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Does the Mundell-Fleming Model Apply to Malaysia's Output?

Yu Hsing

Joseph H. Miller Endowed Professor in Business & Professor of Economics, College of Business, Southeastern Louisiana University, Hammond, LA 70402, USA, E-mail: yhsing@selu.edu
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Abstract: Based on an extended Mundell-Fleming model, this paper finds that both fiscal expansion and monetary expansion raise output in Malaysia and that a lower real interest rate, a higher stock value, a lower real oil price and a lower expected inflation rate increase output. Hence, a managed floating system with no predetermined path of the exchange rate adopted by Malaysia may lead to better outcomes than the predictions of the Mundell-Fleming model that fiscal expansion does not raise output under a floating exchange rate but increases output under a fixed exchange rate whereas monetary expansion increases output under a floating exchange rate but does not affect output under a fixed exchange rate (Mankiw, 2019).

Keywords: Mundell-Fleming model, Fiscal policy, Monetary policy, Exchange rates, Stock prices

JEL Codes: E52, E62, F41

Introduction

In recent years, Malaysia's economy has shown progress. Real GDP grew 5% in 2018. The inflation rate of 2.9% in 2018 suggests that monetary policy has achieved relative price stability. The unemployment rate of 3% in 2018 indicates that the labor market was relatively tight. The central government showed fiscal prudence as evidenced by the government debt-to-GDP ratio of 52.153% and the net borrowing-to-GDP ratio of -2.487% in 2018. International trade continued to show surpluses as the current account surplus as a percent of GDP reached 3.937% in 2018.

Under certain assumptions including a vertical LM^* curve and perfect capital mobility, the Mundell-Fleming model predicts that monetary expansion increases output under a floating exchange rate but does not affect output under a fixed exchange rate whereas fiscal expansion does not raise output under a floating exchange rate but raises output under a fixed exchange rate(Mankiw, 2019, p. 379). The vertical LM^* suggests that money demand is not affected by the exchange rate. Jamal and Hsing (2011) showed that the exchange rate may affect money demand negatively or positively. When a domestic currency depreciates versus a foreign currency, people tend to substitute the foreign currency for the domestic currency. On the other hand, when the domestic currency depreciates, the holding of the domestic currency may increase as people tend to keep a desired level of money demand.

Therefore, if the coefficient of the exchange rate in the money demand function is significant, the LM^* is not vertical, and the predictions of the Mundell-Fleming model may not apply.

Malaysia pursues a managed floating system with no predetermined path of the exchange rate (IMF, 2006). Because a managed floating regime is different from an independently floating regime or a pegged regime, it is interesting to examine whether the predictions of the Mundell-Fleming model may apply to Malaysia.This paper attempts to extend the Mundell-Fleming model to test whether fiscal expansion and monetary expansion may affect Malaysia's output and has several different aspects. First, the exchange rate and the stock price are incorporated in the money demand function to determine whether there may be any substitution or wealth effect. Second, comparative static analysis is made to determine the sign and magnitude of a change in an exogenous variable on equilibrium output. Third, several measures of fiscal expansion are employed to test the robustness of empirical results.

Literature Survey

Huh (1999) applied the Mundell-Fleming model to study Australia's economy using five variables – IS, money demand, money supply, the world interest rate, and aggregate supply. His results are consistent with the predictions of the Mundell-Fleming model. Expansionary monetary policy results in a permanent depreciation and a temporary increase in output. An increase in IS or money demand leads to appreciation whereas a higher world interest rate results in depreciation.

Based on the SVAR model, Gan and Soon (2003) studied Malaysia's monetary transmission mechanism under a managed floating exchange rate and open capital mobility in the 1990s. They found that the Bank of Malaysia relied on the intervention in the foreign exchange market instead of the interest rate to reduce the volatility of the ringgit exchange rate mainly because a relatively high interest rate would hurt private spending and cause output contraction.

