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Asymmetric Effect of Monetary Policy on Asset Prices: Contractionary VS Expansionary Regimes

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Abstract

This research study seeks to investigate the asymmetrical impact of monetary policy on asset prices (stock price and house prices as indicators of asset prices). Understanding this asymmetry is crucial for policymakers and central banks to evaluate the implications of expansionary and contractionary monetary policies on asset price dynamics. The study examines both interest rates and the money supply, which are key tools of monetary policy, to determine if they have similar effects on asset prices across various economic regimes in 51 countries with diverse income levels for the period of 2009 to 2021. Using a linear and non-linear ARDL (NARDL) approach this study analyze the short-run and long-run impacts of monetary policy on stock and house prices, besides comparing the symmetric and asymmetric impacts of monetary policy shocks on these prices. The outcomes accentuate the importance of policymakers being cognizant of the impacts of different policy regimes on asset prices. Notably, the study reveals a significant and negative short-term impact of interest rates on asset prices under contractionary monetary policy. Conversely, expansionary monetary policy does not demonstrate a significant short-term effect on asset prices. This study makes substantial contributions by deepening insights into the efficacy of monetary policy, offering practical guidance for policymakers, and addressing a pivotal void in the extant scholarly discourse.

Keywords: Monetary Policy, Asset Prices, Asymmetric Impact, NARDL

JEL Classification: E52, G12, G15

1. Introduction

The nexus between monetary policy (MP) and asset price remains contentious in the financial industry, with significant attention from financial institutions, notably central banks, on the development of asset prices (Bernanke et al., 1989 and 1999). Asset prices, especially within the lending sector, play a pivotal role in macroeconomic fluctuations. Furthermore, asset prices serve as forward-looking indicators reflecting expectations of future asset returns, making them

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valuable for policymakers gauging private sector sentiments on the economy. Additionally, asset prices often exhibit speculative bubble components that can explicitly influence target variables. Consequently, asset prices can be considered a distinctive measure of monetary policy (Cecchetti et al., 2000).

Given the significance and relevance of asset prices in the broader economy, it is imperative to investigate the effects of monetary policies on asset prices, specifically stock and house prices. The recent global financial crisis, prompted by the US housing bubble crash in 2007-08, resulted in a worldwide decline in securities values linked to real estate prices, leading to the failure of numerous financial institutions, and a global recession caused by a contraction in international trade.

The inclusion of house prices (HP) and stock prices (SP) in the model emphasizes their significance as asset price indicators in regard to monetary policy. These two asset prices have distinct impacts on the economy from different perspectives. Monetary policy primarily affects house prices through its influence on financial stability, particularly considering the global financial crisis that led to the collapse of the housing and real estate market. Furthermore, conventional macroeconomic theory provides a more general understanding of the influence of policy on house prices and financing. Holding other factors constant, housing costs are directly proportional to the interest rate, meaning higher interest rates (IR) leads to upsurge in housing costs and decline in asset values. Therefore, monetary policy undeniably plays a role in determining housing prices in support of financial stability.

According to the Quantity Theory of Money, monetary policy is often deemed ineffective because the effect of money is nominal rather than real. Conversely, an increase in general prices impacts personal income and household expenditures, leading to decreased demand for housing (income effect). Consequently, central banks do not view monetary policy as an effective tool for addressing asset price volatility (Goodhart et al., 2010). This perspective suggests that MP has minimal effect on house and stock prices in real terms. Although the nexus among asset prices, real estate, and commodities (oil and gold) is crucial, as examined through a Markov switching model, the conventional viewpoint suggests limited responsiveness to changes in these variables through monetary policy. In cases where an expected price bubble emerges in the asset or housing market, central banks are advised to implement tight monetary policy to limit the impacts and frequency of these bubbles on the financial market, thereby mitigating the possibility of a market crash.

This study aims to examine the monetary policy impacts on two crucial asset prices, house and stock prices, on a global scale. House prices are both a durable consumption good and a source of wealth, affecting homeowners' wealth, consumption, investment decisions, and credit availability. Shocks to house prices can influence economic growth and price levels, making them key variables for policymakers. Stock prices are also important due to their impact on investment, inflation, and output, especially in developing countries. The sample for this study consists of 51 countries selected from the global population. These countries represent a mix of high, low and middle income level countries. Out of the net 51 countries, approximately 71 percent belong to the high-income group, 23 percent are from the upper-middle-income group, and only 6 percent fall into the low-middle-income category. While the sample size represents only 23 percent of the total countries globally, it is considered a good representation of the global population as it encompasses around 87 percent of the world's GDP. Due to data availability limitations regarding house prices, not all countries could be included in the study. However, this sample is still considered a suitable approximation for studying the asymmetric impact of monetary policy on these two types of asset prices.

