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An Asymmetric Analysis of The Relationship Between Money Supply and Real Income: A Test of Monetary and Real Business Cycle Hypotheses for MIST Countries

Para Arzı ve Reel Gelir Arasındaki İlişkinin Asimetrik Bir Analizi: MIST Ülkeleri İçin Parasalcı ve Reel İş Döngüsü Hipotezlerinin Testi

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ÖZ

Bu makale MIST ülkelerinde asimetrik para-gelir ilişkisini incelemeyi amaçlamaktadır. Bu amaçla Hatemi-J panel gizli eşbütünleşme, asimetrik panel nedensellik, FMOLS ve DOLS testlerine başvurulmuştur. Asimetrik nedensellik testi sonuçları para arzı ve reel gelir arasında çift taraflı bir nedensellik olduğunu ortaya koymaktadır. Reel iş döngüsü hipotezi para arzındaki büyümenin reel gelirden kaynaklandığını ve bunun tersi durumun olmadığını iddia etmektedir. Asimetrik nedensellik sonucu elde edilen bulgu, MIST ülkeleri için hem parasal hem de reel iş döngüsü hipotezlerini desteklemektedir. Sonuç, pozitif ve negatif kümülatif reel para arzı şoklarının ekonomide pozitif ve negatif kümülatif reel geliri etkilediğini; benzer şekilde pozitif kümülatif reel gelir şoklarının da pozitif reel geliri etkilediğini ifade etmektedir. MIST ülkelerinde gerçekleşen ani şoklar neticesinde yaşanılan ekonomik sıkıntıların giderilebilmesi ve piyasaların istikrara kavuşabilmesi için para otoritelerinin piyasadaki pozitif ve negatif şoklardan bağımsız olarak para arzını ve reel geliri düzenlemeleri gerekmektedir.

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ABSTRACT

This article aims to examine the asymmetric money-income relationship in MIST countries. For this purpose, Hatemi-J panel hidden cointegration, asymmetric panel causality, FMOLS and DOLS tests were applied. Asymmetric causality test results show that there is a bidirectional causality between money supply and real income. The real business cycle hypothesis claims that the growth in the money supply is due to real income and not vice versa. The finding obtained as a result of asymmetric causality supports both monetary and real business cycle hypotheses for MIST countries. The result is that positive and negative cumulative real money supply shocks affect positive and negative cumulative real income in the economy; Similarly, they state that positive cumulative real income shocks also affect positive real income. In order for the economic difficulties experienced as a result of sudden shocks in the MIST countries to be eliminated and the markets to stabilize, the monetary authorities should regulate the money supply and real income regardless of the positive and negative shocks in the market.

JEL Classifications: C10, E30, E50.

1. INTRODUCTION

Business cycle fluctuations, which emerged with the industrial revolution and started to gain importance in the economic literature after the Great Depression, have been discussed since the 19th century and these discussions have become an area of interest in recent years. The main reason for this interest is that cyclical fluctuations are a phenomenon that is constantly seen in market economies and that the schools of economics disagree on the reason for the emergence of these fluctuations.

Countries want to increase their social welfare by using their resources effectively. The important thing here is to ensure that the increase in welfare is continuous and regular. Societies strive to ensure economic stability and maintain continuity. Therefore, they avoid all kinds of economic fluctuations that cause instability. However, empirical analyzes show that market economies have faced cyclical fluctuations for many years. In market economies, economic indicators do not increase/decrease regularly and fluctuations occur. Economies continue to develop in a fluctuating process. It has been a problem that occupied the minds of economists that there were years of contraction after the successive expansion process of economic activities. Economic schools have developed theories that explain their views on economic fluctuations. Schools of economics differed

from each other in the definition of cyclical movements and the reasons for their emergence.

One of the most important challenges faced by monetary authorities in developing countries is to follow a policy that is compatible with money and income. Due to the false inferences made according to the direction of the effect between the variables in the econometric analyzes, possible appropriate policies are prevented (Hatemi-J and Irandoust, 2006). An important obstacle in the monetary policies implemented to ensure economic growth in developing MIST countries (Mexico, Indonesia, South Korea, and Turkey) is policy risk. Except for South Korea, policy risk in other countries remains quite high. Due to the high political risk, there are fluctuations in the income level increase.

The money-income relationship is an increasingly common research topic in developed and developing countries. However, while examining the money and income relationship in previous studies, the number of studies in which the asymmetric relationship was taken into account is very few. In this study, it is important because it tries to reveal the asymmetrical relationship between money and income and because it is one of the few studies in the literature in this field.

In order to explain the asymmetrical relationship between money and income, an introduction to the relevant subject is made in the first chapter. In the second part, the theoretical framework is examined and then a short literature review is given. After explaining the data and methodology, the study was concluded with the conclusion part.

