The Mundell-Fleming Trilemma Combination on Middle-Income Countries

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Abstract

A country with a small open economy is unlikely to simultaneously achieve monetary independence, exchange rate stability, and financial integration. In Mundell Fleming's trilemma hypothesis, the three goals are trade-offs. Therefore, this study aims to identify the combination of the Mundell Fleming trilemma in middle-income countries from 1995 to 2017 with the panel Autoregressive Distributed Lag (ARDL) model. This estimation method will provide an overview of the combination of Mundell Fleming's trilemma in the short and long term. The results of this study indicate that the Mundell-Fleming trilemma tends to converge in the short run. While on the long run, middle-income countries tend to choose monetary independence and financial integration, resulting in a less stable exchange rate, as mentioned in the hypothesis

INTRODUCTION

The Mundell-Fleming trilemma hypothesis states that a country cannot simultaneously achieve exchange rate stability, financial integration, and monetary independence (Aizenman, 2018). In other words, the combination of the fixed exchange rate, free capital mobility, and monetary independence is impossible to run simultaneously. Within the framework of the Mundell-Fleming trilemma, three policies are trade-offs. Ito & Kawai (2014) states that one must be sacrificed to achieve the other two policies.

The existence of these trade-offs causes every decision in choosing the combination of the Mundell-Fleming trilemma to be considered carefully. According to Ito & Kawai (2014), each trilemma variable is a double-edged sword. That is, some consequences always accompany every choice made. For example, the choice to achieve high exchange rate stability will lead to reduced monetary independence. On the other hand, monetary independence that is too high, in turn, hurts fiscal discipline through debt monetization. Finally, high financial integration

will make the domestic financial market very open to the outside world, so the domestic economy's resistance will decrease, especially when faced with external shocks and volatility of capital flows. This condition then causes a country to be vulnerable to financial crises.

Based on Pasricha et al. (2018) and Obstfeld et al. (2005), there are three combinations in understanding the framework of the Mundell-Fleming trilemma. The first combination is monetary independence and exchange rate stability. These two can be achieved by limiting the movement of capital flows through capital control policies, as in the Bretton Woods era. In this position, the state can prevent the emergence of arbitrage because it can reduce the close relationship between domestic and foreign interest rates. Aizenman et al. (2013) states that monetary policy in this position tends to lead to a closed economy, where in the short term the monetary authority controls the money supply. To achieve its independence, the monetary authority implements a capital control policy.

The second combination prioritizes exchange rate stability and financial integration, with a consequent loss of monetary independence, as in the euro block or currency board group. Referring to the uncovered interest rate parity concept, assuming that domestic and foreign assets are perfect substitutes, then in a fixed exchange rate regime, the domestic interest rate will be the same as the foreign interest rate. If the government implements an expansionary monetary policy through an increase in the money supply, the domestic interest rate will fall. This condition is seen as a negative sentiment by investors. As a result, demand and prices for foreign assets will increase because investors flock to convert rupiah assets to foreign currencies. Under a fixed exchange rate regime, to meet the demand for foreign assets, the monetary authority must intervene by selling foreign currency and purchasing domestic currency. Due to this action, the monetary authority lost its independence in regulating the money supply. The supply of money supply will adjust to the demand.

Finally, the third combination is monetary independence and financial integration, which is compensated by a loss of control over exchange rate stability. Under a floating exchange rate regime, an increase in the money supply causes the domestic interest rate to fall. By looking at the relationship between interest rates and returns on securities (bonds), the decrease in domestic interest rates is compensated by an increase in capital outflow because investors will look for investment opportunities with higher returns. Capital outflow causes the demand for foreign currencies to increase, eventually dragging down the domestic currency. In this position, the monetary authority has the authority to exercise its independence as compensation for relinquishing exchange rate stability.