This study employs the nonlinear ARDL (NARDL) model to capture this relationship across different countries, each characterized by unique asset price dynamics. This approach allows for the investigation of asymmetric effects of monetary policy, distinguishing between the impacts of expansionary and contractionary monetary policies on asset prices. Precisely, the key objective of this study is to estimate the short-run and long-run effects of monetary policy on stock and house prices, as well as to compare the symmetric and asymmetric impacts of monetary policy on these prices. Additionally, the study investigates whether expansionary and contractionary monetary policies significantly impact asset prices.

Research on this issue is limited, presenting an opportunity for analysis and testing of various hypotheses. Therefore, both HP and SP are included in the nonlinear Autoregressive Distributive Lag (NARDL) model. The adoption of NARDL model enables the investigation of asymmetric relations among monetary policy (expansionary/contractionary) and asset prices. Hence, this study’s novelty lies in its representative sample, comprehensive approach, and use of advanced modeling techniques to analyse the asymmetric impacts of monetary policy on asset prices. Its contribution is significant in enhancing the understanding of monetary policy's effectiveness, providing actionable insights for policymakers, and filling a critical gap in the existing literature.

2. Research Contribution

This study aims to analyze the involvement of two crucial asset prices in the monetary transmission mechanism on a global scale. House and stock prices are selected as indicators of asset prices due to their significant impact on investment, output, and inflation in developing countries (Blanchard et al., 1993). Unlike other types of assets, housing prices serve as dual but vital role for both durable consumption goods and sources of wealth (Case et al., 2001). Consequently, any change in house prices directly affects owners' wealth, indirectly influencing their consumption and investment decisions. Moreover, fluctuations in house prices can affect credit availability for individuals with borrowing constraints. Additionally, shocks to house prices can impact real economic growth and overall price levels, making them vital forward-looking variables for policymakers to monitor and manage.

The nonlinear ARDL is employed to capture this relationship between asset prices and monetary policy across different countries, each characterized by distinct asset price dynamics. The rationale for selecting house and stock prices as indicators of asset prices in the model stems from their significant influence on investment, which in turn has a notable effect on inflation and output in developing countries (Blanchard et al., 1993). This is the pioneer study to investigate the relation between monetary policy and asset prices in a global context using an asymmetric framework through the application of NARDL.

Hence, this study contributes to the literature as a global scope, dual focus on house and stock prices, use of the advanced NARDL model, and its exploration of the asymmetric effects of monetary policy. These innovative aspects contribute to a deeper and more comprehensive understanding of the monetary transmission mechanism and its impact on asset prices across different economic contexts

3. Review of Literature

This study aims to investigate nexus between the asset prices and monetary policy. While there is a considerable amount of research on the impact of stock prices, the importance of house prices in the asset market of industrialized economies remains relatively less focused in literature. This research aims to determine whether monetary policy triggers volatility in asset prices. or not.

Previous research suggests that asset prices, including both stock prices and house prices, are more likely to risen significantly where short run interest rates decline to levels suggested by the Taylor Rule (Ahrend et al., 2008). Taylor (2009) argues that MP was a contributing factor to the housing boom in the early 2000s in the United States. However, Kuttner (2012) challenges these findings by suggesting that house prices and market dynamics do not exhibit volatility unless interest rates deviate from the Taylor rule. Dell' Ariccia and Otrok (2007) find an insignificant relationship between monetary policy and house price dynamics in US, adding further doubts regarding Taylor's claims. Similarly, Bordo and Wheelock (2007) find a negligible relationship between lowered interest rates and high asset prices. However, these studies do not incorporate the structural identification of the bubble element of asset prices. Bernanke (2010) also notes that the surge in housing prices began in 1998, suggesting that the period of the housing bubble predates the questionable lowering of interest rates from 2002 to 2006. Iacoviello (2005) analyzes a monetary business cycle that includes the housing market. However, other researchers argue against this and believe that the Federal Reserve should adopt an opposing approach. Taylor (2009) finds that monetary policy responded more effectively to inflation in the 1980-90s, reducing boom cycles in the housing market.

Numerous articles have indicated an inverse relation between interest rates and house prices (Kamal et al., 2016). The literature suggests that a decrease in interest rates causes cheaper mortgages or housing loans, increasing demand for housing and ultimately driving up housing prices. Ibrahim et al. (2014) find long-term relationships between aggregate housing prices and interest rates, suggesting that both housing prices and bank credit may be negatively linked to positive interest rate shocks.

