trade, exchange rates, and other macroeconomic indicators (Schiff and Valdes, 1992). According to the Asian Development Bank (2009), the Malaysian economy was crashed by the global recession in 2009 due to heavily reliant on external trade. A bigger impact than expected was experienced due to a sharp fall in the world trade and commodity prices. Both gross domestic products (GDP) and total agricultural exports are expected to decline year on year (Asian Development Bank, 2009). Also, Malaysia was identified as one of the crisis-affected developing countries, leading to unexpected currency depreciation. The currency depreciation would raise agricultural prices, increase interest rate and decrease credit availability (USDA Baseline Projection, 2000). Thus, macroeconomic indicators have been considered to be important factors affecting farm economy in

Malaysia. For example, a weakened Malaysian Ringgit (or Ringgit depreciation) tends to increase Malaysian agricultural exports through a decrease in Malaysian agricultural prices and enhancing Malaysian farm income, as well. Similarly, lower interest rates in Malaysia facilitate a higher farm income and lower production costs without necessarily compensating with a decrease in prices of outputs. Hence, it is important to examine macro-agricultural sector linkages to better understand both the causes and the consequences of changes in Malaysian farm income. The result of this study would provide useful guidelines, particularly for the government and policy makers in developing policy framework effectively and planning future strategies for agricultural development. Subsequently, future policies on agricultural development would be streamlined and implemented coherently. The main purpose of this study includes assessing the dynamic interactions between macroeconomic indicators and agricultural variables in Malaysia. The other objectives are to analyze the impact of macroeconomic variables on the relative performance of agricultural sub sectors and to discuss key indicators of macroeconomics that influence agricultural growth patterns.

DATA AND INTEGRATION PROPERTIES

The agricultural gross domestic product (GDP) and producer price index (PPI) are used as a proxy for net farm income (Y_t) and commodity price index (P_t), respectively. The macroeconomic variables include real monetary aggregate or money supply of M2 (MA_t), real interest rates (IR_t) and exchange rates (ER_t). The data for the GDP and agricultural trade (i.e. exports and imports) are collected for the selected agricultural sub sectors comprising livestock and diaries, fisheries, rice and cereal, vegetables, fruits, and industrial crops, excluding the primary commodities (i.e. palm oil and rubber). Both consumer and producer price indices are obtained for the group of food and live animals (i.e. chiefly for food). The M2 component including saving accounts, small time deposits at bank and retail money market funds, represent money aggregate in this study. Since M2 component involves loans for farmers or producers, the M1 and M3 components of money supply will be disregarded in this analysis (Awokuse, 2005). The data set contains 80 quarterly observations for the period 1990:Q1 to 2009:Q4. All variables except the real interest rates are in natural logarithms (*ln*). The choice of variables was considered from common variables in previous studies (Bessler 1984, Orden and Fackler 1989, Townsend and Thirtle 1998, Saghaian, Reed, and Marchant 2002, Kaabia, Gil, Chebbi 2005, Awokuse 2005). The data was 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). Prior to implementation of the co integrating regression model and co integration rank test, the existence of a unit root of the six variables (Y_t, P_t, MA_t, IR_t and ER_t) is tested. The unit root tests (mean stationary tests) are done at the initial stage to test the degree of the integration for each variable. The 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 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.

MODEL SPECIFICATION

The econometric framework is the primary approach in this study since the major data set both involved economic and financial time series. These data often exhibit trending behavior or stationarity in the mean such as price indices, exchange rates, interest rates, money aggregate, and real GDP. Thus, econometric task plays essential role in determining the most appropriate form of the trend in the data (Zivot, 2006). The cointegrating regression model of Fully Modified OLS (Philips and Hansen, 1992) which has been widely applied in related studies (Baek and Koo, 2009; Awokuse, 2005; Kaabia and Gil, 2005) is adopted. Before estimating the model, unit root and co integration are tested. These tests were applied to determine whether the trending data should be first differenced or regressed on deterministic functions of time to render the data stationarity, also, to determine the number of co integration relationships. All variables in the model are considered dependent (endogenous) variables, and the specific model can be presented as:

$$\ln Y_t = \beta_0 + \beta_1 \ln P_t + \beta_2 \ln MA_t + \beta_3 \ln ER_t + \beta_4 IR_t + e_t \quad (1)$$

With regard to the signs of the coefficients in equation (1), it is hypothesized that $\beta_1>0$ and $\beta_2>0$ since an increase in commodity prices (P_t) and money supply have a positive effect on farm income. As to the effect of exchange rate (ER_t), it is expected that $\beta_3<0$, since a depreciation of Malaysian Ringgit is expected to increase exports of agricultural commodities and farm income. Finally, it is expected that $\beta_4<0$, since an increase in the interest rates (IR_t), and thus a surge of costs (i.e credit or borrowing), have a detrimental effect on the farm income.

EMPIRICAL RESULTS

The unit root tests are conducted using the Dickey-Fuller generalized least squares (DF-GLS) (Dickey Fuller, 1979). The results show that the level of the real interest rates is statistically significant at 5%, indicating stationary, while the rests are non stationary. The DF-GLS test statistics are estimated from a model that includes a constant and a trend variable. All the variables are statistically significant at 1% and 5%, meaning they are stationary (i.e. mean and variance of the variables do not change overtime) at first difference. Also, this indicates the variables are integrated of order one (Table 1). Since the results suggest that the null hypothesis of a unit root can be rejected for the series (variables) at the first difference, a trace test (Johansen, 1988, 1991) need to be conducted to analyze the long run movement among variables. The trace test is applied to determine the number of co integrating relationships among the five variables.