The existence of these three combinations illustrates that the Mundell-Fleming trilemma is still an interesting issue to be explored. Previous studies confirm that the trilemma hypothesis is still valid, and trade-offs between exchange rates, capital movements, and monetary independence are getting stronger (see for examples Hsing, 2012; Aizenman & Ito, 2014; Hutchison et al., 2012; Obstfeld et al., 2005; Yunita et al., 2018). On the other hand, some studies have violated the trilemma hypothesis, where exchange rate stability, financial integration, and monetary independence can be achieved simultaneously, which is known as a convergent pattern (see Aizenman et al., 2008; Pantelopoulos, 2021). The same pattern, namely the middle ground, was found by Herwartz & Roestel (2017). This pattern is

illustrated by placing it in the middle position in the trilemma triangle. This policy aims to maintain exchange rate stability in a very open economic condition. In order to reduce the trade-off pressure between the trilemma options, Herwartz & Roestel (2017) suggest a decrease in the degree of financial openness through a capital barrier. This action was taken to reduce the volatility of the exchange rate, so as to ultimately maintain domestic financial stability. Ho & Ho (2018) in their research in Vietnam found an intermediate trilemma policy. This policy is intended to achieve the three objectives of the trilemma simultaneously. To achieve this goal, Ho & Ho (2018) requires two things to be met, namely a strict capital regulation policy and the adequacy of foreign exchange reserves as a controller of exchange rate fluctuations.

It is also interesting to see how the Mundell-Fleming trilemma combination changes over time. A new idea with a different point of view was expressed by Rey (2015). In his research, Rey (2015) found a change in the trilemma policy into a dilemma. This finding seems to be the antithesis of the Mundell-Fleming trilemma framework that has been in effect so far. Rey (2015) stated that the "Global Financial Cycle", characterized by the flow of foreign funds, becomes very fast with increasing integration. A country with an open capital account cannot isolate its domestic economy regardless of the exchange rate system used. In this case, the intended country becomes very vulnerable to the transmission of shocks from outside. Therefore, implementing a capital control policy is the only way to be taken. This policy aims to achieve monetary independence as a protection from external shocks.

In contrast, the study by Berthold & Stadtmann (2019) gives different results in the context of the Mundell-Fleming trilemma. The monetary authority, namely The Swiss National Bank (SNB), does not have total independence in the fixed exchange rate and the floating exchange rate regime. This happens because the assumption of Purchasing Power Parity (PPP) is not fulfilled in the short term, so real exchange rate movements are not constant.

In line with Rey (2015), Aizenman (2018) also provides interesting findings. Aizenman (2018) stated that the 1997/1998 crisis was a lesson to prioritize the importance of financial stability, especially for emerging markets. This concern ultimately presents a new idea within the framework of the Mundell-Fleming trilemma, namely the quadrilemma. The idea of the quadrilemma rests on the urgency of "financial stability" after the increase in integration in 1990. This study was conducted to test the Mundell-Fleming trilemma hypothesis, which focuses on middle-income countries. The results of this study are expected to contribute to verifying the existence of the trilemma hypothesis in middle-income countries, which at the same time provides an overview of the trilemma pattern in the short and long term with the panel Autoregressive Distributed Lag (ARDL) model which so far has not been widely used in previous studies (Ardiansyah et al., 2021).

METHOD

The model of this study refers to the Mundell-Fleming trilemma hypothesis with some modifications from Pasricha et al. (2018) and Beckmann et al. (2016). This study estimates the panel ARDL (Autoregressive Distributed Lag) model to verify the validity of the trilemma hypothesis in middle-income countries. Two-stage least squares (2sls) method is also used to overcome the endogeneity problem

in the trilemma variables. This study uses the data of 8 (eight) middle-income countries (World Bank classification by income per capita), including Indonesia, Philippines, Thailand, South Africa, Mexico, Peru, Mauritius, and Kenya, with annual data from 1995 to 2017 (this period indicate the beginning of financial integration). The construction of the panel ARDL model in this study is as follows:

$$\Delta cf_{it} = \alpha_i + \emptyset_i \left(cf_{i,t-l} - \theta_1 er_{i,t-l} - \theta_2 mi_{i,t-l} - \theta_3 X_{i,t-l} \right) + \sum_{l=1}^{p-1} \lambda_{il} \Delta cf_{it-l} + \sum_{l=0}^{q-1} \lambda'_{il} \Delta er_{it-l} + \sum_{l=0}^{q-1} \lambda''_{il} \Delta mi_{it-l} + \sum_{l=0}^{q-1} \lambda'''_{il} \Delta X_{it-l} + \mu_{it} \quad (1)$$