Some studies suggest that house price changes are predominantly positively correlated across countries, taking into account economic factors such as lower interest rates or business cycles, which are key determinants of housing price cycles (Otrok et al., 2005). While it is challenging for central banks to identify an unsustainable increase in asset prices, they can target inflation and output effects of significant asset price movements to mitigate the threats to financial stability (Bernanke et al., 2001).

Given the significant impact of monetary policy on asset prices, particularly house prices, in United Kingdom, the US, and China, as well as other industrialized nations (Jarocinski et al., 2008; Ahrend et al., 2005), it is surprising that few studies have explicitly considered or solely relied on stock prices for analysis, incorporating lags in response to monetary policy (Goodhart et al., 2001; Giuliodori, 2005; Iacoviello, 2005). However, fluctuations in stock prices in the United States, highlighting the interdependence between the two (Rigobon et al., 2003). Furthermore, monetary policy has no any significant long-term impacts on

GDP or stock levels (Blanchard et al., 1989). In the United Kingdom, during the housing price boom in 1989, the housing market was deemed "at risk of inflation," while in Japan, despite rapid growth in asset prices, house prices, and monetary aggregates, inflation remained low from 1986 to 1988, prompting policymakers to assess the potential for inflationary pressures (Yamaguchi, 1999).

Interest rates have been prominent indicators of monetary policy in empirical literature, alongside other commonly used variables in monetary economics such as inflation, industrial production, and exchange rates. However, previous studies have not adequately modeled the long- and short-term asymmetries between interest rates, stock prices, and house prices. This study helps to address this gap through the NARDL approach. As mentioned in the introduction, this approach not only addresses the limitations of previous nonlinear techniques but also expands the sample size, encompassing both developed and developing countries, thereby adding a new dimension in the literature.

4. Model and Methodology

The literature provides several theoretical explanations for the asymmetric impact of monetary policy (MP) on aggregate variables such as output and inflation (Zakri et al., 2013). One prominent theory is the Keynesian perspective, which posits that wages and prices exhibit downward stickiness but upward flexibility. This approach highlights the potential for monetary policy to have asymmetric effects, with expansionary policy being less effective than contractionary policy. Due to sticky prices and wages, firms tend to respond to contractionary monetary policy by dipping output instead of making downward adjustments to prices. As a result, expansionary and contractionary MP are inclined to yield different outcomes when prices and wages exhibit rigidity downward but flexibility upwards.

Although macroeconomic variables often exhibit nonlinear characteristics, previous research on this relationship has predominantly employed linear frameworks, assuming a symmetric relationship and using various time series methodologies. These linear assumptions may have contributed to the mixed findings regarding the nexus between monetary policy and asset prices, as linear models may not be suitable for exploring this relationship. In this study, we aim to investigate the potential asymmetric relationship between monetary policy indicators and asset prices on a global scale by employing a nonlinear analysis, in contrast to the previously used linear approaches. We examine this relationship under three different scenarios as well.

To address this research objective, we employed the panel NARDL model proposed by Shin et al. (2014), which allows for the evaluation of the asymmetric effects of independent variables i.e., money supply (MS), interest rate (IR), exchange rate (ER), industrial production, and inflation (INF) on asset prices. Through the NARDL model, we propose equation (1) to capture the relationship between asset prices and monetary policy.

$$P_{it} = a_0 + a_1 IR_{it}^{+} + a_2 IR_{it}^{-} + a_3 MS_{it}^{+} + a_4 MS_{it}^{-} + a_5 INF_{it} + a_6 IP_{it} + a_7 X_{it} + \varepsilon_{it} \qquad (1)$$

In the context of this study, Pit represents the price change of asset prices, IR represents the real interest rate, MS represents the change in money supply, INF represents the change in inflation rate, and IP represents the change in industrial production, which serves as a proxy for economic activity based on Kilian's (2009) assertion that "the level of global real economic activity, particularly in relation to industrial commodity markets, is closely associated with this index."

Furthermore, IR^{+} and IR^{-} denote the cumulative sums of positive and -negative changes in the interest rate, respectively, while MS^{+} and MS^{-} represent the cumulative sums of +ive and -ive changes in the money supply, respectively.