2. THE THEORETICAL FRAMEWORK OF MONETARY AND REAL BUSINESS CYCLE HYPOTHESES

The Keynesian view, which dominated from the mid-1940s to the 1960s and could be summarized with the Hick-Hansen Model, showed the mobility experienced in real factors as the cause of cyclical fluctuations, and did not dwell on nominal factors such as money. This has led to the neglect of the role of monetary factors in economic fluctuations. Even in the period when interest rates started to rise after the Second World War, the benefits of monetary policy were ignored while economists focused on fiscal policies. Realizing that the imbalances in the economy were not eliminated by fiscal policies, macroeconomists re-evaluated the importance of monetary policy. The book "*A Monetary History of the United States of America: 1867-1960*" published in 1963 by Milton Friedman and Anna Schwartz contributed significantly to the reassessment of the importance of monetary policy. M.Friedman and A.Schwartz (1963) showed that cyclical fluctuations are historically related to fluctuations in the money supply. They emphasized that before the Great Depression of 1929, a sharp decrease was observed in the money supply. They claimed that the Great Depression of 1929 would not have happened if measures had been taken to prevent the sharp decline in the money supply. In the 1950s and 1960s Milton Friedman made great efforts to revive the existence of Quantity Theory. Friedman (1956) laid out the basic principles of the monetarist view in his study. Karl Brunner named the views of economists who adhered to the quantity theory pioneered by Friedman, Monetarism. According to Mark Blaug, quantity theory, which is the oldest surviving theory in economics, is the basic principle of monetarism (Blaug et al., 1995). Quantity theory dates back to John Locke's 1691 book "*Some Reflections on the Consequences of Lowering Interest and Raising the Value of Money*". According to Blaug et al., Keynes started with liking the quantity theory but ended by hating it (Blaug et al., 1995). The economic stagnation and stagflation phenomenon experienced in the 1970s caused the Keynesian view to be discussed, and the monetarist view gradually came to the fore. According to the monetary view, it is the changes in aggregate demand that cause cyclical fluctuations in the short run. But these cyclical movements are not continuous, they are temporary deviations from the long-term output. The current capital and labor in the economy determine the long-term output ratio, in other words, the natural output ratio (Friedman, 1956).

In the monetary view, the source of cyclical fluctuations is fluctuations in the money supply. This idea is analyzed in the quantity theory. Monetarists argue that unlike Keynes' discretionary policies, there should be a monetary policy depending on the rule. Therefore, they think that Central Banks should increase the money supply steadily and proportionally to the increase in GDP. Underlying this view is the concept of velocity of money. Velocity is a measure of the average number of times a banknote changes hands in the economy in a year. This concept leads us to quantity theory: M.V = P.Y where M is money supply, V is velocity of money, P is price level, Y is real GDP. Monetarists believe on historical grounds that the velocity of money is constant in the short run and changes very slowly in the long run. In other words, the velocity of money is stable. As a result, they argue that a steady increase in the money supply by central banks will result in a steady increase in spending and GDP. For this reason, changes in the total demand and thus cyclical movements are caused by the changes in the money supply determined externally by the central banks (Krugman and Wells, 2011: 477-478).

In the short run, households and firms in the market cannot immediately perceive the increase in money supply because they have incomplete information about the monetary policy of the central bank. Since no increase in money supply is expected, money demand and velocity of money remain constant in the short run. As a result, unexpected increase in money supply will increase the quantity of money in the

hands of economic agents and this money will increase total expenditures. Increasing total expenditures will push firms to increase their production by increasing their labor demand due to adaptive expectations. In short, according to monetarists, unexpected increases in money supply in the short run cause the short run aggregate supply curve (SRAS) to be positively sloping. In other words, money is not neutral in the short run. According to monetarists, the rigidity experienced in expectations is the main cause of cyclical fluctuations in the short run (Friedman and Paden, 1983). The long-run aggregate supply curve (LRAS) is steep due to the realization of expectations in the long run, that is, the removal of the rigidity experienced in expectations. $Y = Y^N + \theta(P - P^e)$ in this equation Y represents the real output, Y^N the natural rate of output, P the realized price level, P^e the expected price level and θ the expectation coefficient. If the realized price is higher than the expected price ($P>P^e$), the realized output level will be higher than the natural product level ($Y>Y^N$). If the actual price is lower than the expected price ($P<P^e$), the actual level of output will be less than the natural level of output ($Y<Y^N$). In the long run, the realized and expected price levels become equal ($P=P^e$), as the economic agents become aware of what is happening in the market and shape their expectations accordingly. Therefore, the actual output level in such a case will be equal to the natural output level ($Y=Y^N$). As a result, the long-run output level does not depend on the price level. In other words, the long-run aggregate supply curve is at the natural level of output and is in the form of a straight line (Krugman and Wells, 2011).

