Journal of International Money and Finance 149 (2024) 103182

Contents lists available at ScienceDirect

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

Monetary and fiscal policy impacts under alternative trilemma regimes☆

Hiro Ito [a,*], Masahiro Kawai [b]

[a] Hiro ITO, Portland State University, 506 SW Mill Street Urban Center Building, #450, Portland, OR 97201, U.S.A.
[b] Masahiro KAWAI, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-0033, Japan

ARTICLE INFO

JEL codes:
F 15
F 21
F31
F36
F41
O24

Keywords:
Trilemma in international finance
Exchange rate stability
Financial market openness
Monetary policy independence
Trilemma regime
Monetary and fiscal policy effectiveness

ABSTRACT

Using a new set of trilemma indexes for exchange rate stability, financial market openness, and monetary policy independence, this paper first locates more than one hundred economies in the trilemma triangle over time. Second, the paper depicts individual economies' trilemma regimes, defined by combinations of the three indexes, in the global map. Third, the paper tests econometrically the impact of monetary and fiscal policies on key macroeconomic variables (i.e., the real GDP growth rate gap, inflation, and their variability/volatility) under alternative trilemma regimes. Fourth, it examines the roles of trilemma regimes in influencing the macroeconomic variables. Econometric analysis uses a sample of 61 emerging market & developing economies over the period 1971–2020. The two-stage least squares estimation results largely support the Mundell-Fleming predictions made for three "corner" regimes. Monetary policy is effective in raising the real GDP growth rate gap and its variability under the "flexible exchange rate" corner regime, but not under the "financially open fixed rate" regime. Monetary policy is most effective in stimulating inflation and inflation volatility under the "flexible rate" regime. Fiscal policy has a positive impact on the GDP growth rate gap under the "flexible rate" regime and positive impacts on inflation and variability/volatility measures under the "financially closed fixed rate" regime, while it has no such impact under the "financially open fixed rate" regime, a somewhat surprising finding. The "financially open fixed rate" regime has a role of achieving price stability in a financially open economy.

1. Introduction

For macroeconomic authorities, achieving stable and low-inflation economic growth is a challenge particularly in emerging market & developing economies (EMDEs). In a financially open economy, authorities face a constraint called the "trilemma" of international finance (Mundell, 1963; Obstfeld, Shambaugh, and Taylor, 2005), where they can choose two out of three policy frameworks, i.e., exchange rate stability (ERS), financial market openness (FMO), and monetary policy independence (MPI). Simply put, they face policy trade-offs.

☆ The authors would like to thank Anella Munro, Andrew Rose, other conference participants, and an anonymous referee for constructive comments. The views expressed in the paper are those of the authors and do not represent those of organizations the authors may have been associated with over the past years. We also thank D. Serra Kirsch for research assistance.

* Corresponding author.
E-mail addresses: ito@pdx.edu (H. Ito), mkawai.tokyo@gmail.com (M. Kawai).

https://doi.org/10.1016/j.jimonfin.2024.103182

Available online 2 September 2024

Over the past decade or two, the trilemma issue has gained attention. Many economists have explored the trade-offs based on the trilemma theory. This paper investigates a fundamental question of how different combinations of the three trilemma choices affect the impacts of monetary and fiscal policies on macroeconomic performance, such as output growth, inflation, and their volatilities. Are there trilemma combinations that help the monetary and fiscal authorities in achieving stable growth and low and stable inflation?

Work by Ito and Kawai (2024a) has found that there is no particular trilemma combination that yields the best macroeconomic performance. Although not surprising, this result calls for further analysis of identifying distinctive macroeconomic roles of trilemma combinations. While the trilemma theory only looks into the monetary policy aspect of open-macroeconomic management, fiscal policy can also be mobilized for macroeconomic stabilization. For example, a country with fixed exchange rates and an open financial market is expected to have no MPI and, as a result, may face high levels of output volatility as demonstrated in the literature. However, in reality, such a country can rely on fiscal policy for macroeconomic stabilization and may successfully mitigate output volatility. Hence, to investigate a broader question of how an open economy is managed under a given trilemma regime, one should consider both monetary and fiscal policies.

The traditional Mundell-Fleming model provides theoretical predictions on the effectiveness of monetary and fiscal policies for three "corner" regimes: (i) under the "financially open flexible rate" regime, monetary policy has a positive, if transitory, impact on output and inflation, while fiscal policy has no or weak impact; (ii) under the "financially closed fixed rate" regime, both monetary and fiscal policies have positive impacts; and (iii) under the "financially open fixed rate" regime, monetary policy has no impact while fiscal policy has high impact. One can examine, econometrically, the extent to which monetary and fiscal policies affect key macroeconomic variables under alternative trilemma regimes. An important question is whether the traditional predictions hold empirically under the three "corner" regimes and how policy impacts might vary under other trilemma regimes.

The paper is organized as follows. Section 2 provides a literature review on the trilemma concept and index, implications of the choice of trilemma regimes for macroeconomic performance, and the effects of monetary and fiscal policies on macroeconomic variables. Section 3 uses the new trilemma indexes developed by Ito and Kawai (2024a) and depicts the evolution of trilemma combinations and trilemma regimes for different economies over time. Section 4 tests econometrically the impact of monetary and fiscal policies on key macroeconomic variables (the real GDP growth rate gap, the CPI inflation rate, and their variability/volatility) under alternative trilemma regimes and the role of trilemma regimes in influencing macroeconomic performance. Section 5 concludes the paper.

2. Literature review

2.1. Measuring trilemma indexes

Systematic empirical investigation using the trilemma theory requires clearly measurable definitions of the three trilemma frameworks, i.e., indexes for ERS, FMO, and MPI. Until recently, there was a paucity of metrics that would systematically measure these. Aizenman, Chinn, and Ito (2010, 2011, 2013) constructed such metrics for the first time and Ito and Kawai (2014, 2024a) have since developed alternative indexes.

Aizenman, Chinn, and Ito (2010, 2011, 2013) defined the three indexes in the following way, all taking values between 0 and 1. First, the index for ERS (ERS_{ACI}) is defined by an inverse of the annual standard deviation of the monthly rate of change in nominal exchange rates vis-à-vis the base country's currency.[1] The base country is identified as the country with which a home economy's monetary policy is most closely linked, as in Shambaugh (2004). The index ranges between 0 and 1, with a higher value of the index representing greater ERS. Second, the degree of FMO (FMO_{ACI}) is based on the *de jure* measure of capital account openness (KAOPEN) developed by Chinn and Ito (2006, 2008). The Chinn-Ito index is normalized between 0 and 1, with a higher value of the normalized index representing a more open financial market to cross-border capital flows. Finally, the index for MPI (MPI_{ACI}) is defined as negatively related to the annual correlation of a home economy's interest rate with the base country's interest rate.[2] By construction, the index ranges between 0 and 1,[3] and a higher value for the index represents greater MPI.

While the quantitative approach initiated by Aizenman, Chinn, and Ito has allowed the trilemma concept to be empirically operational for a large number of economies, their simple approach may fail to capture the subtlety of the policy frameworks. First, the ERS_{ACI} index, based on the standard deviation of a simple exchange rate vis-à-vis the base country, may not reflect the reality of the exchange rate arrangement of an economy that manages its currency value against a basket of major currencies rather than a single base country's currency. Second, the *de jure* measure of FMO_{ACI} may not reflect the actual degree of financial market openness, which may be better represented by *de facto* measures based on observed volumes of cross-border capital flows or external assets and liabilities.[4] Third, the MPI_{ACI} index, defined by simple correlations of interest rates, may be spurious if they are not properly controlled.

To overcome these potential drawbacks, Ito and Kawai (2024a) have developed new indexes for the trilemma dimensions.[5] First, to

[1] More precisely, it is given by $ERS_{ACI} = 0.01/[0.01+SD(\Delta lnE_t)]$, where E_t is the home country's nominal exchange rate against the base country.

[2] This index is expressed as $MPI_{ACI} = 1 - [Corr(i_h, i_b)+1]/2$, where i_h and i_b are the money market interest rates of the home and the base country, respectively.

[3] The index is smoothed by applying the three-year moving average encompassing the preceding, concurrent, and following years of observations.

[4] The issue of whether the *de facto* or *de jure* approach would be better to measure the degree of FMO has long been debated in the literature. For a review, refer to Chinn and Ito (2008), Kose, Prasad, Rogoff, and Wei (2009), and Quinn, Schindler, and Toyoda (2011).

[5] Detailed explanations are provided in Online Appendix I.

calculate a new index for ERS, the Frankel and Wei (1994) or Kawai and Pontines (2016) regression of a home economy's exchange rate movement against those of major currencies is performed and the root mean squared error (RMSE) of the regression is obtained.[6] The new index, ERS_{IK}, is constructed to have an inverse relationship with the RMSE,[7] ranging between 0 and 1, with a higher value indicating greater ERS. Second, a new index for FMO is defined as the sum of external assets, excluding foreign exchange reserves, and liabilities adjusted for GDP and trade values.[8] It is a *de facto* measure, FMO_{IK}, based on data provided by Lane and Milesi-Ferretti (2001, 2007, 2017, and updates), rather than a *de jure* measure. Third, an index for MPI is constructed by running three regressions for the home short-term interest rate, comparing the extent to which the home interest rate is explained by domestic and global factors (the home GDP gap, inflation, world GDP growth, oil prices, etc.) and the extent to which it is explained by the foreign short-term interest rate, and examining whether the former extent is larger than the latter.[9] This procedure is based on the view that economies with high degrees of MPI should be able to set their policy interest rates for the purpose of macroeconomic stabilization in a way similar to the Taylor rule, while economies with low degrees of MPI set policy interest rates in a way linked to foreign interest rates, as discussed by Klein and Shambaugh (2015).

2.2. Implications of trilemma regimes for macroeconomic performance

This paper builds on the empirical literature that attempts to examine the implications of exchange rate regimes and, more broadly, trilemma regimes for macroeconomic performance.

Baxter and Stockman (1989) found no evidence that the behavior of macroeconomic variables changed systematically between fixed and flexible exchange rate regimes. In contrast, Levy-Yeyati and Sturzenegger (2001) observed that exchange regimes mattered in terms of real economic performance. IMF economists (Ghosh, Gulde, Ostry, and Wolf, 1996; Ghosh, Gulde, and Wolf, Ch.6, 2002) argued that there was a strong link between exchange rate regimes and macroeconomic performance: a fixed exchange rate regime led to lower inflation than other regimes; output growth did not vary significantly across regimes, but per capita GDP grew slightly faster and output volatility was smaller under flexible than under fixed rate regimes. Husain, Mody, and Rogoff (2005) found that for developing economies with little access to international capital markets, fixed exchange rate regimes worked well, delivering low inflation. Aghion, Bacchetta, Rancière, and Rogoff (2009) found that economies with more developed financial markets grew faster with more flexible exchange rates while economies with less developed financial markets grew faster with more stable exchange rates.