Asset prices and Interest rate by nonlinear ARDL model

$IRit^{+} = \sum^{t} i=1\ \Delta IRit^{+} = \sum^{t} i=1\ \max(0, \Delta IRit)$ (2)

$IRit^{-} = \sum^{t} i=1\ \Delta IRit^{-} = \sum^{t} i=1\ \min(\Delta IRit, 0)$ (3)

Asset prices and Money Supply by nonlinear ARDL model

$MSit^{+} = \sum^{t} i=1\ \Delta MSit^{+} = \sum^{t} i=1\ \max(0, \Delta MSit)$ (4)

$MSit^{-} = \sum^{t} i=1\ \Delta MSit^{-} = \sum^{t} i=1\ \min(\Delta MSit, 0)$ (5)

The inclusion of the positive and -negative partial sum components in equation (1) highlights the nonlinearity inherent in the long-run relation among asset prices and monetary policy. The NARDL framework, which incorporates cointegration tests and utilizes these partial sum decompositions, allows the identification of asymmetric outcomes in the long-run as well as short-run (Shin, 2011).

In equation (1), the parameter α_1 represents the long-run relation between AP and IR indicating an expected positive effect. Additionally, we anticipate that growth in the interest rate or money supply will lead to different long-run variations in asset prices compared to decreases of the same magnitude, denoted as α1# α2. Consequently, the equation (1) demonstrates an asymmetric long-run monetary policy pass-through to asset prices. To incorporate equation (1) into an ARDL framework, we proceed as follows.

$$\Delta P_{it} = a + \beta Y_{i,t-1} + \beta_1 IR^{+}_{i,t-1} + \beta_2 IR^{-}_{i,t-1} + \beta_3 MS^{+}_{i,t-1} + \beta_4 MS^{-}_{i,t-1} + \beta_5 INF_{i,t-1} + \beta_6 IP_{i,t-1} + \beta_7 X_{i,t-1} + \sum_{i=1}^{p} \delta 1_i \Delta P_{t-1} + \sum_{i=1}^{q} \delta 2_i \, \Delta INF_{i,t-1} + \sum_{i=1}^{m} \delta 3_i \Delta IP_{i,t-1} + \sum_{i=1}^{n} \delta 4_i \Delta X_{i,t-1} + \sum_{i=1}^{x} \left(\theta_i^{+} \Delta IR_{i,t-1} + \theta_i^{-} \Delta^{-}_{i,t-1}\right) + \sum_{i=1}^{z} \left(\theta_i^{+} \Delta MS_{i,t-1} + \theta_i^{-} \Delta^{-}_{i,t-1}\right) + \varepsilon_{it} \quad (6)$$

In the proposed model, the lag lengths p, q, m, n, and z are utilized, where Δ represents the difference operator and ε_t denotes the serially uncorrelated error term. Unlike other cointegration tests, the ARDL model does not necessitate symmetry in lag lengths allowing for different lag terms for every variable (Pesaran and Shin, 1999). The LR coefficients (α_1 = - β_1/ β_2 and α2 = -β_2/ β_0) capture the effects of interest rate rise and fall, respectively, on asset prices in the long run. The term $\sum^{z}_{i=0} \theta^{+}_{i}$ represents the SR impact of interest rate increases on asset prices, while $\sum^{z}_{i=0} \theta^{-}_{i}$ captures the SR impact of interest rate decreases. The equation (6) demonstrates that model accounts for both the asymmetric short run MP effect on asset prices and asymmetric long-run effect.

To ensure the validity of estimated F-statistics to test the existence of a cointegration relationship, we ought to test the integration order of variables in non-linear ARDL framework. This is done to confirm that none of the variables have an order of integration of I(2), as the existence of an I(2) variable would invalidate the estimated F-statistics. In this study, we used the (Levin et al.,2002) panel unit root test to assess the stationarity of the variables. Once cointegration among the variables is established, we conducted relevant tests to verify the stability and reliability of the NARDL, such as the Wald test, CUSUM and CUSUMSQ.

After verifying the absence of I(2), we estimated equation (6) with the typical OLS method, including a substantial number of lags to get accurate depiction of NARDL model. The significance of the long run coefficients beside the error correction term confirms the presence of cointegration. For the panel data of the full sample, we employed the pooled mean group (PMG) to estimate equation (1). PMG estimator allows for variation in short-term parameters across groups while enforcing identical long-run coefficients. It has been shown that maximum likelihood-based PMG estimates are more efficient than other methods (Kisswani, 2017). PMG estimators find out the dynamics of adjustment among the long-run and short-run periods. Here, the results obtained from the PMG estimator offer valuable insights into the observed asymmetry within the panel data. Finally, we examined the direction of causality between asset prices.