$$\Delta mi_{it} = \sigma_i + \emptyset_i \left(mi_{i,t-l} - \theta_1 er_{i,t-l} - \theta_2 cf_{i,t-l} - \theta_3 X_{i,t-l} \right) + \sum_{l=1}^{p-1} \lambda_{il} \Delta mi_{it-l} + \sum_{l=0}^{q-1} \lambda'_{il} \Delta er_{it-l} + \sum_{l=0}^{q-1} \lambda''_{il} \Delta cf_{it-l} + \sum_{l=0}^{q-1} \lambda'''_{il} \Delta X_{it-l} + \varepsilon_{it} \quad (2)$$

$$\Delta er_{it} = \partial_i + \emptyset_i \left(er_{i,t-l} - \theta_1 cf_{i,t-l} - \theta_2 mi_{i,t-l} - \theta_3 X_{i,t-l} \right) + \sum_{l=1}^{p-1} \lambda_{il} \Delta er_{it-l} + \sum_{l=0}^{q-1} \lambda'_{il} \Delta cf_{it-l} + \sum_{l=0}^{q-1} \lambda''_{il} \Delta mi_{it-l} + \sum_{l=0}^{q-1} \lambda'''_{il} \Delta X_{it-l} + \epsilon_{it} \quad (3)$$

Equations 1, 2, and 3 refer to the first, second, and third combinations in the Mundell-Fleming trilemma hypothesis. θ, λ dan $\emptyset$ sequentially shows the long-term, short-term, and speed of adjustment coefficients. On the left side of the three equations above are endogenous variables, namely capital flow (cf), monetary independence (mi), and exchange rate (er). In this study, the trilemma variable is worth 0 to 1, which is obtained from the calculation of Chinn & Ito (2008) and Aizenman et al. (2013). The higher the index value (nearing 1), the more the government's attention is on the free capital mobility policy, monetary independence, and exchange rate stability (by adopting a floating exchange rate system). On the other hand, 0 indicates policies that tend to limit capital flows, reduce monetary independence and release exchange rate stability. Furthermore, the ARDL model construction above also uses five control variables (variable X): (i) economic size (ez), namely the share of a country's GDP to world GDP; (ii) economic development (ed), namely income per capita; (iii) trade openness (to), namely the ratio of total imports and exports to GDP; (iv) financial development (fd), namely the percentage of private credit to GDP; and (v) domestic saving (ds), namely the percentage of gross domestic saving against GDP.

Before executing the panel ARDL model, some pre-estimation tests must be conducted. **First**, a simultaneity test was carried out to ascertain the problem of endogeneity. This test aims to prove whether an independent variable is correlated with the error terms (Gujarati & Porter, 2004). **Second**, order identification ensures that the ARDL model is identified or not so that it can be executed with 2SLS. **Third**, perform a unit root test to ensure the degree of stationarity of the data. **Finally**, the fourth stage is the Hausman test to identify the best panel ARDL model, namely Pooled Mean Group (PMG), Mean Group (MG), or Dynamic Fixed Effect (DFE). The three classifications explain the characteristics of each section or country in the short and long term. Pooled Mean Group (PMG) assumes heterogeneity in the short term and homogeneous responses in the long term. Furthermore, the Mean Group (MG) assumes heterogeneity or different responses in the short and long term. In contrast, the Dynamic Fixed Effect (DFE) assumes a homogeneous response in the short and long term (Chu & Sek, 2014).

RESULTS AND DISCUSSION
Statistical Results

Table 1 presents the first pre-estimation results of the simultaneity test with the Hausman specification error test. The table below shows that the expected residual from the reduced form equations 1, 2 and 3 are significant. Therefore, it can be concluded that the ARDL model in this study has endogeneity problems.

Table 1. Simultaneous Test Result

Equation	P > [t]
1	0.00*
2	0.00*
3	0.01*

Note: *Sign at 5%
Source: Data Processed by Stata 16 (2022)

Furthermore, the second pre-estimation stage is the identification of orders that compares the number of exogenous and endogenous variables. Based on the identification of the order, it was found that the number of exogenous variables (K-K*) was more than the number of endogenous variables (M-1) in each equation. This indicates that the three equations are identified as overidentified. Therefore, the model in this study can be estimated simultaneously with the 2SLS method.

The third pre-estimation stage is the unit root test shown in Table 2 below. The table shows that the model built in this study consists of variables with varying degrees of stationery. On this matter, Pesaran et al. (1999) and Asteriou et al. (2021) state that the ARDL model can be executed with different degrees of stationarity, namely level I(0), I(1), or a combination of both.