Aizenman, Chinn, and Ito (2010, 2011, 2013), using the trilemma indexes they constructed, found that EMDEs with greater ERS or greater FMO tend to experience lower inflation and those with higher levels of MPI tend to experience higher inflation and lower output volatility; and emerging economies with higher levels of ERS tend to experience greater output volatility. They considered the effects of each trilemma dimension, but not the effects of trilemma regimes defined by a combination of the three indexes. Thus, their empirical work did not test the roles of trilemma regimes for macroeconomic performance, such as output growth, inflation, and their variability or volatility.

2.3. Macroeconomic impacts of monetary and fiscal policies under alternative trilemma regimes

This paper also builds on empirical studies of the effects of monetary and fiscal policies on key macroeconomic variables under alternative exchange rate regimes or, more broadly, trilemma regimes. The classical literature is that of the Mundel-Flemming model (Fleming, 1962; and Mundell, 1963), which provided a "trilemma" view on the effectiveness of monetary and fiscal policies for macroeconomic management under alternative trilemma regimes, as stated earlier. Essentially, the effectiveness of monetary and fiscal policies depends on the combination of ERS and FMO, and thus MPI as well.

Prachowny (1977), using data for Canada during fixed and flexible rate periods, found that: under fixed exchange rates, monetary policy had no impact on real income and inflation, while under flexible exchange rates, both monetary and fiscal policies had positive impacts. Loungani and Swagel (2001), using annual data for 53 developing countries over the period 1964–1998, found that money growth and exchange rate changes played a far more important role in affecting inflation in countries with flexible exchange rates than

[6] The Frankel-Wei method is used when the Chinese renminbi (or RMB) is not considered as a major anchor currency, and the Kawai-Pontines method is used when the RMB is considered as a major anchor currency. A severe multicollinearity problem would arise if the RMB, which tends to follow the movement of the U.S. dollar (USD), were added to the right-hand side of the Frankel-Wei regression to estimate the weight on the RMB in addition to those of the traditional anchor currencies (the USD, euro, U.K. pound, and Japanese yen). The Kawai-Pontines method addresses the multicollinearity problem and yields superior and more stable and robust estimates on both the USD and RMB weights than the Frankel–Wei method.

[7] Ito and Kawai (2014, 2021) used the adjusted R^2 of the Frankel-Wei regression. Bleaney and Tian (2020) suggest the use of the RMSE to measure the ERS. The new index is defined as $ERS_{IK,jt} = [RMSE(p90)–RMSE_{jt}]/Max[RMSE(p90)– RMSE_{jt}]$, where RMSE(*p90*) is the 90th percentile of RMSE. An alternative way of defining ERS would be to measure exchange market pressure (market intervention or reserve changes plus exchange rate changes) and obtain the share of exchange rate changes in exchange market pressure.

[8] It is first defined as $FMO\_1_{jt} = (Total\ external\ assets_{jt} + Total\ external\ liabilities_{jt} – Official\ reserve\ assets_{jt})\ x\ [(1/GDP_{jt}) + \{1/(Exports_{jt} + Imports_{jt})\}]$. Next, assuming advanced economies (AEs) as a group have achieved full FMO as of the late 1990s, the FMO index is defined as $FMO_{IK,jt} = FMO\_1_{jt}/FMO\_1_{ADV}$, where FMO_1_{ADV} is the FMO measure for AEs in the period from 1995 to 1999, which is regarded as the highest level of FMO. An alternative way of gauging FMO would be to use the price measure by testing the covered or uncovered interest parity condition.

[9] Such interest rates are defined as the weighted average of major country interest rates, using the estimated weights on major currencies obtained from Frankel-Wei or Kawai-Pontines regressions.

in those with fixed exchange rates. Dahalan and Jayaraman (2006) found that fiscal policy (measured by changes in government spending) had a greater impact on real output than did monetary policy (measured by changes in net foreign assets) in Fiji, which had a fixed exchange rate regime against a basket of currencies, for the period 1970–2002. Various authors (Corsetti, Meier, and Müller, 2012; Ilzetzki, Mendoza, and Vegh, 2013; and Born, Juessen, and Müller, 2013) found that fiscal multipliers were considerably larger under fixed exchange rate regimes than under other, particularly flexible, exchange rate regimes.

Ghosh, Gulde, and Wolf (2002: Ch. 6) and Aizenman, Chinn, and Ito (2010, 2011, 2013) included monetary and fiscal policy factors in their empirical studies but did not focus on the effects of monetary and/or fiscal policy under alternative exchange rate regimes or trilemma regimes. This paper attempts to close this gap by econometrically testing the effectiveness of monetary and fiscal policies under alternative trilemma regimes.

2.4. Debates on a trilemma vs. dilemma

Rey (2013, 2015) challenged the trilemma hypothesis by asserting that the free flow of capital restricts MPI even under a flexible exchange rate regime. She found evidence that US monetary policy was transmitted to other economies through global financial cycles, regardless of the exchange rate regime adopted, suggesting that in economies where capital moves freely, their central banks cannot implement independent monetary policy, even under flexible exchange rates. In this case, the trilemma hypothesis transforms into a dilemma in which the economies have to choose between FMO and MPI.

A large number of recent empirical studies support the trilemma hypothesis (Klein and Shambaugh, 2015; Aizenman, Chinn, and Ito, 2016; Bekaert and Mehl, 2019; Obstfeld, Ostry, and Qureshi, 2019; Obstfeld, 2021; Loipersberger and Matschke, 2022), while some studies support the dilemma hypothesis (Edwards, 2015; Passari and Rey, 2015; Hofmann and Takats, 2015; Miranda-Agrippino and Rey, 2020). A limited number of papers support partially both (Han and Wei, 2016; Cheng and Rajan, 2020). Han and Wei (2016) for example presented empirical findings consistent with a "2.5-lemma" or something between a trilemma and a dilemma depending on the monetary policy stance of the center country, i.e., the US.

An important message of this debate is that, even though exchange rate flexibility enables authorities in EMDEs to insulate themselves from global financial cycles and US monetary policy changes and set independent monetary policy for macroeconomic stabilization, its role as a shock absorber has likely become weaker with greater FMO because global financial and monetary shocks are transmitted through international capital flows. For this reason, authorities may wish to retain as much MPI as possible through adopting exchange rate flexibility and/or use more than one policy, such as macroprudential measures and fiscal policy, to mitigate the spillover effects of financial and monetary shocks on the home economy.

Studies on a trilemma vs. dilemma in the literature are mostly focused on whether monetary policy is independent or not under flexible exchange rates, rather than on whether monetary policy is effective under flexible exchange rates. This paper attempts to fill this vacuum by investigating whether monetary (and fiscal) policy is effective under alternative trilemma regimes, including the "flexible exchange rate" and "financially open fixed rate" corner regimes.

3. Defining and mapping the trilemma regimes

This section utilizes the new set of indexes developed by Ito and Kawai (2024a) to define trilemma regimes, plot trilemma combinations for different economy groups, and map trilemma regimes for individual economies for selected years where data are available. See Online Appendix I for detailed explanations of how the three indexes are constructed.

3.1. Defining trilemma regimes

The most intuitive way to define trilemma regimes and illustrate their evolution for any economy is to plot the combinations of the three indexes in a trilemma triangle and see how they move over time. To plot trilemma combinations in an equilateral trilemma triangle with the height of unity, the sum of the three trilemma indexes must equal two. As the constructed indexes do not always sum up to two, an adjustment is made so that the sum of the three adjusted indexes becomes *exactly* equal to two. As the sum of the three indexes can be expressed as $ERS_{IK,jt} + FMO_{IK,jt} + MPI_{IK,jt} = 2C_{jt}$, the adjusted indexes are obtained by dividing each of the original indexes by C_{jt}, where subscript j denotes an economy and t a year. No previous literature, except the current authors' work such as Ito and Kawai (2014, 2021, 2024a), has plotted the combination of the three indexes in a trilemma triangle.

A trilemma regime is defined by the location of each economy in the trilemma triangle. Fig. 1 shows such a triangle, where the bottom, right-hand, and left-hand sides represent the highest levels of ERS, FMO, and MPI, respectively. Starting from any one corner, a move vertically toward the opposite side enables the achievement of a higher degree of the outcome indicated by that side. In other words, any corner means the zero attainment and a point on the opposite side means the maximum attainment of the outcome represented by the side. The top vertex in the triangle illustrated in the figure, labeled "flexible exchange rate" is characterized by the full extent of FMO and MPI and the zero extent of ERS (thus full exchange rate flexibility). The left bottom corner, called "financially closed with fixed rates," is a combination of the full extent of ERS and MPI and the zero extent of FMO (thus financially closed). The right bottom corner, called "financially open with fixed rates," is characterized by the full extent of ERS and FMO with no MPI. An economy may choose any point, i.e., a corner, along a side, or inside, of the triangle, which defines a trilemma regime.

For ease of empirical investigation, Fig. 1 defines ten different trilemma regimes by first dividing the large trilemma triangle into nine equal sized, smaller triangles, named A to I, and then adding a hexagon that includes the central triangle with the same small size and parts of all the non-corner triangles. Smaller triangles A, E, and I approximate the "corner" regimes, and the hexagon represents the

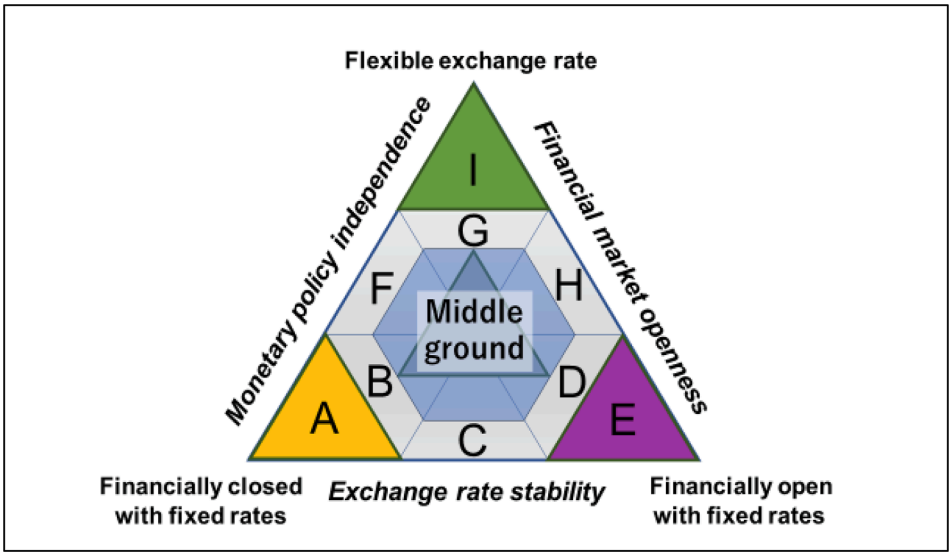

Fig. 1. Definition of ten trilemma regimes.