To assess causality within the panel data, we employed the pairwise Dumitrescu and Hurlin Panel Causality test (2012). This test evaluates our null hypothesis of the nonexistence of homogeneous Granger causality. The general hypothesis of this test can be generally stated as:

$$p_{it} = a_1 + \sum_{k=1}^{k} \gamma_i^k p_{i,t-k} + \sum_{k=1}^{k} \beta_i^k X_{i,t-k} + \varepsilon_{i,t} \quad (7)$$

where $k \in N^*$ and $\beta i = (\beta^1{}_{i}, \ldots\ldots\ldots, \beta^2 i)$

The subsequent section presents the econometric findings and provides a comprehensive discussion of the estimation outcomes.

5. Data and Sample

This paper used quarterly data spanning from 2009 to 2021, encompassing fifty-one countries across the globe. The chosen starting year of 2009 was deliberate, as it allows for the exclusion of the financial crisis years of 2007-2008, thus accounting for any potential structural breaks. Additionally, data availability limitations prior to 2009 also influenced this choice. The quarterly data pertaining to house prices, stock prices, inflation, industrial production, and interest rates were sourced from reputable institutions such as the Bank of International Settlements, IFS, and WB dataset. Specifically, the house price (HP) and stock price (SP) indices were considered in terms of quarterly percentage changes, the interest rate (IR) was analyzed in its real form, inflation (INF) was measured as a percentage change per quarter[1], and exchange rate (X) is taken as quarterly exchange rate change. House price data represents the percentage change in housing prices per quarter in each country, while stock price data refers to stock market indices based on the percentage of stock prices traded on the respective stock exchanges.

Within the sample of fifty-one countries, thirty-six are classified as high-income countries, twelve fall under the higher-middle income category, and only three are categorized as low-middle income economies. Significantly, all three low-middle income economies are in South Asia (Bangladesh, India, and Pakistan) based on the World Bank's income level categorization[2].

6. Empirical Results

This segment provides an analysis of the characteristics of data used in this research. Following the discussion on data description, a comprehensive analysis is

[1] The inflation data is available on monthly basis and to align the overall frequency of data we make it quarterly. It is done by taking simple average for each quartet.

[2] For the year 2020, the low-middle income countries have per capita GNI in range of $1,035 to $4,045, high-middle income economies have per capita GNI ranging from $4,046 to $12,535, whereas high income have GNI/ capita more than $12,536.

presented to assess the impact of MP and economic activity on both indicators of asset price. Descriptive statistics for all variables of interest in the empirical models are provided. The findings are presented and discussed in Table 1 below. Notably, the maximum change observed in stock prices (SP) is 65 percent for India, with Colombia showing the minimum change at -89%. However, when considering the mean value for stock price returns, the change is recorded at 2 percent.

Table 1. Descriptive Statistics for All Countries in the Sample (2009Q1-2021Q4)

	SP	*IP*	*X*	*MS*	*IR*	*INF*	*HP*
Mean	2.07	1.96	0.09	2.08	0.77	3.17	0.30
Median	2.25	2.25	0.21	1.70	0.63	2.69	1.19
Standard Deviation	9.56	7.61	19.82	2.04	2.44	2.92	8.91
Sample Variance	91.30	57.86	392.94	4.16	5.97	8.52	79.45
Minimum	-89.67	-135.40	-465.36	-4.33	-16.23	-7.89	-98.79
Maximum	65.77	55.45	232.73	12.07	12.89	19.23	60.46
Range	155.43	190.85	689.09	16.40	29.12	27.12	159.25

Due to the characteristic differences between the financial market and the housing market, it is evident that we observe that the range in the percentage change of stock prices is significantly high. Similarly, the house price index (HP) also exhibits considerable variation, with a mean percentage change of only 0.3 percent, yet notable maximum and minimum values in both positive and negative directions. This diversity can be attributed to the inclusion of a wide range of countries in the sample, each characterized by distinct features within their respective housing markets.

6.1 Model Results

The initial section of the results provides a vision regarding the impact of MP on stock market. To achieve this, we first examine the stationarity of the variables. This step is essential, as the ARDL model is most suitable when no variable exhibits stationarity at the second difference. If some variables display stationarity at the first difference and others at the second difference, an ARDL model can still be employed. However, if any variable remains stationary only at the second difference, the use of an ARDL model is not feasible. The same principle applies to the NARDL model. Consequently, we begin by assessing the stationarity level of the variables of Model number 1, which investigates the impact of MP on stock prices. To determine if any variable experiences a unit root, we first examine the significance of the constant and time trend, as they have a substantial impact on stationarity. Subsequently, the existence of the unit root is assessed using the test of Levin, Lin and Chu.

Upon reviewing Table 2 below, it is evident that for the entire sample of 51 countries, most variables exhibit stationarity at the level, with the exception of the inflation rate. The inflation rate demonstrates a unit root and becomes stationary on first difference, i.e., which classified as I (1).