According to monetarists, unexpected monetary policies cause cyclical fluctuations in aggregate demand and economy. While the unexpected increase in money supply increases both the prices and the level of output; An expected increase in the money supply will only increase the price level at the same rate. Therefore, while money is not neutral in the short run, it is neutral in the long run (Friedman and Paden, 1983).

According to monetarists, there are political preferences in fiscal policies that include taxes and public expenditures. In addition, the effective use of monetary policies means that the management of the economy can be taken from the hands of politicians to a large extent. According to monetarists, monetary policies should be used to balanced the economy. Because, in the Monetarist Business Cycle Theory, the cause of instability, that is, fluctuations in the economy, is the changes in the money supply (Friedman, 1956; Blaug et al., 1995).

In the Monetarist Business Cycle Theory, it is the rate change experienced in the increase in the money supply that creates the stimulating effect. The acceleration seen in the increase in money supply leads to economic expansion; slowdown means economic stagnation. The task of controlling the money supply in the market is done by central banks. If the central bank fails in monetary policy, cyclical fluctuations are seen in the economy (Zarnowitz, 1996).

When the central bank increases the growth rate of money, the quantity of real money in the market increases. This leads to a decrease in interest rates and an increase in investment. The increase in the money supply in the market also increases the exchange rate and the country's exports are positively affected. The acceleration of the increase in the money supply, together with the multiplier-accelerator effect, increases the aggregate demand and causes economic expansion. Expansionary monetary policy primarily affects the money market and this effect spreads to other markets. While this policy affects the real economy in the short run, it has no effect in the long run. Similarly, when the Central Bank slows down the growth rate of money, the amount of real money in the market decreases, the exchange rate decreases and interest rates rise. Rising interest rates reduce investment, and a falling exchange rate reduces exports. The slowdown in the increase in the money supply reduces the aggregate demand in the market, causing a contraction in the economy. As can be seen, the changes experienced in the increase in money supply through the central bank cause cyclical fluctuations in aggregate demand and economic activities in the market. When the rate of acceleration in the increase in money supply is low, the economy is dragged into recession in the long run, while if the rate of acceleration is negative, the economy tends to fall into depression (Zarnowitz, 1996: 47). As a result, an effect in the money market spreads to the whole real economy by affecting the labor, goods and foreign exchange markets.

In the 1970s, the inadequacy of the Keynesian and monetarist economic policies to the global economic problems caused economic debates. Thereupon, the real business cycle theory, which emerged in the 1980s, aroused great repercussions in the relevant field.

The Real Business Cycle Theory was put forward by Kydland and Prescott (1982) by making use of Lucas' Rational Expectations Hypothesis. Economists such as J. Long, C. Plosser and R. King are among the main representatives of the theory, which began to gain fame after the 1980s. Real business cycle theory has brought a different perspective to business cycle theories by giving importance to supply shocks. While there were theories emphasizing that demand shocks cause cyclical fluctuations on the economy, now with the Real Business Cycle Theory, the cause of cyclical fluctuations is attributed to supply shocks. For this

reason, it is also known in the literature as the Supply-Side Cycle Theory (Mankiw, 1994).

Kydland and Prescott (1982) cited temporary and permanent productivity shocks, not political, monetary and demand shocks, as the cause of fluctuations in the economy. Efficiency shocks are also usually caused by technology. Productivity shocks resulting from technological innovation or the increase in real wages affect the economy by causing fluctuations in employment and production levels. In addition, supply shocks such as energy, raw material prices, wars and natural disasters do not cause any increase in technology, but cause cyclical fluctuations in the economy by affecting the production level, that is, the aggregate supply.

If changes in productivity due to technology shocks cause cyclical fluctuations, defining and measuring technological expansion is important in Real Business Cycle Theory. Prescott (1986) claimed that the Solow Growth Model can be used for this purpose. Solow defined technological change as subtracting the contributions of labor and capital inputs from the change in production. Using this phenomenon, also known as Solow residual, in the study conducted by Kydland and Prescott (1991) for the USA, the idea that the business cycles experienced in the economy is mainly caused by technological fluctuations, that is, the changes in the Solow residual, that is, the Real Business Cycle Theory, was supported. The assumptions on which the real business cycle theory is based can be listed as follows (Mankiw, 1989): Economic units aim at profit or utility maximization; Rational Expectations Hypothesis dominates the market; A perfectly competitive market applies; Since wages and prices are flexible, the market is always in equilibrium; There is intertemporal substitution of labor in the long run; Monetary policy is ineffective on real variables, since money is neutral like the classical ones; Fluctuations in the economy are caused by perceptible technological changes.