"middle ground.".

The division of the large triangle into nine equal sized, smaller triangles reflects the procedure of defining three levels of ERS, FMO, and MPI, i.e., high, intermediate, and low.[10] For example, regime A is marked by a combination of high ERS, low FMO, and high MPI, which approximates the "financially closed fixed rate" corner; regime E matches the "financially open fixed rate" corner with the combination of high ERS, high FMO, and low MPI; and regime I corresponds to the "flexible exchange rate" corner with the combination of low ERS, high FMO, and high MPI.

There are seven non-corner regimes. For example, regime B represents a combination of high ERS, intermediate FMO, and high MPI. The "middle ground" regime—depicted by the hexagon—is identified as one of the trilemma regimes on the notion that some economies may not choose corner regimes because of their preference for mid-level combinations of trilemma indexes. Although this regime has overlaps with the other six non-corner regimes and does not constitute an exclusive area in the triangle, it deserves attention as a number of economies appear to adopt the "middle ground.".

3.2. Plotting trilemma combinations for various economy groups

Figs. 2.A and B plots trilemma combinations in trilemma triangles for illustrative purposes. Fig. 2.A indicates trilemma combinations for different economy groups for three five-year periods: 1986–1990, 2001–2005, and 2016–2020. Economies are classified into three groups, i.e., advanced economies (AEs), emerging market & middle-income economies (EMMIEs), and low-income economies (LIEs). Several interesting observations can be made.

In AEs, while various trilemma combinations are observed in the late 1980 s and early 2000 s, they moved toward higher degrees of FMO in the late 2010 s. AEs can be classified into three types. The first type, mainly made up of Euro Area members, seeks to achieve the "financially open fixed rate" corner. The second type pursues the "flexible exchange rate" corner. The third type sets the three indexes at intermediate levels and does not aim for any corner. Interestingly, several AEs that had achieved the remaining "financially closed fixed rate" corner in the early years have recently moved away from such a corner.

Emerging market & middle-income economies (EMMIEs) allow varying degrees of ERS with less FMO and greater MPI than AEs. Looking at the first half of the 2000 s, EMMIEs can be broadly divided into two types. The first type consists of economies that maintain high MPI under varying degrees of ERS and FMO. The second type maintains relatively high ERS and varying degrees of FMO and MPI. In the second half of the 2010 s, all types of economies generally reduced ERS and increased FMO. Several economies especially within the first type have maintained or moved towards the "flexible exchange rate" corner. Some economies remain at, or close to, the "financially closed fixed rate" corner. A number of economies adopt the "middle ground.".

Low-income economies (LIEs) exhibit patterns different from AEs and EMMIEs. LIEs have not opened up their financial markets and appear to value ERS and MPI more highly than other economies (with the exception of Nigeria which chose the "flexible exchange rate" corner in the 1980 s). In addition, although they tend to consider MPI as important, its levels do not seem to be as high as those in

[10] This division is arbitrary, as there is no theory that determines how many regimes to consider is optimal. Dividing the large triangle into four, nine, 16, or more equal-sized triangles is a possibility. However, dividing it into just four may fail to capture the subtlety of regimes and dividing it into 16 or more may make the number of observations too small for many regimes. Dividing the large triangle into nine smaller triangles appears to mitigate either risk.

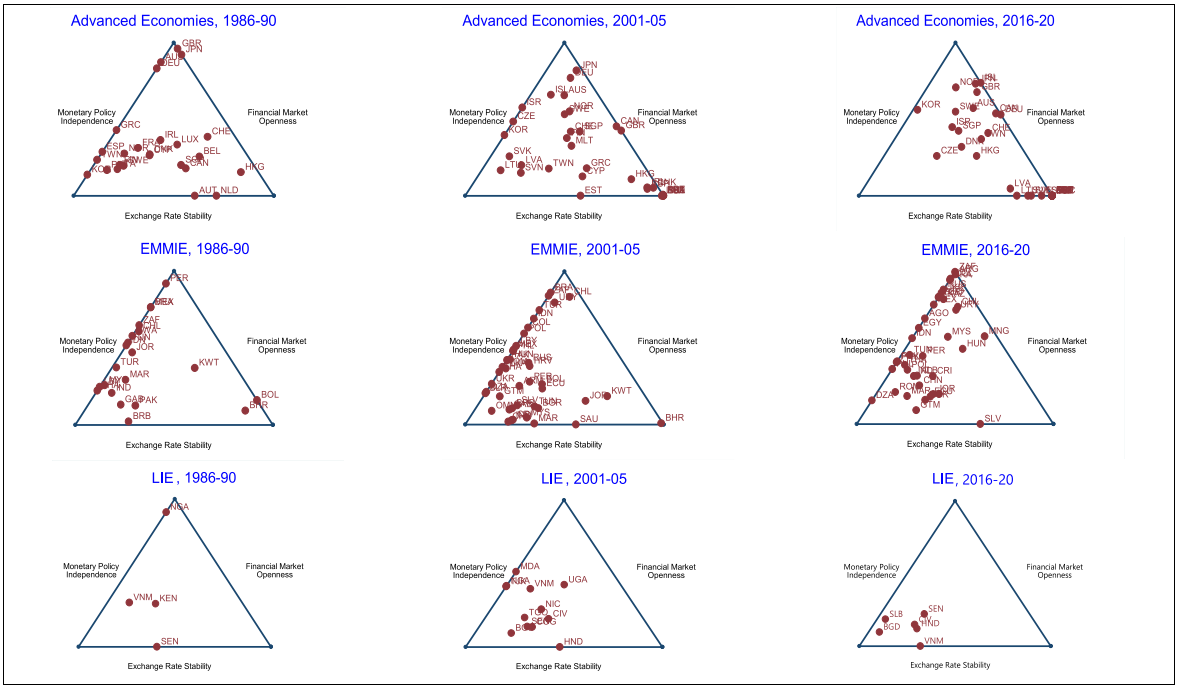

Fig. 2A. Trilemma triangles – Economies in the world by income group for three sub-periods.

EMMIEs. As a result, they are generally positioned close to the traditional "financially closed fixed rate" corner throughout the periods. As far as the available data are concerned, there has been no LIE choosing the "flexible exchange rate" corner since the early 2000 s. Moreover, no LIE adopts the "financially open fixed rate" corner.

Fig. 2.B depicts the evolution of trilemma combinations for selected Asian economies over the period 1975–2020. Each trilemma combination plotted in the triangles represents the average value for the past five years, including the year indicated. The general trend for the Asian economies is that the trilemma combinations have moved away from the "financially closed fixed rate" corner (except for Hong Kong and Singapore which started from different points) over time by reducing ERS and increasing FMO. The ASEAN economies have reduced the levels of ERS and maintained relatively high MPI after the Asian currency crisis but, apart from Singapore, they are yet to achieve full FMO.

Asia's largest economies, China, India, and Japan, have followed different trilemma combination trajectories. China has long maintained the "financially closed fixed rate" corner by seeking high ERS and MPI with low FMO. Since the global financial crisis, however, China has moved toward the "middle ground," with deliberate decreases in ERS and increases in FMO. Also starting from the "financially closed fixed rate" corner, India increased MPI while cautiously reducing ERS and raising FMO and then moved toward the "middle ground" by somewhat sacrificing MPI in the most recent period. Japan started to gradually reduce ERS in the 1970 s after the collapse of the Bretton Woods system and achieved high FMO by the 1990 s, realizing the "flexible exchange rate" corner. Being large economies, China, India, and Japan have pursued relatively high levels of MPI during most of the sample period.

3.3. *Mapping trilemma regimes for individual economies*

Fig. 3 visually presents economies that have attained one of the three corner regimes, the "middle ground," or the remaining non-corner regimes in the global map for the two periods, 2001–2005 and 2016–20. There are many economies where the trilemma regimes cannot be defined due to lack of data, but the figure still provides useful general trends on trilemma regimes.

The figure shows that, among the three corner regimes, the "financially closed fixed rate" corner was popular in the first period but lost popularity in the second period, while the "flexible exchange rate" corner and, to a lesser extent, the "financially open fixed rate" corner has gained traction from the first to the second period. In the second period, the "financially closed fixed rate" corner is selected by only a few EMDEs (Algeria, Bangladesh, Romania, and Vietnam), and the remaining two corners are roughly equally selected. The "flexible exchange rate" corner is adopted not only by AEs (such as Iceland, Japan, Norway, and the U.K.) but also by an increasing number of EMDEs (such as Argentina, Brazil, Mexico, Russia, South Africa, and Turkey). The "financially open fixed rate" corner is adopted by a number of small AEs joining the Euro Area but not by EMDEs.

The "middle ground" regime (represented by the hexagon in Fig. 1) continues to attract interest among economies. Economies like Ecuador, Jordan, Peru, Singapore, Sweden, Switzerland, and Taiwan maintain the "middle ground" in both periods, while Russia, Norway and others adopted the regime in the first period and China, Hungary, India, Israel, and others adopt it in the second period. As mentioned above, China and India, two large emerging economies, adopted the "financially closed fixed rate" corner in the first period