Applying an extended Mundell-Fleming model, Hsing (2006) analyzed real exchange rate movements in South Korea during 1980.Q1- 2004.Q4. He found that expansionary monetary policy leads to real depreciation of the Korean won whereas expansionary fiscal policy does not affect the real exchange rate. In addition, a higher real stock price and the lagged real exchange rate lead to real appreciation whereas a higher real world interest rate and country risk result in real depreciation. The mixed results is mainly because the exchange rate system in South Korea changed from a pegged system to a floating system during this time period.

Umezaki (2007) applied an extended Mundell-Fleming model to examine Malaysia's monetary policy. According to his findings, the Central Bank of Malaysia conducted monetary policy using a policy rule in a flexible manner

and taking into consideration of both internal factors such as output and inflation and external factors such as the foreign interest rate and the exchange rate. It achieved autonomy in exchange rate stability and monetary policy mainly due to imperfect capital mobility.

Based on the Keynesian macroeconomic framework, Manap and Kassim (2007) examined the relations among output, the money supply, the price level, the interest rate, and the real exchange rate for Malaysia. According to their findings, positive supply shocks raise output whereas negative supply shocks reduce output. A shock to the money supply raises output and the price level. A shock to the real exchange rate raises the price level and reduces output in the short run. Demand shocks are reflected less in output than in the price level whereas demand shocks exert less weight on output than supply shocks in the long run.

Based on a sample of 44 countries including Malaysia, Ilzetzki, Mendoza, and Végh (2010) revealed that the effect of fiscal expansion depends on the exchange rate regime, government debt, trade openness, and the development stage. The fiscal multiplier is zero under a floating exchange rate but relatively large under a predetermined exchange rate. The fiscal multiplier is negative in countries with a high level of debt. The fiscal multiplier is greater in closed economies than in open economies. The effect of fiscal expansion is greater in industrialized countries than in developing countries.

Based on a sample of 61 countriesincluding many Asian developing countries and using the panel data technique including the fixed effect and the random effect, Karras (2011) found that the estimated long-run fiscal multiplier ranges from 1.21 to 1.53 in the full sample, from 1.44 to 2.43 for countries with fixed exchange rates, and from 0.98 to 1.39 for countries with floating exchange rates. Hence, fiscal multipliers are more effective under fixed exchange rates than under floating exchange rates. Based on a sample of 179 developing and developed countries including Malaysia during 1970-2011, Karras (2014) also showed that the domestic multiplier is much higher in the least open economies than in the most open economies, that the spillover effect is much greater in the most open economies than in the least open economies. These results suggest that there would be a tradeoff of the domestic multiplier and the spillover effect in the least open and most open economies.

Tang, Liu and Chung (2013) investigated fiscal multipliers for 5 ASEAN countries based on different models. For Malaysia, the impact of a tax cut on GDP ranges from 0.24 to 0.52 whereas the impact of government spending on GDP ranges from 0.20 to 0.28. These results suggest that a tax cut is more effective than more government spending for Malaysia.

Blanchard, Ostry, Ghosh, and Chamon (2016, 2017) applied an extended Mundell-Fleming model to study the impacts of capital inflows on 19 emerging markets including Malaysia. They showed that bond inflows are contractionary due to currency appreciation whereas non-bond inflows also causes currency

appreciation but reduce borrowing cost and are expansionary. Different policy tools need to be used in combination in response to different types of inflows.

Jeong, Kang and Kim (2017) investigated the effect of fiscal expansion on output, the exchange rate and the trade balance based on an extended Mundell-Fleming model. According to their findings, the fiscal multipliers are much greater than 1. Expansionary fiscal policy has become more effective in Korea and Japan than China. China's multiplier is larger than Japan's multiplier. Higher fiscal multipliers are affected by monetary policy, the exchange rate policy and institutional factors. Under a flexible exchange rate, fiscal expansion tends to cause real depreciation and improve the trade balance.