Table 2. Levin, Lin and Chu Unit Root Test for all Samples

	Full sample (51 countries)
SP	I(0)
IR	I(0)
HP	I(0)
IP	I(0)
X	I(0)
MS	I(0)
INF	I (1)

Given that the variables in the full sample exhibit stationarity at either the level or at the first difference, and none display stationarity at the second difference, we can employ the non-linear ARDL model to analyze the short and long run impact of expansionary or contractionary MP on the stock market. To attain this, we ought to ascertain the lag length of model. In our case, since we are dealing with a panel ARDL, we can select the optimal lag by analyzing the maximum lag across the cross-sections employing the Akaike Information Criterion. The optimal lag length is automatically chosen for pooled mean group dynamic panel ARDL model. This process is also applied to analyze the MP transmission in both stock and housing markets. The findings of sample ARDL and NARDL models are presented in Table 2.

The results are presented in two vertically divided sections. The first section displays the outcomes for ARDL and NARDL models[1]. Horizontally, the effect of MP on stock market prices is separated into short as well as long run. The term "ECT" represents the error correction term, indicating the speed of adjustment of dependent variable. A negative sign denotes convergence from the short run to the long run. Empty cells indicate that results are unavailable for a specific independent variable in either the ARDL or NARDL model. Results for the negative (Neg) and positive (Pos) impact of monetary policy (IR and MS) are detailed in the NARDL model.

[1] From NARDL here we mean the asymmetric impact of MP on the financial assets (stock as well as house market). The functional form of the independent variables is not the focus of this study.

Table 3. Monetary Policy Transmission in Stock Market (Sample = World)

Independent Variable	PanelA ARDL		PanelB NARDL	
	Dependent variable: Stock price			
	Lag length: Dep=1, Indep=1		Lag length: Dep:4, Indep=4	
Short-run dynamics				
D(X)	-0.4019	0.0006	-0.5753	0.0025
D(IP)	0.4549	0.1022	-0.0183	0.9016
D(INF)	-6.3313	0.0478	-5.6997	0.0837
D(IR)	-5.8142	0.0734	-	-
D(IR)-POS	-	-	-5.146	0.2201
D(IR_NEG)	-	-	-6.4545	0.0527
D(MS)	0.2096	0.2167	-	-
D(MS)-POS	-	-	-1.5535	0.0064
D(MS_NEG)	-	-	0.991	0.1844
ECT	-0.9548	0.0000	-1.1751	0.0000
Long-run dynamics				
X	0.0028	0.8349	-0.0098	0.6363
IP	-0.2727	0.0000	0.3037	0.0000
INF	-1.0200	0.0002	0.0349	0.8764
IR	-1.1986	0.0000	-	-
IR-POS	-	-	-0.8173	0.0003
IP-NEG	-	-	-0.1569	0.4722
MS	-0.5196	0.0254	-	-
MS-POS	-	-	1.0399	0.0024
MS-NEG	-	-	1.2368	0.0006

As previously discussed, the effect of monetary policy (MP) on stock prices (SP) can be analyzed through interest rates (IR) and money supply (MS). The classical theory of asset pricing is valuable in understanding this relationship, as it recognizes that stock prices reflect the discounted present value of future expected cash flows. Therefore, decisions regarding monetary policy closely affect changes in stock prices, considering the discount rate. Additionally, changes in interest rates influence stock prices by affecting expectations of future inflation (Lobo, 2000).

Existing literature reveals that different MP regimes have varying impacts on asset prices. Studies suggest that the impact of interest rates on stock prices is negative for high-income countries (Hsing, 2011) and lower-middle-income countries. In addition to interest rates, this study also considers money supply as a significant instrument of monetary policy influencing stock market performance. However, most of the existing research focuses on specific country or group of small number of countries, leading to mixed findings regarding the impact of MP on stock returns. For instance, it shows a positive impact in countries like Ghana and Malaysia, but a negative impact in Pakistan.

The outcomes of ARDL model demonstrate that in the short run, exchange rates and inflation have significant negative impacts on stock prices. However, economic activity and money supply do not significantly affect stock market returns. In contrast, the long-run (LR) effects are significant for all variables except exchange rates. Both monetary policy variables have significant negative impacts on stock returns in the long run, but their impacts are insignificant in the short run.

This suggests that an upsurge in the interest rates puts downward pressure on stock prices, leading to a decline in stock returns over time. The long-run dynamics indicate that a 1% rise in interest rates leads to a 1.2% decline in stock market returns globally. A similar relationship is observed between money supply and changes in stock prices. Expansionary monetary policy, in terms of interest rates, leads to a reduction in stock market returns. It illustrates that globally expansionary monetary policy through increases in money supply can also result in a decrease in stock market returns.