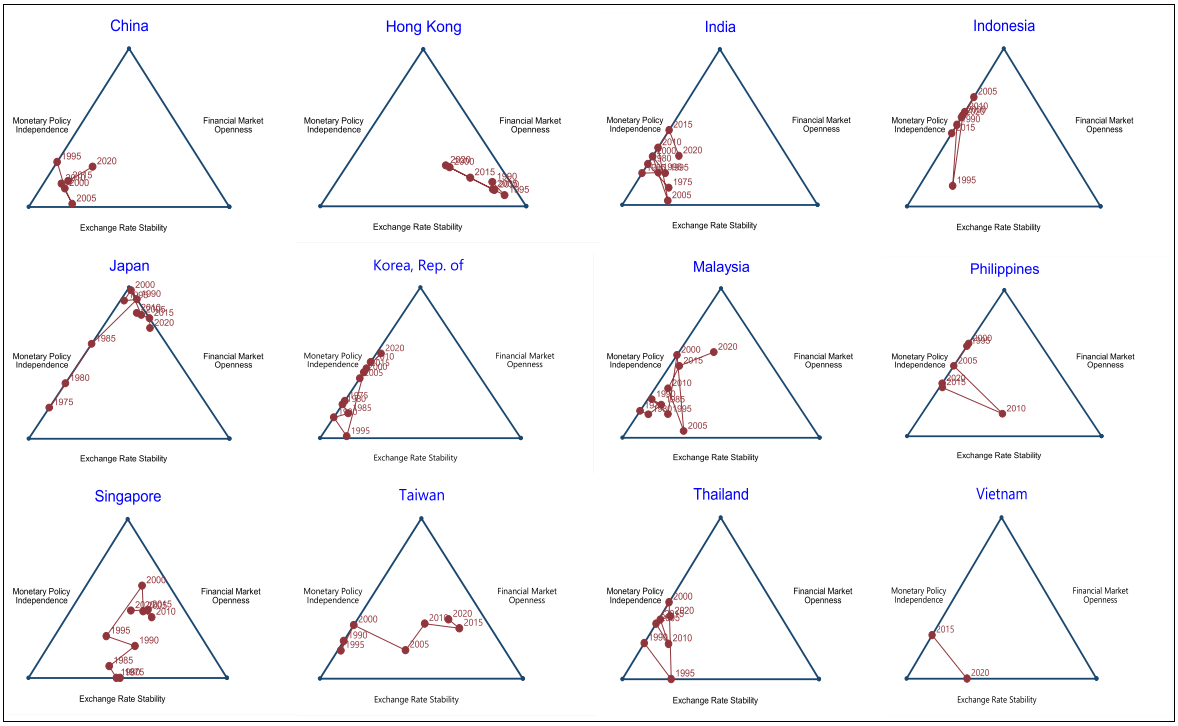

Fig. 2B. Trilemma triangles – Evolution for selected economies in Asia, 1975–2020.

and then moved to the "middle ground" regime in the second period. Russia moved from the "middle ground" in the first period to the "flexible rate" corner in the second period. Other non-corner regimes are shared by a number of economies, including both AEs (Australia, Canada, and the ROK) and EMDEs (Egypt, Indonesia, Malaysia, Pakistan, and Thailand).

4. Estimating the macroeconomic impacts of monetary and fiscal policies under alternative trilemma regimes

4.1. Specification of the estimation model

This section investigates the possible impacts of monetary and fiscal policies on macroeconomic variables under alternative trilemma regimes as well as the roles of trilemma regimes in influencing macroeconomic performance in EMDEs. Especially, it attempts to examine the impacts of monetary and fiscal policies under different trilemma regimes by using the following model:

$$y_{j,t} = \alpha + D'_{j,t}\gamma + \beta_1 MP_{j,t} + \beta_2 MP_{j,t-1} + \beta_3 D'_{j,t} \bullet MP_{j,t} + \beta_4 FP_{j,t} + \beta_5 FP_{j,t-1} + \beta_6 D'_{j,t} \bullet FP_{j,t} + X_{j,t}{}'\Theta + \upsilon_t + \epsilon_{j,t} \quad (1)$$

where $y_{j,t}$ is one of the macroeconomic variables, i.e., the GDP growth rate gap, the CPI inflation rate, GDP growth rate gap variability, or inflation volatility; $MP_{j,t}$ is a measure for monetary policy; $FP_{j,t}$ is a measure for fiscal policy; $X_{j,t}$ represents a vector of control variables that affect the macroeconomic variables; $D_{j,t}$ is a set of dummy variables that capture alternative trilemma regimes; and υ_t is a year dummy variable. The GDP growth rate gap is the deviation of the real GDP growth rate from the potential GDP growth rate, which is constructed via the Hodrick-Prescott filter. The CPI inflation rate is the percentage change in the CPI at the end of the year. The variability measure is the natural log of the absolute value of the annual change in the real GDP growth rate gap,[11] and inflation volatility is the natural log of the annual standard deviation of the year-on-year monthly rate of change in CPI. The econometric analysis covers 61 EMDEs over the period 1971–2020.

In the estimations of the real GDP growth rate gap and CPI inflation, MP_{jt} and FP_{jt} measures are the annual growth rates of broad money supply and general government final consumption expenditure, respectively. In the estimations of GDP growth rate gap variability and inflation volatility, they are the variabilities of broad money and government expenditure growth rates, respectively. These variabilities are defined by the natural logs of the absolute changes in broad money and government expenditure growth rates, respectively, from the previous year. To consider possible lags in policy impacts, the estimation equations add the first-lag of both

[11] To compute variability, the calculation method suggested by Rother (2004) is used for several other variables whose higher frequency (like monthly) data are difficult to obtain for a large number of economies, such as the broad money growth rate, the government expenditure growth rate, and the GDP gap.

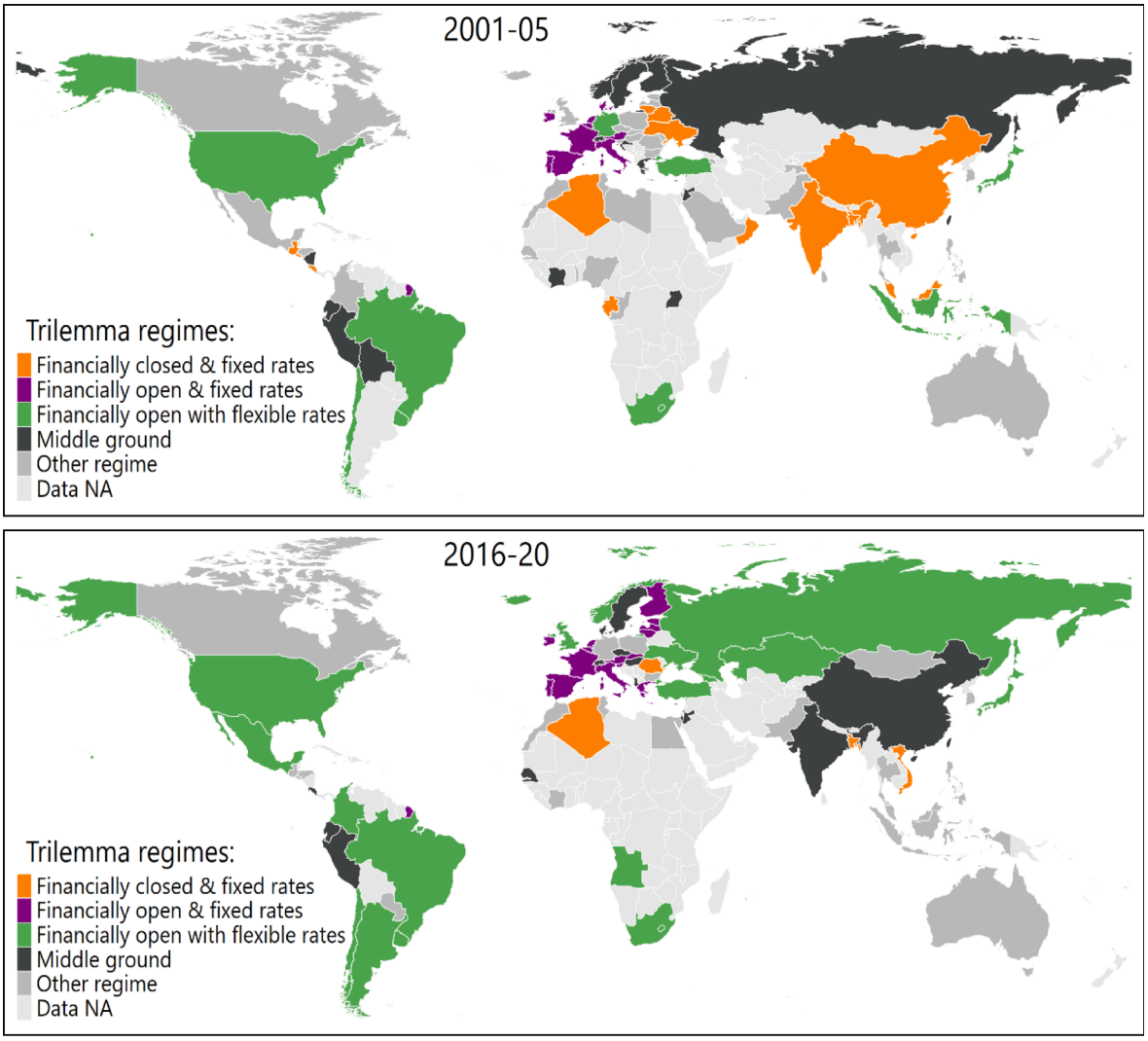

Fig. 3. Trilemma Regimes in the World, 2001–2005 and 2016–2020.

policy variables to the current variables.

A vector of control variables ($X_{j,t}$) includes variables identified as important or relevant in the literature, such as the FDI inflow/GDP ratio, the export growth rate, the terms of trade (TOT) growth rate or its volatility (Ghosh, Gulde, and Wolf, 2002; Aizenman, Chinn, and Ito, 2010, 2011, 2013), the nominal effective exchange rate (NEER) growth rate or its volatility (Loungani and Swagel, 2001), trade openness (Di Giovanni and Levchenko, 2009), financial openness (Buch, Doepke, and Pierdzioch, 2005; Bekaert, Harvey, and Lundblad, 2006, 2011; Ahmed and Suardi, 2009), the gross external debt/GDP ratio, the government expenditure/GDP ratio (Fatás and Mihov, 2001; Andrés, Doménech, and Fatás, 2008), and the financial crisis dummy.[12] Online Appendix II lists the explanatory variables used in the six estimations, and their theoretical or expected signs in the estimation models. To capture global common shocks, the estimations include time fixed effects (υ_t).[13]

To test the possibility that the macroeconomic impacts of monetary and fiscal policies are different across different trilemma regimes, the estimation equations include trilemma regime dummies and interactive terms between trilemma regime dummies and policy variables, i.e., $D'_{j,t} \bullet MP_{j,t}$ and $D'_{j,t} \bullet FP_{j,t}$. Four trilemma regimes are considered in this estimation: the "flexible exchange rate"

[12] Variables used in estimations are basically obtained from the World Bank's *World Development Indicators*.

[13] Thus, the estimations do not consider the impact of specific global common shocks, such as US monetary policy changes and oil price hikes, on home macroeconomic variables.

corner regime (denoted as *Flex*),[14] the "financially closed fixed rate" corner regime (*Closed_Fix*), the "financially open fixed rate" corner regime (*Open_Fix*), and the "middle ground" regime (*Middle*). The *Middle* regime here is the hexagon area in Fig. 1. One can assess the policy impact under a certain trilemma regime by combining the estimated coefficients on current and lagged policy variables and the interactive term. For example, the impact of monetary policy under the *Flex* regime can be captured by $\widehat{\beta}_1 + \widehat{\beta}_2 + \widehat{\beta}_3$, where $\widehat{\beta}_3$ is the estimated coefficient on the interactive term between *Flex* and $MP_{j,t}$.