3. A BRIEF LITERATURE REVIEW

David Hume (1752) explains that there is a proportional relationship between prices and money, and since that date, the nature of causality between money and income has been an increasing debate in the literature. While Keynes argued that the changes in the money supply did not have a significant effect on the income level; Monetarists state that changes in income level are caused by the money supply.

Friedman and Schwartz (1963), one of the first studies in the literature to examine the relationship between money supply and real income, states that money has a strong causal effect on output. Sims (1972) emphasizes that there is a one-way causality running from money supply to income in his analysis with US data. Sims (1980) included explanatory variables such as short-term interest rate in his model in addition to money supply and income variables, and determined that there is no causality relationship between the variables. Barth and Bennett (1974) state that there is a one-way causality running from money supply to income in their study. Dereyes et al. (1980) a one-way causality running from income to money supply for the United Kingdom; They also found a bidirectional causality relationship for India and Singapore. In the study of Joshi and Joshi (1985), Dereyes et al. (1980), supporting his work, concludes that there is a bidirectional causality relationship between money supply and income for India. Patil and Ramanathan (1989) say that there is no causal relationship between money and income. While Abbas and Rizavi (1991) did not find a causal relationship between M1 and income in their studies; They state that there is a bidirectional causality relationship between M2 and income. In their study on the USA, Friedman and Kuttner (1992) show that money supply does not have a strong causal effect on real output, that is, income. Freeman (1992) states in his study that there is no causal relationship between money supply and real output, but there is a correlation between these two variables. While Yadav (2008) did not find a causal relationship between real money supply and real income in India, he found a one-way causality relationship between nominal money supply and nominal income. Hossain (2011) shows that there is a bidirectional causality relationship between money supply and income in Bangladesh. Lee and Yang (2012) find in their study that there is a weak Granger causality relationship between money and income. Ahmed et al. (2013) show that there is a causal relationship from money supply to income in Pakistan. Aslam (2016) states in his study on Sri Lanka that money supply has a positive effect on growth in real output. Hussain and Haque (2017), in their study for Bangladesh, argue that money supply has a significant effect on growth in real income or output in the long run. Evans (2019) states that money supply has an effect on output in the short run. Mkupete and Ndanshau (2017) concluded that the monetarist thinking is consistent and the effect of monetary policy on output is effective in the short run in the analysis they applied for Tanzania in their study. On the other hand, Maganya and Ndanshau (2020) supported the Keynesian-based view by saying that there is a causal relationship from real output to money for Tanzania. As can be understood from these two studies, it is possible to see different results arising from methodological differences in many studies in the literature. Therefore, it would be useful to examine the relationship between money supply and income with an asymmetric analysis.

4. DATA AND METHODOLOGY

This paper uses quarterly data from 1980:Q1 to 2022:Q1 which is not a problem in obtaining data in MIST countries (Mexico, Indonesia, South Korea, and

Turkey). The data on money supply (M2) and real income was collected from the International Financial Statistics (IFS). The definitions of the variables used in the econometric analysis are shown in Table 1.

Table 1. Variable Definitions

Variable	Abbreviations	Definition
Money Supply (M2)	M^+	The cumulative sum of positive components of the M
	M^-	The cumulative sum of negative components of the M
Real Income	I^+	The cumulative sum of positive components of the I
	I^-	The cumulative sum of negative components of the I

The econometric models used in the analysis are expressed in equations (1) and (2).

$$I_{i,t}^{+} = \sigma_i^{+} + \beta_i^{+} M_t^{+} + e_{i,t}^{+} \quad (1)$$

$$I_{i,t}^{-} = \sigma_i^{-} + \beta_i^{-} M_t^{-} + e_{i,t}^{-} \quad (2)$$

The variable I in Equations (1) and (2) shows real income and the M variable shows the money supply. The variable e refers to the disturbance term under the white noise assumption. σ represents the unit effect and β indicates the parameter coefficient.

In their study, Granger and Yoon (2002) popularized hidden cointegration concept among variables that could not be detected by classical cointegration tests, but may actually exist. Hidden cointegration reveals the nonlinear cointegration relationship that ordinary linear cointegration analysis cannot define (Koutroulis et al., 2016). The most important advantage of the hidden cointegration method is that it examines all combinations of cointegration between data components, including cumulative positive and negative changes.

In this study, it is aimed to contribute to the related literature by using Hatemi-J Panel Hidden Cointegration test, which adapts the hidden cointegration test that can be applied on time series data by Granger and Yoon (2002) to panel data analysis. Panel data integrates the time series size with the cross section size, resulting in higher degrees of freedom, giving the advantage of increasing the number of observations. In addition, Hatemi-J Panel Hidden Cointegration test helps us to see the interaction between the variables more clearly by separating the variables included in the analysis into positive and negative components.