Table 2. Panel Unit Root Test

Variables	Level	First difference
er (*exchange rate*)	0.00*	
mi (*monetary independence*)	0.30	
cf (*capital flow*)	0.54	
ds (*domestic saving*)	0.11	All variable is stationary
fd (*financial development*)	0.69	
ez (*economic size*)	1.00	
ed (*economic development*)	1.00	
to (*trade openness*)	0.24	

Note: *sign at 5%
Source: Data Processed by Stata 16 (2022)

Finally, the pre-estimate in Table 3 shows the best ARDL model specifications for the three equations. Based on the table, it is known that the probability value (P>|T|) for the three equations is greater than 5% (not significant). These results indicate acceptance of the null hypothesis, which states that sections are homogeneous in the long term and that Pooled Mean Group (PMG) is more efficient than Mean Group (MG). In other words, the results in the table state that the best ARDL model in this study is PMG.

Table 3. Hausman Test Results

Equation	chi-square	P>|T|
1	1.99	0.73
2	2.73	0.43
3	1.84	0.6

Source: Data Processed by Stata 16 (2022)

After conducting the pre-estimation test, the estimation results of the ARDL panel model are shown in Table 4. The ARDL panel estimation results verify the Mundell-Fleming trilemma hypothesis in the third equation/combination. These results found that the monetary independence and capital flows significantly affected the exchange rate. In the short term, the relationship between the three variables is positive, while in the long term, it is negative. This means that monetary independence, free capital mobility and exchange rate stability can be implemented simultaneously in the short run. On the other hand, in the long run, the government must sacrifice exchange rate stability.

Result and Discussion

Since 1990, the global economy has been increasingly integrated in trade and traffic in financial services. This phenomenon causes the flow of goods and capital to increase rapidly. For middle-income countries, this phenomenon is addressed by implementing a free capital mobility policy in the short and long term. That is, there is considerable attention from middle-income countries to abolish capital control policies so that capital flows increase sharply.

Table 4. Results of Panel ARDL Estimation Trilemma Mundell Fleming

dep var: cf	coeff	dep var: mi	coeff	dep var: er	coeff
ardl (1,2,2,0,0)		ardl (1,1,1,1,1)		ardl (1,1,1,1,1)	
Long-Term Coeff		Long-Term Coeff		Long-Term Coeff	
mi	0.01	cf	-1.61*	mi	-0.38*
er	0.05	er	-0.35	cf	-5.17*
fd	-0.00*	ds	0.02	cf	-0.00*
ez	-0.00	Short-Term Coeff		to	0.02*
Short-Term Coeff		Δmi_{t-1}	0.17**	Short-Term Coeff	
Δcf_{t-1}	-0.12	Δcf	-2.21	Δer_{t-1}	-0.01
Δmi	0.01	Δcf_{t-1}	2.79**	Δmi	-0.26
Δmi_{t-1}	-0.00	Δer	2.55	Δmi_{t-1}	2.79**
Δmi_{t-2}	0.02	Δer_{t-1}	-2.12**	Δcf	-0.07
Δer	0.10	Δds	0.08	Δcf_{t-1}	5.13*
Δer_{t-1}	0.05	Δds_{t-1}	-0.05	Δed	0.00**
Δer_{t-2}	-0.07	ect	-0.37*	Δed_{t-1}	0.00
Δfd	0.00			Δto	0.00
Δez	0.00*			Δto_{t-1}	-0.03*
Ect	-0.20	cons	0.09**	ect	-1.04*
Cons	0.08			cons	0.70*

Note: Sign: *5%; **10%
Source: Data Processed by Stata 16 (2022)

The decision to relax capital flows provides benefits and threatens middle-income countries. The policy is believed to stimulate economic growth through capital accumulation and technology transfer (Selvarajan & Ab-Rahim, 2020). On the other hand, from a different point of view, the flow of foreign capital will lead to the financial system's vulnerability and overall macroeconomic stability (Tanago et al., 2019; Saputra, 2020; Riyanto et al., 2021) .

Not only freeing up capital movements, middle-income countries also appear to maintain and achieve higher monetary independence in the short and long term. This decision was taken as an effort to protect domestic economic stability. Aizenman et al. (2013) state that high monetary independence will provide better economic stability. For middle-income countries, monetary independence can control inflation, which is still an issue in developing countries (Cevik & Zhu, 2019).