The roles of trilemma regimes in influencing the macroeconomic variables can similarly be found by combining the estimated coefficients on the trilemma regime dummies and the interactive terms. For example, the total coefficient of the *Flex* regime is given by $\widehat{\gamma}_{FLEX} + \widehat{\beta}_3 \bullet \overline{MP} + \widehat{\beta}_6 \bullet \overline{FP}$, where $\widehat{\gamma}_{FLEX}$ is the estimated coefficient on the *Flex* dummy and $\overline{MP}$ and $\overline{FP}$ are the sample averages of monetary and fiscal policy measures, respectively, under the *Flex* regime.

Monetary and fiscal policy variables, given by broad money and government expenditure growth rates and their variabilities, are possibly endogenous, affected by the GDP growth rate gap, inflation, and their variability or volatility. In addition, monetary variables can be endogenous to the nominal exchange rate regime (Ghosh, Gulde, and Wolf, 2002). To account for the possible endogeneity problem of monetary and fiscal policy measures (as well as a few other variables such as the TOT, NEER, FDI inflow/GDP, and the export growth rate), the analysis utilizes the two-stage least squares (2SLS) estimation procedure. The first stage regression includes the one-year and two-year lagged values of these possibly endogenous variables as instruments, and the specifications are different depending on the left-hand side variable of the second stage estimation. The first-stage estimation results are reported in Online Appendix III.

The reason the real GDP growth rate gap is chosen as an output variable is that one of the major roles of monetary policy is to stabilize economic growth around the potential growth path rather than spurring economic growth well beyond potential growth.[15]

One can identify some theoretical predictions on the impact of monetary and fiscal policies on the key macroeconomic variables under three corner regimes: (i) the broad money growth rate (or its variability) has positive impacts on the real GDP growth rate gap and inflation (or their variability/volatility),[16] while the government expenditure growth rate (or its variability) has a weak or no impact under the "flexible exchange rate" regime; (ii) both the broad money and government expenditure growth rates (or their variabilities) have positive impacts under the "financially closed fixed rate" regime, and (iii) the broad money growth rate (or its variability) has no impact while the government expenditure growth rate (or its variability) has a high impact under the "financially open fixed rate" regime. For other non-corner regimes, it is difficult to apply specific theoretical predictions.

4.2. Estimation results and findings

Tables 1.A and B report 2SLS estimation results for the real GDP growth rate gap and the CPI inflation rate, respectively, and Tables 2.A and B report 2SLS estimation results for the variability of the real GDP growth rate gap and the volatility of CPI inflation, respectively.[17] The explanatory variables include the broad money and government expenditure growth rates (both in Tables 1.A and B) or their variations (in Tables 2.A and B), other factors that may explain the respective macroeconomic variables in a statistically significant way, trilemma regime dummies, and the interactive terms between trilemma regimes and monetary and fiscal policy measures. The total number of annual observations for 61 EMDEs over the 50-year period is 1,416, of which the *Flex*, *Closed_Fix*, *Open_Fix*, and *Middle* regime dummies apply to 251, 414, 56, and 138 observations, respectively.

Table 3 summarizes key information obtained from the regression results. More specifically, the table reports the estimated total coefficients of monetary and fiscal policies under the respective trilemma regimes and the levels of their statistical significance when policy interactions with trilemma regime dummies are taken into account for two models: one including each trilemma regime dummy separately (i.e., the case of model (2), (3), (4), or (5)) and the other including all regime dummies together (i.e., the case of model (6)). The results for these two models turn out to be very similar. Table 3 also provides information on the roles of trilemma regimes in influencing the respective macroeconomic variables. It reports the estimated total coefficients on the four trilemma regime dummies and their statistical significance levels by considering the interactive terms with monetary and fiscal policies,

4.2.1. Real GDP growth rate gap (deviation of the actual from the potential growth rate)

Table 1.A shows that broad money growth has contemporaneously and statistically significant positive impacts on the real GDP growth rate gap under certain models and that its interactive terms with the *Flex* and *Open_Fix* regime dummies are statistically significantly positive and negative, respectively. Government expenditure growth has contemporaneously positive and lagged negative impacts on the GDP growth rate gap, and its interactive term with the *Flex* dummy is statistically significant and positive. When interactive terms with trilemma regime dummies are taken into account (Table 3.A), the total impact of broad money growth is weakly significant and positive and the total impact of government expenditure growth is statistically significant and positive, both only under the *Flex* regime. In contrast, the total impact of broad money growth is not statistically significant under the *Open_Fix* regime.

[14] It should be noted that the monetary policy framework under the "flexible exchange rate" corner regime may include inflation targeting, monetary aggregate targeting, and other not-so-well-defined frameworks. This suggests that the "flexible exchange rate" regime may include economies which cannot control money growth and as a result experience high inflation and currency volatility.

[15] The authors thank Andrew Rose for pointing out this important issue.

[16] The usual monetary transmission mechanism works, that is, expansionary monetary policy leads to a lower domestic interest rate and domestic currency depreciation, thereby stimulating both domestic and external demand and also economic growth relative to potential growth.

[17] Additional estimations were also conducted for the per capita real GDP growth rate and its variation, but are not reported to conserve space.

Table 1.A
2SLS estimation results of the real GDP growth rate gap.

	Baseline (1)	Model (2)	Model (3)	Model (4)	Model (5)	All (6)
Broad money (BM) growth rate	0.024	0.015	0.024	0.025	0.022	0.009
	(0.011)**	(0.013)	(0.012)**	(0.011)**	(0.011)*	(0.017)
BM growth rate (t-1)	−0.018	−0.022	−0.017	−0.019	−0.017	−0.020
	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)
Government expenditure (GE) growth rate	0.094	0.055	0.072	0.100	0.100	0.003
	(0.052)*	(0.056)	(0.055)	(0.053)*	(0.053)*	(0.066)
GE growth rate (t-1)	−0.069	−0.055	−0.072	−0.069	−0.071	−0.062
	(0.034)**	(0.034)	(0.034)**	(0.034)**	(0.034)**	(0.035)*
Export growth rate	0.193	0.195	0.194	0.192	0.193	0.197
	(0.024)***	(0.024)***	(0.024)***	(0.024)***	(0.023)***	(0.024)***
TOT growth rate	0.102	0.101	0.101	0.099	0.099	0.095
	(0.052)*	(0.052)*	(0.053)*	(0.052)*	(0.052)*	(0.053)*
Financial openness (ln)	−0.003	−0.005	−0.006	−0.003	−0.003	−0.007
	(0.002)*	(0.002)**	(0.003)**	(0.002)	(0.002)	(0.004)*
Financial crisis	−0.029	−0.028	−0.029	−0.029	−0.029	−0.028
	(0.006)***	(0.006)***	(0.006)***	(0.006)***	(0.006)***	(0.006)***
Flex		−0.011				−0.014
		(0.005)**				(0.006)**
BM growth rate x Flex		0.026				0.031
		(0.014)*				(0.018)*
GE growth rate x Flex		0.287				0.332
		(0.116)**				(0.121)***
Closed_Fix			−0.005			−0.012
			(0.007)			(0.008)
BM growth rate x Closed_Fix			−0.006			0.010
			(0.016)			(0.020)
GE growth rate x Closed_Fix			0.065			0.126
			(0.107)			(0.112)
Open_Fix				0.015		0.010
				(0.007)**		(0.008)
BM growth rate x Open_Fix				−0.037		−0.022
				(0.021)*		(0.024)
GE growth rate x Open_Fix				−0.219		−0.118
				(0.158)		(0.165)
Middle					0.001	−0.004
					(0.011)	(0.011)
BM growth rate x Middle					0.004	0.018
					(0.034)	(0.036)
GE growth rate x Middle					−0.192	−0.105
					(0.218)	(0.223)
Adjusted R^2	0.19	0.20	0.19	0.19	0.19	0.20
Number of observations	1,216	1,216	1,216	1,216	1,216	1,216
Number of economies	61	61	61	61	61	61
Sample period	1971–2020	1971–2020	1971–2020	1971–2020	1971–2020	1971–2020

BM = broad money; Closed_Fix = "financially closed fixed rate" regime dummy; CPI = consumer price index; FDI = foreign direct investment; Flex = "flexible exchange rate" regime dummy; GDP = gross domestic product; GE = government expenditure; Middle = "middle ground" regime dummy; NEER = nominal effective exchange rate; Open_Fix = "financially open fixed rate" regime dummy; TOT = terms of trade.
Notes: (i) * $p<0.10$; ** $p<0.05$; *** $p<0.01$.
(ii) The BM growth rate, GE growth rate, natural log of FDI inflow/GDP, export growth rate, TOT growth rate, and NEER growth rate are the predicted values from the first stage regression.
(iii) Time fixed effects are included in the estimation, but not reported to conserve space.

Although not reported in the paper, an additional estimation revealed that broad money growth had no statistically significant impact on the per capita real GDP growth rate under any trilemma regime.[18] The result reported in Table 1.A and that obtained from the additional estimation are consistent with the notion that monetary policy can stabilize economic growth around the potential growth path but does not spur economic growth, which explains why broad money growth has a positive impact on the GDP growth rate gap, and not on the per capita real GDP growth rate. The finding supports the Mundell-Fleming prediction. However, the observation that government expenditure growth has a positive impact on the GDP growth rate gap under the "flexible exchange rate" corner regime but not under the "financially open fixed rate" regime is somewhat surprising in view of the Mundell-Fleming predictions.

On the role of trilemma regimes in influencing the GDP growth rate gap, Table 3.A shows that the total coefficients are weakly

[18] See the working paper version of this paper (Ito and Kawai, 2024b) for details of the regression results.

Table 1.B
2SLS estimation results of the CPI inflation rate.