Hatemi-J (2020) made the concept of hidden cointegration applicable in panel data analysis and examined the impact of expansionary and contracting fiscal policies on economic performance on Denmark, Norway and Sweden. Thus, the concept of Hatemi-J Panel Hidden Cointegration is also included in the literature. This approach distinguishes between the upward and downward trends of variables. In this study, this new method is tried to be applied on geopolitical risk and stock market volatility.

Consider the following two variables that are first order integrated with the solution obtained for each found by the recursive approach:

$$Y_{i,t} = Y_{i,t-1} + e_{i1,t} = Y_{i,0} + \sum_{j=1}^{t} e_{i1,j} \quad (3)$$

$$X_{i,t} = X_{i,t-1} + e_{i2,t} = X_{i,0} + \sum_{j=1}^{t} e_{i2,j} \quad (4)$$

For i = 1, 2,..., m. Where m denotes the cross sectional dimension, and e is a disturbance term that is considered a white noise process. Positive and negative shocks for each panel variable are defined as,

$$e_{i1,t}^{+} = \max\{e_{i1,t}, 0\}$$

$$e_{i1,t}^{-} = \min\{e_{i1,t}, 0\}$$

$$e_{i2,t}^{+} = \max\{e_{i2,t}, 0\}$$

$$e_{i2,t}^{-} = \max\{e_{i2,t}, 0\}$$

By substituting positive and negative shock definitions in equations (3) and (4), the following equations are obtained:

$$Y_{i,t}^{+} = Y_{i,0}^{+} + e_{i1,t}^{+} = Y_{i,0} + \sum_{j=1}^{t} e_{i1,t}^{+}$$

$$X_{i,t}^{+} = X_{i,0}^{+} + e_{i2,t}^{+} = X_{i,0} + \sum_{j=1}^{t} e_{i2,t}^{+}$$

$$Y_{i,t}^{-} = Y_{i,0}^{-} + e_{i1,t}^{-} = Y_{i,0} + \sum_{j=1}^{t} e_{i1,t}^{-}$$

$$X_{i,t}^{-} = X_{i,0}^{-} + e_{i2,t}^{-} = X_{i,0} + \sum_{j=1}^{t} e_{i2,t}^{-}$$

The two cointegration equations created for the components with the assumption that the dependent variable is Y is as follows:

$$Y_{i,t}^{+} = \vartheta_i^{+} + \beta_i^{+} X_{i,t}^{+} + e_{i,t}^{+} \quad (5)$$

$$Y_{i,t}^{-} = \vartheta_i^{-} + \beta_i^{-} X_{i,t}^{-} + e_{i,t}^{-} \quad (6)$$

If $e_{i,t}^{+}$ is stationary, positive cumulative shocks are cointegrated in the panel, whereas $e_{i,t}^{-}$ is stationary, negative cumulative shocks are cointegrated in the panel. If cointegration is found, equations (5) and (6) can be estimated by the least squares method or a more effective econometric approach (Hatemi, 2020).

It is necessary to test whether there is a cross-section dependency between the countries and unit root tests should be applied according to the result before performing Hatemi-J Panel Hidden Cointegration test. Table 2 shows the results of the tests performed for cross-sectional dependence.

Table 2. Cross-Sectional Dependence Test Results

Variables	I		M	
Tests	Statistic	Prob.	Statistic	Prob.
Breusch-Pagan LM	75.431	0.0000	94.352	0.0000
Pesaran scaled LM	18.541	0.0000	41.847	0.0000
Bias-corrected scaled LM	28.310	0.0000	42.285	0.0000
Pesaran CD	8.037	0.0000	13.164	0.0000
Null Hypothesis: No cross-sectional dependence				

When the results of Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM and Pesaran CD tests performed to test the existence of cross-sectional dependency are examined in Table 2, it is seen that p probability values are less than 0.05. In other words, the "*no cross-sectional dependence*" zero hypothesis is not accepted, that is, the cross-sectional dependence exists for MIST countries. Therefore, the panel unit root test to be applied should be the second generation panel unit root test. Hatemi-J (2020) applied Im Pesaran Shin (IPS) test as a panel unit root test in his article. In this study, IPS, the first generation unit root test applied by Hatemi-J, who developed the panel cointegration test, and the Pesaran CADF test, the second generation unit root test, are applied. Table 3 shows the panel unit root test results.