Furthermore, middle-income countries respond differently regarding exchange rate stability in the short and long term. In the short term, exchange rate stability, financial integration, and monetary independence remain a priority. The three policies, free capital mobility, monetary independence, and a fixed exchange rate, can be implemented simultaneously. However, this pattern cannot be maintained in the long term. In order to achieve financial integration and monetary independence in the long term, the government must reduce control over exchange rate stabi¨ In other words, the fixed exchange rate system must be abandoned and switche a floating one.
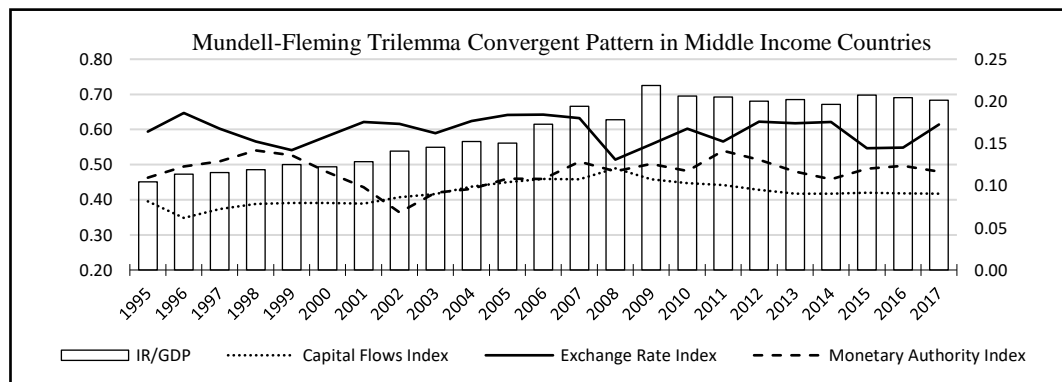

Figure 1. The Mundell Fleming Trilemma Combination
Source: Chinn & Ito (2008); Aizenman et al (2013)

Figure 1 explains the combined Mundell-Fleming trilemma in middle-income countries in the short run. During this period, a convergent trilemma pattern was found, in which the state could maintain monetary independence, manage exchange rate stability, and be actively involved in financial integration. Aizenman et al. (2008) emphasized that the convergent pattern can be used to increase economic growth and reduce output volatility.

Apart from the positive impact, maintaining a convergent pattern requires the availability of foreign exchange reserves. Pantelopoulos (2021) states that foreign exchange reserves are a shield when facing speculators' attacks due to increased financial integration. Aizenman & Ito (2012) also emphasized that the ownership

of foreign exchange reserves can change the configuration of the trilemma, especially in developing countries, into a middle ground pattern.

Finally, the results of this study prove that the convergent pattern in middle-income countries is not sustainable in the long term. This research is in line with Steiner (2015), who states that the convergent pattern only occurs in the short run. After reaching equilibrium, the trilemma pattern in middle-income countries will return to its original rule. In the long run, exchange rate stability must be sacrificed to achieve monetary independence and financial integration, the third combination in the Mundell-Fleming trilemma hypothesis (Granata, 2020; Obstfeld et al., 2005; Kharroubi & Zampolli, 2016).

CONCLUSION

The results of this study confirm that the Mundell-Fleming trilemma hypothesis in middle-income countries is only valid in the long run. Meanwhile, a convergent pattern was found in the short term, a deviation from the Mundell-Fleming trilemma hypothesis. Nevertheless, the convergent pattern provides a positive stimulus to economic growth. This pattern requires the availability of foreign exchange reserves. Therefore, the government needs to take policies that save on foreign exchange reserves, such as import substitution policies, and macroprudential policies, such as capital flow management (cfm), to reduce the sensitivity of capital inflows and outflows.

Based on the limitations of this study, several suggestions are recommended for further research. Firstly, adding the number of countries so that the trilemma conditions in middle-income countries can be explored broader. Secondly, further research may use other methods, such as Vector Auto Regression (VAR) or Vector Error Correction Model (VECM) to see more complex combinations of Mundell Fleming triangles so that more information is obtained. Third, related to research results, in the future, it can be developed by identifying the impact of each pattern of the Mundell-Fleming trilemma on macroeconomic indicators.

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