	Baseline (1)	Model (2)	Model (3)	Model (4)	Model (5)	All (6)
Broad money (BM) growth rate	0.481	0.399	0.643	0.495	0.496	0.670
	(0.074)***	(0.070)***	(0.091)***	(0.075)***	(0.076)***	(0.115)***
BM growth rate (t-1)	0.274	0.277	0.251	0.269	0.271	0.240
	(0.071)***	(0.070)***	(0.067)***	(0.070)***	(0.070)***	(0.063)***
Government expenditure (GE) growth rate	−0.074	−0.004	−0.519	−0.083	−0.101	−0.801
	(0.189)	(0.193)	(0.315)*	(0.190)	(0.196)	(0.418)*
GE growth rate (t-1)	−0.167	−0.156	−0.144	−0.146	−0.166	−0.112
	(0.150)	(0.148)	(0.146)	(0.150)	(0.151)	(0.145)
FDI inflow/GDP (ln)	−0.010	−0.010	−0.009	−0.010	−0.011	−0.009
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
NEER growth rate	0.113	0.100	0.115	0.107	0.109	0.097
	(0.047)**	(0.039)**	(0.045)**	(0.047)**	(0.047)**	(0.040)**
Financial openness (ln)	0.035	0.032	0.028	0.037	0.035	0.029
	(0.008)***	(0.009)***	(0.010)***	(0.009)***	(0.008)***	(0.011)***
Financial crisis	0.041	0.038	0.028	0.039	0.042	0.030
	(0.022)*	(0.022)*	(0.022)	(0.022)*	(0.022)*	(0.022)
Flex		−0.042				−0.036
		(0.024)*				(0.027)
BM growth rate x Flex		0.316				0.082
		(0.186)*				(0.207)
GE growth rate x Flex		−0.229				0.517
		(0.584)				(0.690)
Closed_Fix			0.042			0.033
			(0.016)**			(0.016)**
BM growth rate x Closed_Fix			−0.548			−0.561
			(0.126)***			(0.152)***
GE growth rate x Closed_Fix			1.023			1.289
			(0.364)***			(0.464)***
Open_Fix				0.019		0.017
				(0.020)		(0.022)
BM growth rate x Open_Fix				−0.523		−0.685
				(0.094)***		(0.141)***
GE growth rate x Open_Fix				0.683		1.374
				(0.425)		(0.525)***
Middle					0.016	0.011
					(0.023)	(0.026)
BM growth rate x Middle					−0.250	−0.390
					(0.119)**	(0.159)**
GE growth rate x Middle					0.412	1.003
					(0.525)	(0.628)
Adjusted R^2	0.49	0.50	0.53	0.49	0.49	0.54
Number of observations	1,045	1,045	1,045	1,045	1,045	1,045
Number of economies	58	58	58	58	58	58
Sample period	1973–2020	1973–2020	1973–2020	1973–2020	1973–2020	1973–2020

significant for the *Middle* dummies with a negative sign. That is, the "middle ground" regime tends to reduce the GDP growth rate gap. Other regimes have no statistically significant impact.

All the additional explanatory variables exhibit the expected signs. Faster export growth and TOT growth tend to stimulate the GDP growth rate gap, while greater financial openness and the presence of financial crisis tend to reduce it.

4.2.2. CPI inflation rate

Results in Table 1.B demonstrate that both contemporaneous and lagged coefficients on broad money growth in the CPI inflation equation are statistically significant and positive. Interestingly, the interactive term of broad money growth with the *Flex* dummy is statistically significant and positive, while those with other trilemma dummies are statistically significant and negative. Government expenditure growth has largely negative impact on inflation, while its interactive term with the *Closed_Fix* dummy is statistically significant and positive.

When interactive terms with trilemma regime dummies are considered (Table 3.B), the total effect of broad money growth on CPI inflation is significantly positive under any trilemma regime. Thus, no economy can escape from the inflationary impact of broad money growth expansion. It turns out that the impact of broad money growth is largest under the *Flex* regime and smallest under the *Open_Fix* regime measured by the size of the total coefficient. This result supports the Mundell-Fleming prediction that monetary policy is most effective under the "flexible exchange rate" corner regime and least effective under the "financially open fixed rate" regime.

The total effect of government expenditure growth is to raise inflation in a statistically significant way only under the *Closed_Fix* regime. Thus, it is interesting to note that while broad money growth always has a positive impact on inflation under any trilemma

Table 2.A
2SLS estimation results of the (log of) variability of the GDP growth rate gap.

	Baseline (1)	Model (2)	Model (3)	Model (4)	Model (5)	All (6)
Broad money (BM) growth rate variability (ln)	0.002	0.001	0.003	0.002	0.001	0.002
	(0.002)	(0.002)	(0.002)*	(0.002)	(0.002)	(0.002)
BM growth rate variability	0.003	0.003	0.003	0.003	0.004	0.004
(ln, t-1)	(0.002)**	(0.002)*	(0.002)*	(0.002)**	(0.002)**	(0.002)**
Government expenditure (GE) growth rate variability (ln)	0.011	0.011	0.009	0.011	0.011	0.008
	(0.004)***	(0.004)***	(0.004)**	(0.004)***	(0.004)***	(0.005)
GE growth rate variability	−0.000	0.000	0.000	−0.000	0.000	0.000
(ln, t-1)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GE/GDP (t-1)	0.009	0.009	0.009	0.008	0.009	0.009
	(0.003)**	(0.003)**	(0.003)***	(0.003)**	(0.003)**	(0.003)***
Gross external debt/GDP	0.003	0.003	0.003	0.003	0.002	0.003
(ln, t-1)	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)*	(0.001)**
NEER volatility (ln)	0.010	0.010	0.010	0.010	0.010	0.010
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Financial crisis	0.011	0.011	0.011	0.011	0.012	0.012
	(0.006)**	(0.006)**	(0.006)**	(0.006)**	(0.006)**	(0.006)**
Flex		−0.000				0.009
		(0.032)				(0.034)
BM growth rate variability (ln) x Flex		0.002				0.001
		(0.003)				(0.003)
GE growth rate variability (ln) x Flex		−0.002				0.001
		(0.009)				(0.009)
Closed_Fix			0.000			0.009
			(0.020)			(0.022)
BM growth rate variability (ln) x Closed_Fix			−0.007			−0.006
			(0.003)***			(0.003)*
GE growth rate variability (ln) x Closed_Fix			0.006			0.007
			(0.005)			(0.006)
Open_Fix				−0.006		0.007
				(0.038)		(0.040)
BM growth rate variability (ln) x Open_Fix				0.003		0.003
				(0.006)		(0.006)
GE growth rate variability (ln) x Open_Fix				−0.003		0.000
				(0.010)		(0.010)
Middle					0.098	0.105
					(0.045)**	(0.047)**
BM growth rate variability (ln) x Middle					0.009	0.008
					(0.005)*	(0.005)
GE growth rate variability (ln) x Middle					0.017	0.020
					(0.011)	(0.012)*
Adjusted R^2	0.10	0.10	0.10	0.10	0.10	0.10
Number of observations	1,077	1,077	1,077	1,077	1,077	1,077
Number of economies	57	57	57	57	57	57
Sample period	1973–2020	1973–2020	1973–2020	1973–2020	1973–2020	1973–2020

BM = broad money; Closed_Fix = "financially closed fixed rate" regime dummy; Flex = "flexible exchange rate" regime dummy; GDP = gross domestic product; GE = government expenditure; Middle = "middle ground" regime dummy; NEER = nominal effective exchange rate; Open_Fix = "financially open fixed rate" regime dummy; TOT = terms of trade.
Notes: (i) * $p<0.10$; ** $p<0.05$; *** $p<0.01$.
(ii) The natural logs of BM growth rate variability, GE growth rate variability, NEER volatility, and TOT volatility are the predicted values from the first stage regression.
(iii) Time fixed effects are included in the estimation, but not reported to conserve space.

regime, government expenditure growth has a positive impact on inflation only under the "financially closed fixed rate" regime.

The estimated total coefficients on trilemma regime dummies show that only the *Open_Fix* dummy has a statistically significant impact on CPI inflation, which is negative. Essentially, the "financially open fixed rate" regime tends to reduce inflation, a benefit of adopting this regime for authorities attempting to control inflation.

Other variables possess the expected impacts on inflation. Economies with more FDI inflows tend to have lower inflation and those with greater financial openness, faster pace of NEER depreciation, and with more frequent financial crisis tend to experience higher inflation.

4.2.3. Variability of the real GDP growth rate gap

Table 2.A shows that variability in broad money growth has a lagged positive effect and that in government expenditure growth has a contemporaneous positive effect on the variability of the GDP growth rate gap. When interactive terms with trilemma regime dummies are taken into account (Table 3.C), the total impact of money growth variability on the variability of the GDP growth rate gap

Table 2.B
2SLS estimation results of the (log of) volatility of the CPI inflation rate.

	Baseline (1)	Model (2)	Model (3)	Model (4)	Model (5)	All (6)
Broad money (BM) growth	0.094	0.075	0.098	0.095	0.109	0.090
rate variability (ln)	(0.045)**	(0.045)*	(0.051)*	(0.045)**	(0.047)**	(0.059)
BM growth rate variability	0.146	0.142	0.146	0.145	0.145	0.142
(ln, t-1)	(0.037)***	(0.038)***	(0.037)***	(0.037)***	(0.038)***	(0.038)***
Government expenditure (GE) growth rate variability (ln)	0.256	0.259	0.262	0.260	0.238	0.240
	(0.060)***	(0.061)***	(0.076)***	(0.061)***	(0.060)***	(0.082)***
GE growth rate variability	0.087	0.093	0.086	0.087	0.086	0.093
(ln, t-1)	(0.045)*	(0.045)**	(0.046)*	(0.046)*	(0.045)*	(0.045)**
CPI inflation rate (t-1)	0.856	0.808	0.855	0.854	0.846	0.805
	(0.317)***	(0.318)**	(0.317)***	(0.315)***	(0.315)***	(0.317)**
GDP gap variability (t-1)	4.055	3.911	4.043	4.014	4.028	3.874
	(1.196)***	(1.193)***	(1.196)***	(1.197)***	(1.190)***	(1.188)***
GE/GDP (t-1)	−0.132	−0.129	−0.130	−0.154	−0.123	−0.139
	(0.081)	(0.081)	(0.081)	(0.084)*	(0.082)	(0.083)*
Gross external debt/GDP	0.127	0.131	0.127	0.123	0.138	0.137
(ln, t-1)	(0.052)**	(0.052)**	(0.052)**	(0.052)**	(0.053)***	(0.054)**
TOT volatility (ln)	−0.038	−0.041	−0.038	−0.041	−0.039	−0.044
	(0.023)*	(0.023)*	(0.023)	(0.023)*	(0.023)*	(0.024)*
NEER volatility (ln)	0.318	0.290	0.317	0.308	0.314	0.284
	(0.067)***	(0.074)***	(0.067)***	(0.067)***	(0.067)***	(0.075)***
Trade openness (ln)	−0.218	−0.207	−0.217	−0.198	−0.222	−0.196
	(0.063)***	(0.062)***	(0.063)***	(0.064)***	(0.064)***	(0.065)***
Financial openness (ln)	−0.255	−0.292	−0.258	−0.228	−0.255	−0.265
	(0.066)***	(0.072)***	(0.084)***	(0.069)***	(0.067)***	(0.106)**
Financial crisis	0.598	0.592	0.601	0.593	0.595	0.589
	(0.149)***	(0.148)***	(0.150)***	(0.149)***	(0.150)***	(0.148)***
Flex		0.427				0.414
		(0.854)				(0.873)
BM growth rate variability (ln) x Flex		0.100				0.086
		(0.085)				(0.091)
GE growth rate variability (ln) x Flex		0.003				0.022
		(0.214)				(0.221)
Closed_Fix			−0.132			−0.017
			(0.422)			(0.440)
BM growth rate variability (ln) x Closed_Fix			−0.015			−0.006
			(0.077)			(0.084)
GE growth rate variability (ln) x Closed_Fix			−0.020			0.006
			(0.104)			(0.110)
Open_Fix				−0.871		−0.708
				(1.753)		(1.754)
BM growth rate variability (ln) x Open_Fix				0.045		0.059
				(0.157)		(0.160)
GE growth rate variability (ln) x Open_Fix				−0.199		−0.171
				(0.418)		(0.420)
Middle					0.801	0.907
					(0.917)	(0.956)
BM growth rate variability (ln) x Middle					−0.173	−0.145
					(0.100)*	(0.107)
GE growth rate variability (ln) x Middle					0.369	0.374
					(0.264)	(0.275)
Adjusted R^2	0.36	0.36	0.36	0.36	0.36	0.36
Number of observations	1,038	1,038	1,038	1,038	1,038	1,038
Number of economies	55	55	55	55	55	55
Sample period	1973–2020	1973–2020	1973–2020	1973–2020	1973–2020	1973–2020