The findings from NARDL model are consistent with linear ARDL model. In the long-run, expansionary monetary policy leads to an upsurge in stock prices. The asymmetric impacts of both interest rates and money supply are significant in the long-run, except for negative changes in interest rates. This indicates that while expansionary monetary policy through interest rate decreases significantly affects changes in stock prices, the same is not true for contractionary policy. Specifically, a one percent expansion in monetary policy through interest rate decreases results in a 5.14 percent positive change in stock prices.

The negative coefficient value alongside negative interest rates in the short run suggests an inverse relationship between monetary policy and changes in stock prices (Hsing, 2011; Naik, 2013). Regarding money supply, both expansionary (positive) and contractionary (negative) monetary policies significantly impact changes in stock prices. In the short run, the coefficients of interest rates are insignificant, indicating that it takes more than one time period for changes in interest rates to cause changes in stock prices. Only positive changes in money supply have a significant positive impact on changes in stock prices (Vejzagic et al., 2013).

Furthermore, ECT shows the speed with which stock prices converge to equilibrium. Its negative value signifies convergence. In both the short and long run, the ECT term displays a negative and significant value, indicating a high speed of convergence where stock prices reach equilibrium in the current period. The results from both the ARDL and NARDL models exhibit the same statistical trends.

Besides analyzing the monetary policy (MP) impacts, we further examine effects of economic activity, exchange rate, and inflation rates. The outcomes indicate that the coefficients of economic activity (industrial production) and inflation rates are insignificant in the short run, with p-values exceeding 0.05. However, the coefficient of exchange rates has a significant negative value, suggesting that a 1% appreciation in ER causes 0.5% upsurge in stock prices. In the short-run, currency appreciation is presumed as good news for the stock market. Conversely, in the long run, the coefficients of exchange rate and inflation are insignificant, indicating that changes in exchange rates only affect changes in stock prices in the short run, as investors quickly adapt to the news. Industrial production, on the other hand, has a positive impact on changes in stock prices only in the long-run, aligning with previous literature that suggests changes in industrial production have long-term effects on the economy. The coefficient implies that a 1% increase in industrial production causes a positive change of 0.3 percent in stock prices in the long run.

Table 4. Diagnostic Test [Dep: Stock price, Sample: All Countries]

Diagnostic test	NARDL - Asymmetric relationship	Normality of Residuals	
Wald test-IR	p-value = 0.0000	ARDL	p = 0.0948
Wald test-MS	p-value = 0.0004	NARDL	p = 0.1805

Table 4 displays the results of two tests. The column one and two of the table illustrates the findings of the Wald test, which investigates whether there is an asymmetric impact of MP variables i.e., interest rate (IR) and money supply (MS) on changes in stock prices. Specifically, this study tries to probe how negative changes in interest rate affect stock prices differently than positive changes, the same applies to the money supply either. The probability values from the Wald test indicate that the asymmetric impact of both monetary policy instruments is statistically significant. Moving to the last two columns of the table, we observe that the residuals of the panel ARDL and NARDL models exhibit normal distribution.

After investigating the asymmetric impact of MP on stock prices, we turn to evaluating its influence on another asset price, namely house prices. Similar to the analysis for stock prices, we assess the effects of expansionary and contractionary MP by using interest rate and money supply as the instruments of MP. The outcomes of ARDL as well as NARDL models are presented in Table 4, including data from all sampled economies.

In the short-run we find that house prices remain least responsive to changes in monetary policy. The coefficients of the linear ARDL model are insignificant for monetary policy, as well as for other control variables such as the exchange rate, inflation, and industrial production. This suggests that abrupt changes in these variables do not translate into immediate effects on house prices within a quarter. Therefore, we conclude that house prices demonstrate no responsiveness to monetary policy or other control variables. These findings remain consistent even when considering the non-linear ARDL model, verifying their robustness.

In the long-run, we discovered that MP has an impact on HP primarily through changes in the interest rate, exhibiting a negative relationship with house prices. Specifically, for the ARDL model, an expansionary monetary policy characterized by a decline in the interest rate leads to a positive change in HP. This impact of monetary policy mirrors what was observed for changes in stock prices. The NARDL model outcomes indicate a significant effect of both positive and negative changes in monetary policy. The contractionary monetary policy, represented by an increase in interest rates (i.e., IR-Pos), has a significant negative effect on changes in house prices in the long-run. However, the results for negative changes in the MP are significant but not consistent with theoretical anticipations.