Table 3. Panel Unit Root Tests Results

Variables	**Im Pesaran Shin (IPS)**		**Pesaran CADF**	
	H_0:I(1), H_1(0)	**H_0:I(2), H_1(1)**	**H_0:I(1), H_1(0)**	**H_0:I(2), H_1(1)**
I	<0.001	<0.001	<0.001	<0.001
M	<0.001	<0.001	<0.001	<0.001
I^+	0.039	<0.001	0.038	<0.001
M^+	<0.001	<0.001	<0.001	<0.001
I^-	0.039	<0.001	0.037	<0.001
M^-	<0.001	<0.001	<0.001	<0.001

According to the Panel Unit Root test results in Table 3, the variables included in the analysis become stationary when the first degree difference is taken according to IPS and Pesaran CADF tests. Whether there is a long-term relationship between I and M variables and all combinations of these variables' positive and negative components, Hatemi-J Panel Hidden Cointegration Test has been tried to investigate. Table 4 shows the results of Hatemi-J Panel Hidden Cointegration test.

Table 4. Hatemi-J Panel Hidden Cointegration Test Results

Variables	**t statistics**	**p value**
I, M	-3.097	0.006***
I^+, M^+	1.889	0.038**
I^+, M^-	1.423	0.108
I^-, M^+	1.021	0.162
I^-, M^-	0.725	0.197
Kao Panel Cointegration Test	-3.427	0.000***

Notes: ***, ** and * refer to significance at the 1%, 5% and 10% respectively.

Looking at the results of the Hatemi-J Panel Hidden Cointegration test in Table 4, cointegration is determined between I and M variables at a 1% significance level and between I^+ and M^+ components at a 5% significance level. In addition, cointegration is not found between other positive and negative combinations of variables. The conclusion is that there is a long-term relationship between income and money supply. When the components of these variables are analyzed, it is concluded that a positive shock in the money supply will lead to an increase in the income. When income increases in MIST countries, money supply also increases. In addition, the Kao Panel Cointegration test is employed to check the robustness of Hatemi-J Panel Hidden Cointegration test results. As a result of the Kao Panel Cointegration with zero hypothesis "*there is no cointegration*", when the probability value of p is examined, it is determined that there are cointegrated vectors among the components of the variables in the long run. Asymmetric Panel Causality Test following Dumitrescu and Hurlin (2012) is applied to determine the direction of this cointegrated relationship while cointegration is detected between the positive components of I and M variables.

The standard panel granger causality test assumes that all intercepts and slope coefficients are the same due to the homogeneous panel assumption:

$$\alpha_i = \alpha_j \ \forall i,j$$

$$\beta_i^1 = \beta_j^1, \beta_i^2 = \beta_j^2, \dots, \beta_i^K = \beta_j^K \quad \forall i,j$$

$$\gamma_i^1 = \gamma_j^1, \gamma_i^2 = \gamma_j^2, \dots, \gamma_i^K = \gamma_j^K \quad \forall i,j$$

where K is lag length, α is intercept, β and γ are slope coefficients. However, there may be two sources of heterogeneity or asymmetry in panel data. The first source is derived from the intercept (α), while the second can be caused by the slope coefficient (β). For this reason, Asymmetric Panel Causality Test following Dumitrescu and Hurlin (2012) is based on the heterogeneous panel assumption:

$$\alpha_i \neq \alpha_j \; \forall i,j$$

$$\beta_i^1 \neq \beta_j^1, \beta_i^2 \neq \beta_j^2, \dots, \beta_i^K \neq \beta_j^K \quad \forall i,j$$

$$\gamma_i^1 \neq \gamma_j^1, \gamma_i^2 \neq \gamma_j^2, \dots, \gamma_i^K \neq \gamma_j^K \quad \forall i,j$$

The Asymmetric Panel Causality Test following Dumitrescu and Hurlin (2012) assumes that all intercepts and slope coefficients are different. Given that the data in the current study are highly heterogeneous, Asymmetric Panel Causality Test following Dumitrescu and Hurlin (2012) would be a more suitable method for empirical analysis. Table 5 shows the results of this test.

Table 5. Asymmetric Panel Causality Test Following Dumitrescu and Hurlin (2012) Results

	k=1 Zbar-Stat (p value)	k=2 Zbar-Stat (p value)
$(I)^+ \neq > (M)^+$	1.764* (0.071)	1.716* (0.082)
$(I)^+ \neq > (M)^-$	-0.045 (0.525)	-1.142 (0.320)
$(I)^- \neq > (M)^-$	-0.285 (0.745)	-0.232 (0.853)
$(I)^- \neq > (M)^+$	0.364 (0.543)	0.268 (0.622)
$(M)^+ \neq > (I)^+$	2.523** (0.045)	2.542** (0.048)
$(M)^+ \neq > (I)^-$	-1.104 (0.124)	-0.241 (0.581)
$(M)^- \neq > (I)^-$	2.965** (0.049)	2.983** (0.048)
$(M)^- \neq > (I)^+$	0.268 (0.773)	1.036 (0.301)

Notes: While the values in parentheses indicate p-probability values, ***, ** and * refer to significance at the 1%, 5% and 10% respectively. k indicates the lag length.