is statistically significant and positive under the *Flex* and *Middle* regimes, but not under the *Open_Fix* regime, and the total effect of government expenditure growth variability is statistically significant and positive under the *Closed_Fix* and *Middle* regimes. These results are largely consistent with the Mundell-Fleming predictions.

The total effects of trilemma regime dummies indicate that no regime has a statistically significant impact on the variability of the GDP growth gap.

Table 3
Summary of the estimated total coefficients.

Model	A. Real GDP growth rate gap		B. CPI inflation rate		C. Variability of real GDP growth rate gap		D. Volatility of CPI inflation rate	
	(2)–(5)	(6)	(2)–(5)	(6)	(2)–(5)	(6)	(2)–(5)	(6)
Monetary policy impact (total)								
Flex	0.020(*)	0.020*	0.963***	0.962***	0.006**	0.006**	0.317***	0.318***
Closed_Fix	0.000	−0.001	0.301***	0.307***	−0.001	−0.001	0.229***	0.226***
Open_Fix	−0.030(*)	−0.030(*)	0.213**	0.200**	0.008(*)	0.008(*)	0.286*	0.291*
Middle	0.008	0.007	0.506***	0.513***	0.013**	0.013**	0.081	0.088
Fiscal policy impact (total)								
Flex	0.286**	0.273**	−0.143	−0.139	0.010	0.010	0.356*	0.354*
Closed_Fix	0.064	0.067	0.594*	0.663*	0.015***	0.015***	0.328***	0.339***
Open_Fix	−0.189	−0.177	0.857(*)	0.875(*)	0.008	0.008	0.149	0.162
Middle	−0.163	−0.164	0.605	0.571	0.028**	0.028**	0.693***	0.707***
Trilemma regime dummy (total)								
Flex	0.003	0.005(*)	−0.005	−0.015	0.001	0.001	0.123(*)	0.060
Closed_Fix	−0.003	−0.005(*)	−0.004	0.000	0.002	0.001	−0.005	−0.021
Open_Fix	0.000	0.001	−0.026***	−0.050***	−0.005	−0.004	−0.223*	−0.236(*)
Middle	−0.005*	−0.006	−0.002	−0.015	0.003	0.005(*)	−0.084	−0.075

Closed_Fix = "financially closed fixed rate" regime; Flex = "flexible exchange rate" regime; Middle = "middle ground" regime; Open_Fix = "financially open fixed rate" regime.
Notes: (i) Columns (2)–(5) in monetary and fiscal policy impacts (total) report the estimated total coefficients on monetary as well as fiscal policy measures and their significance levels when the regression equation includes only one of the trilemma regime dummies and its interactive terms, i.e., the case of model (2), (3), (4), or (5) in Table 1.A through Table 2.B. Columns (6) report the estimated total coefficients on monetary as well as fiscal policy measures and their significance levels when the regression equation includes all trilemma regime dummies and their interactive terms, i.e., the case of model (6) in Table 1.A through Table 2.B.
(ii) Trilemma regime dummy (total) reports the estimated total coefficients on each trilemma regime dummy and its statistical significance level, assuming that policy measures take on values corresponding to their sample averages under the respective trilemma regimes.
(iii) (*) $p<0.20$; * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Economies with a larger government size, higher gross external debt as a ratio of GDP, greater NEER volatility, and more frequent financial crisis tend to experience higher variability in the GDP growth rate gap.[19]

4.2.4. *Volatility of the CPI inflation rate*

Table 2.B affirms that variabilities in broad money and government expenditure growth, both current and lagged, have statistically significant positive impacts on inflation volatility under all specifications. When the interactive terms with trilemma regime dummies are included in calculations (Table 3.D), the total effects of variabilities in broad money and government expenditure growth on inflation volatility are statistically significant under all trilemma regimes except the *Middle* regime and the *Open_Fix* regime, respectively. The observation that money growth variability has a significant positive impact on inflation volatility under both the *Flex* and the *Open_Fix* regimes presents a mixed result from the perspective of the Mundell-Fleming prediction.

The total coefficients on regimes show that only the *Open_Fix* regime has a statistically significant, negative (though relatively weak) impact on inflation volatility. This means that the "financially open fixed rate" regime exerts a stabilizing impact on inflation volatility, confirming again the benefit of the regime.

Economies with higher rates of inflation, larger GDP gap variability, higher gross external debt, greater NEER volatility, and more frequent financial crisis tend to experience greater inflation volatility. Economies with a larger government, greater TOT volatility, and higher trade and financial openness tend to experience lesser inflation volatility. The negative impact of government size is an expected outcome, while the negative impact of TOT volatility is counterintuitive.

5. Concluding remarks

For macroeconomic authorities, achieving stable and low-inflation economic growth is a challenge particularly in EMDEs. They need to pay attention to the "trilemma" of international finance, where they can choose only two out of three policy frameworks, i.e., ERS, FMO, and MPI.

Using a new set of indexes for ERS, FMO, and MPI developed in the authors' most recent work (Ito and Kawai, 2024a), the paper has first located more than one hundred sample economies in the trilemma triangle over time. The paper has also depicted individual economies' trilemma regimes, focusing on the three "corner" regimes as well as the "middle ground" regime, in the global map. The results demonstrate that both AEs and EMDEs have generally moved toward greater exchange rate flexibility and financial market openness over time, with some exceptions. Today, the number of economies adopting the "flexible exchange rate" corner regime is

[19] The positive impact of government size on growth rate gap variability is somewhat counterintuitive, as economies with a larger government are expected to have more room for macroeconomic stabilization through automatic stabilizer effects. The positive impact observed here may imply that economies with a large government tend to resort to active, often procyclical, policy especially considering that the estimation covers only EMDEs.

rising. On the other hand, no AE adopts the "financially closed fixed rate" corner regime. While a group of Euro Area member countries have adopted the "financially open fixed rate" corner regime, the number of EMDEs choosing this regime is limited. Many economies maintain trilemma regimes other than the three corners, including the "middle ground.".

The paper has tested econometrically the effectiveness of monetary and fiscal policies in achieving macroeconomic stabilization under alternative trilemma regimes as well as the role of trilemma regimes in influencing macroeconomic performance, for a sample of 61 EMDEs over the period 1971–2020. To account for the possible endogeneity of monetary and fiscal policy variables (as well as a few other variables), the analysis has utilized the 2SLS estimation method. An important question is whether the impacts of monetary and fiscal policies are consistent with Mundell-Fleming predictions under the three corner regimes.

The estimation results mostly support the Mundell-Fleming hypothesis. Monetary policy is effective in positively affecting the GDP growth rate gap, CPI inflation, GDP growth rate gap variability, and inflation volatility under the "flexible exchange rate" corner regime, while it is not or much less effective under the "financially open fixed rate" corner regime, both consistent with the Mundell-Fleming predictions. Evidence is found for an increase in broad money growth to raise the GDP growth rate gap, but not the per capita real GDP growth rate, consistent with its role to stabilize economic growth around the potential growth path. Broad money growth expansion stimulates inflation under any trilemma regime, with the largest inflationary impact under the "flexible rate" regime and the least effect under the "financially open fixed rate" regime, again consistent with the theoretical prediction. Greater variability in monetary policy leads to larger variability in the growth rate gap under the "flexible rate" regime, but not under the "financially open fixed rate" regime, and also leads to larger inflation volatility under the "flexible rate" regime than under the "financially open fixed rate" regime.

Fiscal policy, defined by government expenditure growth and/or its variability, is also effective under the "flexible rate" regime (in raising the GDP growth rate gap and inflation volatility), under the "financially closed fix rate" regime (in stimulating inflation, growth rate gap variability, and inflation volatility), and under the "middle ground" regime (in enlarging growth rate gap variability and inflation volatility). Fiscal policy is not effective under the "financially open fixed rate" regime, which is a somewhat surprising finding.

Finally, some trilemma regimes have been shown to exert direct influences on macroeconomic performance. For example, the "middle ground" regime has a weakly negative effect on the GDP growth rate gap. The "financially open fixed rate" corner regime reduces both inflation and inflation volatility, a desirable feature for authorities aiming to achieve price stability in a financially open economy.

More research is needed to deepen the understanding of the impacts of monetary and fiscal policies and the roles of trilemma regimes. Monetary and fiscal policy impacts on EMDEs may be compared with those on AEs. Other monetary and fiscal policy instruments such as the monetary base, the short-term interest rate, and the structural primary balance as a share of GDP may be considered. Alternative ways of measuring trilemma regimes may be explored. Impacts of monetary policy under the "flexible exchange rate" corner regime may further be examined for economies with inflation targeting, monetary aggregate targeting, and other frameworks.

CRediT authorship contribution statement

Hiro Ito: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Masahiro Kawai:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jimonfin.2024.103182.

References

Aghion, P., Bacchetta, P., Rancière, R., Rogoff, K., May 2009. Exchange rate volatility and productivity growth: The role of financial development. J. Monet. Econ. 56 (4), 494–513.

Ahmed, A.D., Suardi, S., October 2009. Macroeconomic volatility, trade and financial liberalization in Africa. World Dev. 37 (10), 1623–1636.

Aizenman, J., Chinn, M.D., Ito, H., June 2010. The emerging global financial architecture: Tracing and evaluating new patterns of the trilemma configuration. J. Int. Money Financ. 29 (4), 614–641.