Chen and Liu (2018) explored the relation between fiscal expansion and exchange rates based on the Mundell-Fleming model and the VAR framework. They found that increased government consumption and investment spending results in real appreciation of the Chinese yuan and that more government deficits along with more government spending cause the trade balance to decline, leading to the twin deficits.

The Model

Suppose that aggregate expenditures are affected by real income, government taxes, government spending, the real interest rate, the real stock price and the real exchange rate, that real money demand is a function of the nominal interest rate, real output or income, the real stock price and the real exchange rate, and that the inflation rate is determined by the expected inflation rate, the output gap, the real energy cost and the real exchange rate. We can express the IS*function, the LM*function, and expectations-augmented aggregate supply function as:

$$Y = F(Y, T, G, R, S, \varepsilon) \tag{1}$$

$$M = L(R + \pi^e, Y, S, \varepsilon) \tag{2}$$

$$\pi = H(\pi^e, Y - Y^*, E, \varepsilon) \tag{3}$$

where

Y = real GDP,

T = government taxes,

G = government spending,

R = the real interest rate,

S = the real stock price,

ε = the real exchange rate measured as unit of the ringgit per U.S. dollar. An increase means real depreciation of the ringgit.

M = real money supply,

π^e = the expected inflation rate,

π = the inflation rate,

Y^* = potential real GDP, and

E = real energy cost.

Solving for Y, ε, and π simultaneously, we can write equilibrium real GDP as:

$$\bar{Y} = \bar{Y}(G-T, M, R, S, E, \pi^e) \tag{4}$$

The Jacobian for the three endogenous variables can be expressed as:

$$|J| = [-L_\varepsilon(1-F_Y) - F_\varepsilon L_Y] < 0 \text{ if } L_\varepsilon > 0. \tag{5}$$

The effect of fiscal expansion on equilibrium real GDP is positive if $F_G > F_T$:

$$\partial\bar{Y}/\partial(G-T) = -(F_G - F_T)L_\varepsilon / |J| \tag{6}$$

Monetary expansion has a positive impact on equilibrium real GDP:

$$\partial\bar{Y}/\partial M = -F\varepsilon / |J| > 0 \tag{7}$$

A higher stock price may affect equilibrium real GDP negatively or positively depending upon whether the sign of the real stock price or the real exchange rate in the money demand function is positive or negative:

$$\partial\bar{Y}/\partial S = (-F_S L_\varepsilon + F_\varepsilon L_S)/|J| < or > 0 \tag{8}$$

Because an increase in the real exchange rate means real depreciation of the Malaysian ringgit, the IS^* curve is upward sloping. Hence, the condition for a downward sloping LM^* is a positive relation between real money demand and the real exchange rate in the (Y, ε) space. An analysis of the data suggests that the correlation coefficient between real money demand and the real exchange rate is positive and significant. Hence, the condition is met.

Empirical Results

The data were collected from the International Monetary Fund and the Central Bank of Malaysia.

Real GDP and real money supply are measured in billions. Fiscal policy is represented by net borrowing as a percent of GDP, structural balance as a percent of GDP, andthe government debt-to-GDP ratio. Real M2 is employed to represent monetary policy. The real interest rate is represented by the government bond yield minus the expected inflation rate. The expected inflation rate is theaverage inflation rate of the past four years. The nominal stock price is divided by the consumer price index to derive the real stock price. The real crude oil price per barrel is chosen to represent the real energy cost. Real GDP, the debt-to-GDP ratio, the real stock price, and the real crude oil price are measured on a log scale. Other variables are measured in level due to potential or actual negative values before or after log transformation. Because quarterly

data for fiscal policy are incomplete, the annual data are used and ranges from 1992 to 2018. Earlier data for the government bond yield are not available.