Asymmetric Panel Causality Test following Dumitrescu and Hurlin (2012) results in Table 5 show the causality relationship between all combinations of positive and negative components of I and M variables. As can be seen, the causality relationship between the positive and negative components of the I and M variables is determined. Thus, the direction of the cointegration relationship between I and M variables is detected. Positive shocks experienced in I cause M to experience a positive shock. It is observed that negative shocks experienced in the real income do not have causal relationship in order to decrease money supply. In addition, it is determined that there is causality relationship from the positive components of the money supply to the real income. Besides, it is observed that negative shocks experienced in the money supply have causal relationship in order to decrease real income. Based on these findings, policy decision makers in MIST countries should determine policies by taking into account the positive shocks in the real income while pursuing policies on the money supply. After determining the cointegration and causality relationship between the positive components of I and M variables, determining the coefficient of causality relationship from I^+ to M^+; M^+ to I^+ ; M^- to I^- and will be useful for understanding the subject. Panel Fully Modified Ordinary Least Square (FMOLS) and Panel Dynamic Ordinary Least Square (DOLS) methods are used to determine the coefficient of the long-term relationship between the components of these two variables and the results are shown in Table 6.

Table 6. The FMOLS and DOLS Estimations Results

Variables	FMOLS	DOLS
I^+ to M^+	0.209*** (0.000)	0.274*** (0.000)
M^+ to I^+	0.312*** (0.000)	0.321*** (0.000)
M^- to I^-	0.128** (0.019)	0.146** (0.034)

Notes: The values in the parenthesis indicate the p-values. ***, ** and * show to significance at the 1%, 5% and 10% respectively.

According to both FMOLS and DOLS estimators, I^+ variable was found to positive affect the M^+ variable at the significance level of 1%. Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS) results showed that a one unit positive shock in I^+ increased the increase in M^+ by 0.209 and 0.274, respectively. Moreover, M^+ was detected to have significant and positive effects on I^+. According to coefficient estimations results, one unit positive shock in M^+ increases the increase in I^+ by 0.312 and 0.321, respectively. To explain it more clearly, an increase in the M2 money supply increases the income level. Finally, M^- variable was found to positvely affect I^- variable. Coefficient estimations (FMOLS and DOLS) results show that a one unit negative shock in M^- increase in I^- by 0.128 and 0.146, respectively. In short, according to the results of all models, it was determined that the increase in money supply increased the real income and the decrease in money supply had negative effects on the real income. In addition, according to the results icrease in real income increased the money supply.

5. CONCLUSION

The study examined the relationship between money supply and real income in MIST countries. A panel data analysis was performed with quarterly data from the period between 1980 and 2022. For this purpose, the Panel Hidden Cointegration Method and the

Asymmetric Panel Causality Test were used. According to the analysis results, there is a cointegration relationship between positive components of the variables. These results show that there is a hidden cointegration relationship between Money supply and real income. A bidirectional asymmetric causality relationship was detected between the positive components of money supply and real income. According to the results of the coefficient estimations, increase or decrease in money supply has a positive or negative effect on the real income. In addition, an increase in real income increases the money supply. The rationale behind this is that an increase in real income increases the demand for money and raises market interest rates. In order to prevent the decrease observed in investments due to the rising interest rate, central banks increase the money supply and reduce the interest rates to the previous level or even lower. The real business cycle hypothesis shows the real income level as the main reason for the increase in money supply and does not accept the opposite situation. However, in the study, a bidirectional causality relationship was found between money supply and real income. In this case, it can be said that the real business cycle theory and monetary theory are valid for MIST countries. As a policy result of the study, monetary authorities in MIST countries can regulate the money supply and real income independently of positive and negative shocks in the market, thereby reducing the negative effects of sudden shocks and stabilizing the markets.

REFERENCES

Abbas, K., and Rizavi, S. S. (1991). Causality Test between Money and Income: A Case Study of Selected Developing Asian Countries (1960-1988) [with Comments]. *The Pakistan Development Review*, 30(4), 919-929.

Ahmed, N., Asad, I., and Hussain, Z. (2013). Money, Prices, Income and Causality: A Case Study of Pakistan. *The Journal of Commerce*, 4(4), 19-24.

Aslam, A. L. M. (2016). Impact of Money Supply on Sri Lankan Economy: An Econometric Analysis. *International Letters of Social and Humanistic Sciences*, 67, 11-17.

Barth, J. R., and Bennett, J. T. (1974). The Role of Money in The Canadian Economy: An Empirical Test. *The Canadian Journal of Economics/Revuecanadienne d'Economique*, 7(2), 306-311.

Blaug, M., Eltis, W., O'Brien, D., Patinkin, D., Skidelsky, R., and Wood, G. (1995). The Quantity Theory of Money. Books.