Aizenman, J., Chinn, M.D., Ito, H., September 2011. Surfing the waves of globalization: Asia and financial globalization in the context of the trilemma. J. Japanese Int. Econ. 25 (3), 290–320.
Aizenman, J., Chinn, M.D., Ito, H., August 2013. The 'Impossible Trinity' hypothesis in an era of global imbalances: Measurement and testing. Rev. Int. Econ. 21 (3), 447–458.
Aizenman, J., Chinn, M.D., Ito, H., November 2016. Monetary policy spillovers and the trilemma in the new normal: Periphery country sensitivity to core country conditions. J. Int. Money Financ. 68 (C), 298–330.
Andrés, J., Doménech, R., Fatás, A., February 2008. The stabilizing role of government size. J. Econ. Dyn. Control 32 (2), 571–593.
Baxter, M., Stockman, A.C., May 1989. Business cycles and the exchange-rate regime: Some international evidence. J. Monet. Econ. 23 (3), 377–400.
Bekaert, G., Harvey, C.R., Lundblad, C., April 2006. Growth volatility and financial liberalization. J. Int. Money Financ. 25 (3), 370–403.
Bekaert, G., Harvey, C.R., Lundblad, C., January 2011. Financial openness and productivity. World Dev. 39 (1), 1–19.
Bekaert, G., Mehl, A., June 2019. On the global financial market integration "Swoosh" and the trilemma. J. Int. Money Financ. 94 (C), 227–245.
Bleaney, M., Tian, M.o., 2020. Exchange rate flexibility: How should we measure it? Open Econ. Rev. 31, 881–900. https://doi.org/10.1007/s11079-019-09577-z.
Born, B., Juessen, F., Müller, G.J., February 2013. Exchange rate regimes and fiscal multipliers. J. Econ. Dyn. Control 37 (2), 446–465.
Buch, C.M., Doepke, J., Pierdzioch, C., September 2005. Financial openness and business cycle volatility. J. Int. Money Financ. 24 (5), 744–765.
Cheng, R., Rajan, R.S., Summer 2020. Monetary trilemma, dilemma, or something in between? Int. Financ. 23 (2), 257–276.
Chinn, M.D., Ito, H., October 2006. What matters for financial development? Capital controls, institutions, and interactions. J. Dev. Econ. 81 (1), 163–192.
Chinn, M.D., Ito, H., September 2008. A new measure of financial openness. J. Compar. Policy Anal. 10 (3), 309–322.
Corsetti, Giancarlo, Andre Meier, and Gernot J. Müller. 2012. "What Determines Government Spending Multipliers?" *IMF Working Paper*, 12/150 (June). Washington, DC: International Monetary Fund.
Dahalan, Jauhari and Tiru K. Jayaraman. 2006. "Monetary and Fiscal Policies in Fiji: A Test of Effectiveness." *Pacific Economic Bulletin*, 21:2 (January), pp. 94-102. https://www.researchgate.net/publication/265082563_Monetary_and_fiscal_policies_in_Fiji_A_test_of_effectiveness.
Di Giovanni, J., Levchenko, A.A., 2009. Trade openness and volatility. Rev. Econ. Stat. 91 (3), 558–585.
Edwards, S., 2015. Monetary policy independence under flexible exchange rates: An illusion? World Econ. 38 (5), 773–787.
Fatás, A., Mihov, I., 2001. Government size and automatic stabilizers: International and intranational evidence. J. Int. Econ. 55 (1), 3–28.
Fleming, J. Marcus. 1962. "Domestic Financial Policies under Fixed and Floating Exchange Rates." *IMF Staff Papers*, 9 (November), pp. 369-379. Washington, DC: International Monetary Fund.
Frankel, J., and S. J. Wei. 1994. Yen Bloc or Dollar Bloc? Exchange Rate Policies in East Asian Economies. In T. Ito and A. Krueger, eds., *Macroeconomic Linkage: Savings, Exchange Rates, and Capital Flows*. Chicago: University of Chicago Press. pp. 295–329.
Ghosh, Atish R., Ann-Marie Gulde, Jonathan D. Ostry, and Holger Wolf. 1996. "Does the Exchange Rate Regime Matter for Inflation and Growth?" *Economic Issues*, 2. Washington, DC: International Monetary Fund. https://www.imf.org/external/pubs/ft/issues2/issue2.pdf.
Ghosh, A.R., Gulde, A.-M., Wolf, H., 2002. Exchange Rate Regimes: Choices and Consequences. MIT Press, Cambridge, Massachusetts and London.
Han, X., Wei, S.-J., January 2016. International transmissions of monetary shocks: Between a trilemma and a dilemma. J. Int. Econ. 110, 205–219.
Hofmann, Boris and Előd Takáts. 2015. "International Monetary Spillovers." *BIS Quarterly Review* (September), pp. 105-118.
Husain, A.M., Moday, A., Rogoff, K.S., January 2005. Exchange rate regime durability and performance in developing versus advanced economies. J. Monet. Econ. 52 (1), 35–64.
Ilzetzki, E., Mendoza, E., Vegh, C., 2013. How big (Small?) are fiscal multipliers? J. Monet. Econ. 60 (2), 239–254.
Ito, Hiro and Masahiro Kawai. 2014. "New Measures of the Trilemma Hypothesis: Implications for Asia." In Masahiro Kawai, Mario B. Lamberte, and Peter J. Morgan, eds., *Reform of the International Monetary System: An Asian Perspective* (Tokyo, Heidelberg, New York, Dordrecht, and London: Springer, 2014), pp. 73-104.
Ito, Hiro and Masahiro Kawai. 2024a. "Evolution of the International Monetary System from the Perspective of Trilemma Challenges." *Public Policy Review*, 20:2 (September). Tokyo: Policy Research Institute, Ministry of Finance.
Ito, Hiro and Masahiro Kawai. 2024b. "Impacts of Monetary and Fiscal Policies under Alternative Trilemma Regimes." Bank of Japan Working Paper Series, No. 24-E-10 (September).
Ito, Hiro and Masahiro KAWAI. 2021. "The Global Monetary System and Use of Regional Currencies in ASEAN+3." In Diwa Guinigundo, Masahiro Kawai, Cyn-Young Park, and Ramkishen S. Rajan, eds., *Redefining Strategic Routes to Financial Resilience in ASEAN+3*. (Manila: Asian Development Bank, December), pp. 86-159. https://www.adb.org/publications/strategic-routes-financial-resilience-asean3.
Kawai, M., Pontines, V., April 2016. Is there really a renminbi bloc in Asia? A modified Frankel-Wei approach. J. Int. Money Financ. 62, 72–97.
Klein, Michael W. and Jay C. Shambaugh. 2015. "Rounding the Corners of the Policy Trilemma: Sources of Monetary Policy Autonomy." *American Economic Journal: Macroeconomics*, 7:4 (October), pp. 33-66.
Kose, M. Ayhan, Eswar Prasad, Kenneth Rogoff, and Shang-Jin Wei. 2009. "Financial Globalization: A Reappraisal." *IMF Staff Papers*, 56:1 (Frontiers of Research on Financial Globalization), pp. 8-62.
Lane, Philip R. and Gian Maria Milesi-Ferretti. 2007. "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004." *Journal of International Economics*, 73:2 (November), pp. 223-250.
Lane, Philip R. and Gian Maria Milesi-Ferretti. 2017. "International Financial Integration in the Aftermath of the Global Financial Crisis." *IMF Working Paper*, WP/17/115 (May). Washington, DC: International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2017/05/10/International-Financial-Integration-in-the-Aftermath-of-the-Global-Financial-Crisis-44906.
Lane, Philip. R. and Gian Maria Milesi-Ferretti. 2001. "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Countries." *Journal of International Economics*, 55:2 (December), pp. 263-294.
Levy-Yeyati, Eduardo and Federico Sturzengger. 2001. "Exchange Rate Regimes and Economic Performance." *IMF Staff Papers*, 47 (Special Issue, February), pp. 62-98. https://www.imf.org/External/Pubs/FT/staffp/2000/00-00/ls.pdf.
Loipersberger, F., Matschke, J., April 2022. Financial cycles and domestic policy choices. Eur. Econ. Rev. 143, 1–29.
Loungani, Prakash and Phillip Swagel. 2001. "Sources of Inflation in Developing Countries." *IMF Working Paper*, 01/198 (December). Washington, DC: International Monetary Fund.
Miranda-Agrippino, Silvia and Hélène Rey. 2020. "U.S. Monetary Policy and the Global Financial Cycle." *Review of Economic Studies*, 87:6 (317, November), pp. 2754-2776.
Mundell, Robert A. 1963. "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates." *Canadian Journal of Economics and Political Science*, 29: 4 (November), pp. 475-485.
Obstfeld, Maurice, Jay C. Shambaugh, and Alan M. Taylor. 2005. "The Trilemma in History: Tradeoffs among Exchange Rates, Monetary Policies, and Capital Mobility." *Review of Economics and Statistics*, 87:3 (August). pp. 423−438.
Obstfeld, M., Ostry, J.D., Qureshi, M., 2019. A tie that binds: Revisiting the trilemma in emerging market economies. Rev. Econ. Stat. 101 (2), 279–293.
Obstfeld, Maurice. 2021. "Trilemmas and Trade-offs: Living with Financial Globalization." In Davis, Steven J., Edward S. Robinson, and Bernard Yeung, eds., *The Asian Monetary Policy Forum: Insights for Central Banking* (World Scientific Publishing Co. Pte. Ltd), pp. 16-84.
Passari, Evgenia and Hélène Rey. 2015. "Financial Flows and the International Monetary System." *Economic Journal*, 125:584 (May), pp. 675-698.
Prachowny, M.F.J., 1977. The effectiveness of fiscal and monetary policies under fixed and flexible exchange rates: Some empirical evidence for Canada, 1950–1970. Weltwirtschaftliches Arch. 113 (3), 462–486.
Quinn, Dennis, Martin Schindler, and A. Maria Toyoda. 2011. "Assessing Measures of Financial Openness and Integration." *IMF Economic Review*, 59:3 (November), pp. 488-522. Washington, DC: International Monetary Fund.
Rey, Hélène. 2013. "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence." In Federal Reserve Bank of Kansas City, *Global Dimensions of Unconventional Monetary Policy*, *Proceedings of the Jackson Hole Symposium*, pp 285–333.

Rey, Hélène. 2015. "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence." *NBER Working Paper*, No.21162 (May, revied February 2017).

Rother, Philipp C. 2004. "Fiscal Policy and Inflation Volatility." *ECB Working Paper Series*, 317 (March). Frankfurt: European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp317.pdf.

Shambaugh, J.C., February 2004. The effect of fixed exchange rates on monetary policy. Q. J. Econ. 119 (1), 300–352.