Table 5. Monetary Policy Transmission in Housing Market (Sample = World)

Independent Variable	Panel A ARDL		Panel B NARDL	
	Dependent variable: House price			
	Lag length: Dep=4, Indep=4		Lag length: Dep:4, Indep=4	
Short-run dynamics				
	Coefficient	Significance	Coefficient	Significance
D(X)	-0.03765	0.644	-0.2111	0.0414
D(IP)	-0.1212	0.1356	0.0848	0.1776
D(INF)	-0.3043	0.8088	1.5405	0.6359
D(IR)	0.2038	0.8338	-	-
D(IR)-POS	-	-	2.5676	0.5166
D(IR_NEG)	-	-	0.8410	0.7444
D(MS)	-0.2653	0.1631	-	-
D(MS)-POS	-	-	-2.1273	0.1077
D(MS_NEG)	-	-	0.8316	0.2552
ECT	-0.5835	0.0000	-0.3072	0.1287
Long-run dynamics				
X	0.0088	0.2645	-0.0172	0.0002
IP	-0.0133	0.3254	-0.0308	0.4207
INF	-0.0917	0.0661	-0.3070	0.0006
IR	-0.3183	0.0000	-	-
IR-POS	-	-	-0.2301	0.0069
IP-NEG	-	-	-0.1649	0.0966
MS	0.083	0.176	-	-
MS-POS	-	-	2.1743	0.0000
MS-NEG	-	-	2.0039	0.0000

A decrease in the money supply is likely to bring about a negative change in house prices due to the contractionary impact of monetary policy on economic activity. These findings align with the principles of supply and demand of money, as proposed by Moore (1997). When the money supply contracts, the demand for money increases in order to maintain price stability. Consequently, the price level rises in the long-run. This explains why a -negative change in the money supply causes a decline in house prices.

The findings of this study reveal the presence of an asymmetric relation between changes in monetary policy variables and changes in house prices. Additionally, long-run estimates for exchange rate and inflation demonstrate significant and negative associations. Specifically, these results indicate that over the long term, a depreciation in the ER is linked to a decline in house prices, and the same holds true for inflation.

Table 6. Diagnostic Test [Dep: House price, Sample: All countries]

Diagnostic test	NARDL - Asymmetric relationship	Normality of Residuals	
Wald test-IR	p-value = 0.0000	ARDL	p = 0.9847
Wald test-MS	p-value = 0.0028	NARDL	p = 0.1284

The table above presents the diagnostic tests conducted to examine the impact of MP on house price fluctuations. The results of the Wald test indicate the significant asymmetric effect of monetary policy, as evidenced by probability values below the 5 percent threshold. Furthermore, the normality test confirms that the residuals of the model exhibit a normal distribution, indicating the stability of the results.

7. Conclusion and Policy Recommendations

This study aims to examine the existence of an asymmetric impact of MP on asset prices. Understanding the asymmetric impact is pivotal for policymakers and central banks in assessing the significance of expansionary or contractionary monetary policy on changes in asset price dynamics. For clarification of these different monetary policy regimes, this study focuses on two specific asset marekets: the housing market and the stock market.

This study contributes to the ongoing debate surrounding the potentially asymmetric response of MP in relation to asset prices. We provide evidence suggesting that implementing an asymmetric policy towards the stock market can lead to asymmetric business cycles. Expansionary shocks are likely to amplify output booms while dampening recessions, likewise for the inflation. This phenomenon can be attributed to the policymaker's desire to mitigate the asymmetries present in an economy. This study illustrates that while assuming non-linearities in the financial accelerator or the stock wealth effect, the asymmetric monetary policy may yield symmetric results in a reaction to supply shocks but only partially alleviates asymmetries following demand shocks. Empirical studies indicate that the extent of the asymmetric policy reaction is relatively minor, and our analysis suggests that its effects on the macroeconomy are modest, particularly when these economic variations are caused by technological shocks.

Furthermore, the outcomes of this extensive analysis highlight the significance for policymakers to be aware of the impact of different policy regimes on asset prices. For instance, when considering contractionary monetary policy, it is evident that interest rates illustrate a significant and negative impact on asset prices in the short run. Conversely, expansionary monetary policy does not show a significant impact on asset prices in the short run. Therefore, policymakers should exercise caution when swiftly implementing contractionary measures, particularly in terms of increasing interest rates, as they can adversely affect both stock and house prices.

However, in the long run, the transmission of monetary policy through interest rates and money supply proves significant for asset prices. When formulating long-term monetary policy aiming at ensuring price stability, it is crucial to recognize that both contractionary and expansionary policies can significantly influence changes in asset prices.

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