Dereyes, F. R., Starleaf, D. R., and Wang, G. H. (1980). Tests of The Direction of Causation Between Money and Income in Six Countries. *Southern Economic Journal*, 477-487.

Dumitrescu E. I., and Hurlin C. (2012). Testing for Granger Noncausality in Heterogeneous Panels. *Economic Modelling*, 29(4): 1450-1460.

Evans, O. (2019). Money, Inflation and Output in Nigeria and South Africa: Could Friedman and Schwartz be right?. *Journal of African Business*, 20(3), 392-406.

Freeman, S. (1992). Money and Output: Correlation or Causality. *Economic Review*, Federal Reserve Bank of Dallas, (3), 1-7.

Friedman, M. (1956). The Quantity Theory of Money: A Restatement. Studies in The Quantity Theory of Money, 5, 3-31.

Friedman, M., and Schwartz, A. J. (1963). A Monetary History of The United States, 1867-1960. Princeton University Press.

Friedman, M. and Paden, D. W. (1983). A Monetarist View. *The Journal of Economic Education*, 14(4), 44-55.

Friedman, B. M., and Kuttner, K. N. (1992). Money, Income, Prices, and Interest Rates. *The American Economic Review*, 472-492.

Granger C. W., and J., Yoon G. (2002). Hidden Cointegration. University of California: Economics Working Paper, No. 2002-02.

Hatemi-J A. (2020). Hidden Panel Cointegration. Journal of King Saud University-Science, 32(1): 507-510.

Hatemi-J, A., and Irandoust, M. (2006). A Bootstrap-corrected Causality Test: Another Look at The Money–Income Relationship. *Empirical Economics*, 31(1), 207-216.

Hossain, M. A. (2011). Money-Income Causality in Bangladesh: An Error Correction Approach. *The Bangladesh Development Studies*, 39-58.

Hume, D. (1752). Of Money, Political Discourses. Edinburgh: as reprinted in Hume (1955).

Hussain, M. E., and Haque, M. (2017). Empirical Analysis of The Relationship Between Money Supply and per capita GDP Growth Rate in Bangladesh. *Journal of Advances in Economics and Finance*, 2(1), 54-66.

Joshi, K., and Joshi, S. (1985). Money, Income, and Causality: A Case Study for India. *Arthavikas*, 21(1), 1-2.

Koutroulis A., Panagopoulos Y., and Tsouma E. (2016). Asymmetry in The Response of Unemployment to Output Changes in Greece: Evidence from Hidden Cointegration. *The Journal of Economic Asymmetries*, 13(C): 81-88.

Krugman, P., and Wells R. (2011). Makro İktisat. 2 Ed. Trans.: F. Oğuz, M. Arslan, K. A. Akkemik and K. Göksal, Ankara: Palme Publishing.

Kydland, F. E., and Prescott, E. C. (1982). Time to Build and Aggregate Fluctuations. *Econometrica: Journal of the Econometric Society*, 1345-1370.

Kydland, F. E., and Prescott, E. C. (1991). Hours and Employment Variation In Business Cycle Theory. *Economic Theory*, 1(1): 63-81.

Lee, T. H., and Yang, W. (2012). Money-Income Granger-Causality in Quantiles. In 30th Anniversary Edition. Emerald Group Publishing Limited.

Locke, J. (1691). Some Considerations of the Consequences of the Lowering of Interest, and Raising the Value of Money. London.

Maganya, M. H., and Ndanshau, M. O. (2020). Money and Output in Tanzania: A Test for Causality. *African Journal of Economic Review*, 8(2), 39-58.

Mankiw, N. G. (1989). Reel Business Cycles: A New Keynesian Perspective. *Journal of Economic Perspectives*, 79-90.

Mankiw, N. G. (1994). Macroeconomics. ABD: Worth Pulishers Inc.

Mkupete, M. J., and Ndanshau, M. O. (2017). Monetary vs. Fiscal Policy: An Empirical Investigation in Tanzania, 1966–2013. *Tanzanian Economic Review*, 7(1-2).

Patil, R. P., and Ramanathan, A. (1989). A Re-examination of Monetarist Propositions in India. *Prajnan*, 18(4), 389-427.

Prescott, E.C. (1986). Theory Ahead of Business Cycle Measurement. Federal Reserve Bank of Minneapolis Quarterly Review, 9-23.

Sims, C. A. (1972). Money, Income, and Causality. *The American Economic Review*, 62(4), 540-552.

Sims, C. A. (1980). Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered. *American Economic Review*,70, 250–257.

Yadav, I. S. (2008). Co-integration, Causality, Money and Income in India. *Journal of Quantitative Economics*.

Zarnowitz, V. (1996). Business Cycles. USA: University of Chicago Press.