Table 1 reports empirical results. The GARCH process is applied in empirical work to correct for autoregressive conditional heteroscedasticity. When government net borrowing as a percent of GDP is used to represent fiscal policy (Model A), all the coefficients are significant at the 1% or 5% level. Approximately 98.75% of the change in real GDP can be explained by the six exogenous variables. Real GDP has a positive relation with government net borrowing as a percent of GDP, real M2, the real stock price and a negative relation with the real interest rate, the real crude oil price and the expected inflation rate. Monetary expansion exerts the highest influence on a percent basis. A 1% increase in real M2 raises real GDP by 0.5968%. When government net borrowing rises 1 percentage point, log of real GDP will increase by 0.0099.

Table 1: Estimated Regressions of Log(Real GDP) for Malaysia

	Model A	*Model B*	*Model C*
Constant	-1.134627 (0.0000)	-1.094143 (0.0000)	-0.941595 (0.0001)
Government net borrowing-to-GDP ratio	0.009862 (0.0000)		
Government structural balance-to-GDP ratio		0.006304 (0.0022)	
Log(Government debt-to-GDP ratio)			0.019218 (0.0000)
Log(Real M2 money)	0.596826 (0.0000)	0.592165 (0.0000)	0.580496 (0.0000)
Real interest rate	-0.011101 (0.0000)	-0.011387 (0.0001)	-0.019528 (0.0000)
Log(Real stock price)	0.092932 (0.0000)	0.070418 (0.0000)	0.047218 (0.0000)
Log(Real crude oil price)	-0.136933 (0.0000)	-0.115167 (0.0000)	-0.102993 (0.0000)
Expected inflation rate	-0.036071 (0.0000)	-0.030322 (0.0015)	-0.029367 (0.0000)
R-squared	0.987480	0.987396	0.986351
Adjusted R-squared	0.983725	0.983615	0.982257
Akaike info criterion	-3.921089	-3.683982	-3.828479
Schwarz criterion	-3.489144	-3.252036	-3.396533
Sample period	1992-2018	1992-2018	1992-2018
Number of observations	27	27	27

Notes: Figures in the parenthesis are probabilities.

When government structural balance as a percent of GDP is selected to represent fiscal policy (Model B), the six right-hand side variables can explain approximately 98.74% of the variation in real GDP. All the coefficients are significant at the 1% level. Fiscal expansion, monetary expansion and higher real stock prices have positive impacts on real GDP whereas a higher real interest rate, a higher real crude oil price and a higher expected inflation rate have negative effects on real GDP.

Again, monetary expansion has the largest impact on a percent basis. A 1% increase in real M2 leads to a 0.5922% increase in real GDP. When the ratio of government structural balance to GDP rises 1 percentage point, log of real GDP will increase by 0.0063.

If the government debt-to-GDP ratio is selected to represent fiscal policy (Model C), the results are similar. About 98.64% of the change in real GDP can be explained by the independent variables. All the coefficients are significant at the 1% level. A 1% rise in the government debt-to-GDP ratio will result in a 0.0192% increase in real GDP, and a 1% increase in real M2 will raise real GDP by 0.5805%. These results suggest that different measures of fiscal policy yield similar outcomes and that both fiscal expansion and monetary expansion have positive impacts on output.

Summary and Conclusions

This paper has examined whether the predictions of the Mundell-Fleming model would apply to Malaysia's output. Three different measures of fiscal expansion are chosen to test the robustness of empirical results. Both fiscal expansion and monetary expansion affect output positively. In addition, a lower real interest rate, a higher real stock price, a lower crude oil price and a lower expected inflation rate would raise output.

Empirical results have several policy implications. It seems that a managed floating system in Malaysia yields better outcomes for fiscal expansion and monetary expansion after the exchange rate is incorporated in the money demand function. The results in this study are in contract with the predictions of the Mundell-Fleming model that monetary expansion is effective under a floating exchange rate and fiscal expansion is effective under a fixed exchange rate. Hence, the assumptions that money demand is not affected by the exchange rate and the LM^* curve is vertical inthe Mundell-Fleming model may not apply to some of the countries.

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