The results show that the trace tests reject the hypothesis of inexistence co integrating vector ($r = 0$) at the 5% level of significance. However, the tests fail to reject the null hypothesis of at most three co integrating vector ($r \leq 3$) (Table 2), indicating the existence of a long run linkages among Y_t, P_t, MA_t, ER_t *and* IR_t.

Additionally, the co integrating regression Durbin Watson (CRDW) showed that the null hypothesis should be rejected. The hypotheses of CRDW can be written as:

H_0: DW = 0 , no co integration (DW < 0.38)
Ha: DW > 0, co integration (DW > 0.38)

Since DW= 1.438, indicating the variables in the model are cointegrated. The co integrating regression model is estimated by Fully Modified OLS (FMOLS) and the result showed commodity prices, monetary aggregate and interest rates are the significant factors affecting agricultural income in Malaysia. The exchange rate is not statistically significant even 10% level of significance, indicating the exchange rate has little effect on the farm income (Table 3).

The positive signs of P_t and MA_t indicate that both parameters have positive effects to the farm income while both ER_t and IR_t would negatively affect the income in agricultural sector.

CONCLUSION

This study examined the macroeconomic policy linkages to agriculture since the agricultural sector is the main contribution to economic development in Malaysia. Previous studies found agricultural economy is very sensitive to changes in interest rates and inflation, and changes in monetary, fiscal and trade policies affect the performance of the agricultural economy through several respective factors such as input and output prices. However, policy makers often have little concerns in outlining policies. This study utilized time series data from various sources, comprising quarterly data set from 1990:Q1 to 2009:Q4. The selected variables include agricultural income (Y_t), commodity price (P_t), monetary aggregate (MA_t), exchange rate (ER_t), and interest rate (IR_t). All the data was analyzed using several statistical analyses including unit root test, trace test, co integrating regression Durbin Watson and co integrating regression model of Fully Modified OLS (FMOLS). The result showed that commodity prices, money supply (monetary aggregate) and interest rates play a crucial role in affecting the farm income in Malaysia. Further research will focus on forecasting the impacts on macroeconomic variables to the agricultural sector.

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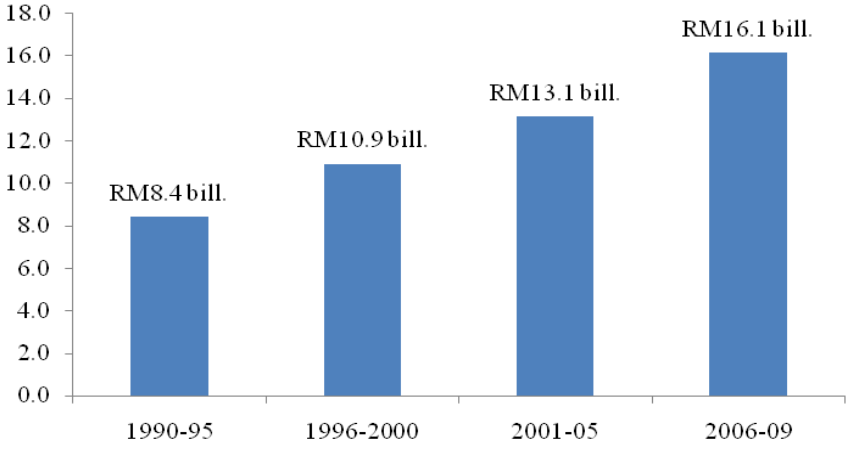
Figure 1. Net Farm Income for Selected Agricultural Sub Sectors (Excl. palm oil and rubber), 1990-2009



Source: Department of Statistics, Malaysia.

TABLE 1 : Results of DF-GLS Unit Root Tests

	Level	First Difference
Variable	DF-GLS Statistic	DF-GLS Statistic
Y_t	-2.82	-4.67***
P_t	-1.52	-4.34***
MA_t	-2.55	-4.36***
ER_t	-1.29	-3.45**
IR_t	-3.43**	-5.46***

*** and **denotes rejection of the null hypothesis of a unit root at the 1% and 5% levels, respectively. The 1% and 5% critical values for the DF-GLS tests are -3.77 and -3.19, respectively.

TABLE 2 : Result of Cointegration Rank Tests

Null Hypothesis	Eigenvalue	Trace statistics
r = 0	0.90	99.86 [0.00]**
r ≤ 1	0.74	59.24 [0.00]**
r ≤ 2	0.66	34.78 [0.01]**
r ≤ 3	0.44	15.36 [0.05]
r ≤ 4	0.24	5.00 [0.03]**

Note: *r* denotes the number of co integrating relationships.
**denotes rejection of the hypothesis at the 5% sig. level. *p*-values are given in parentheses.

TABLE 3 : Estimated Coefficients Using the Co integrating Regression

Variable	**Coefficient**
P_t	0.205 [2.002]*
MA_t	0.292 [4.481]***
ER_t	-0.115 [-1.092]
IR_t	-0.029 [-2.918]**
Constant	7.542 [1.615] ***

Note: ***, ** and * denote significant at 1%, 5% and 10% levels, respectively.
t values are given in the parentheses.