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Financial Development, Monetary Policy, and the Monetary Transmission Mechanism—An Asymmetric ARDL Analysis

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Abstract: This paper's objective is to examine the asymmetric cointegration and asymmetric effects of financial development and monetary policy on monetary transmission mechanisms in the Nigerian context using annual data spanning the period from 1986 to 2023. This study pushes the frontiers of knowledge by providing information on the nonlinear impacts of monetary policy and financial sector innovations on monetary transmission mechanisms in Nigeria to help policymakers tailor their strategies to local conditions, enhancing the effectiveness of monetary interventions in the economy. To achieve this, this paper adopted nonlinear ARDL models to understand how changes in the direction of monetary policy and developments in the financial system induce changes in the transmission of monetary policy. The findings document the existence of asymmetries in both the short and long run, revealing that the impacts of financial development and monetary policy on the different monetary policy channels are not uniform. These asymmetries indicate that the responses of various economic variables to monetary policy actions differ depending on the level of financial development. These findings underscore the complexity of the monetary transmission mechanism and the necessity for a nuanced understanding of how financial development and monetary policy interact in different contexts. Consequently, this finding is symptomatic of some characteristics of those financial markets on their way toward advanced developments. As the financial system matures, monetary policy may have a greater impact on the cost of short-term funding for banks without having any discernible effect on the rates at which businesses and households access funding. Therefore, this paper recommends focusing on the policies that will foster the financial system across the banking sector, capital market, bond market, and overall financial sector to improve the efficiency of the monetary transmission process.

Keywords: financial development; credit channel; asset price channel; exchange rate channel; inflation expectations channel; interest rate channel; monetary policy; monetary transmission mechanism

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1. Introduction

Financial systems have witnessed massive developments globally over the last four decades due to the changes and innovations within the financial system. These developments are also founded on new ways of providing financial services, the increasing variety of financial products, and improved service offerings. It has been established that financial development has many positive benefits on economic activities (Levine 1997, 2005; Bernanke et al. 1997; Oyadeyi 2023a, 2023c). The financial system is also critical to the conduct and performance of central bank operations and the channels through which they impact economic activity. This is because the financial system, vis-à-vis the monetary policy channels, is the conduit that allows monetary policies to affect economic activities. There are five channels through which monetary policies impact economic activities. These are the asset price, credit, exchange rate, inflation expectations, and interest rate channels (Bernanke et al. 1997; Mishkin 1995, 2004). Monetary policy operations affect the economy through these channels, and financial development plays a crucial role in these operations.

According to the literature, financial development and the monetary policy decisions of central banks may be related in two opposing ways. The first is that financial devel-

opments, as well as financial innovations, may weaken the role of traditional financial institutions (like commercial banks) in providing finance to the real sector when these developments and innovations deepen capital market liquidity. This may, in effect, weaken the credit channel, since households and firms may switch from traditional financial institutions, such as commercial banks, as the external finance premium of bank funding rises (Singh et al. 2008; Seth and Kalyanaraman 2017; Oyadeyi 2023b). In effect, when banks are in equilibrium, they may not adjust lending rates in line with shifts in the central bank's policies (Meneses-González et al. 2022; Oyadeyi 2024a). This, however, may depend on whether banks can switch from their traditional short-term lending or not (due to financial development or other innovations). If they can, then they may not adjust deposit rates in line with a monetary policy rate change, while, if they cannot, they most likely will change deposit rates in line with a central bank's monetary policy rate change.

Secondly, financial development can also strengthen the monetary transmission process, since economic agents operating in highly developed financial markets are more likely to influence activities within the financial system and their decisions tend to be connected with the policy authorities (Meneses-González et al. 2022). Furthermore, highly developed financial markets are characterized by a broader range of financial products that are linked to the monetary policy decisions in an economy (Vrolijk 1997; Oyadeyi 2022b; Oyadeyi 2023d). This implies that a policy rate change will induce changes in investor preferences for the different financial instruments and investments (like stocks, bonds, and fixed income). In addition, Seth and Kalyanaraman (2017) are of the view that financial markets that are not highly developed do not witness the same level of financial innovations and products as highly developed markets, because banks in these markets tend not to adjust their interest rates in line with shifts in the policy rate, due to the chance that the credits created may be weakly linked to deposit creation in the financial system, thereby negatively affecting the money multiplier.

Nigeria currently adopts five monetary policy transmission channels. However, these channels are sometimes weak or ineffective (Shortland and Stasavage 2004; Kireyev 2015; Bordalo et al. 2020; Oyadeyi 2022a). For instance, the level of financial progress within the interbank market has hampered the interest rate channel. Furthermore, the asset price channel is weakened because of the shallow equity market, while limited capital mobility and the continuous adoption of different exchange rate systems across different foreign exchange markets hamper the effectiveness of the exchange rate channel. The credit channel is often hampered by developments within the capital market, while the inflation expectations channel is weakened because of the inability of the monetary authorities to meet their inflation target and, by extension, their inability to control inflation over extended periods. As a result, financial developments and monetary policy operations play a vital role in strengthening a central bank's policy effectiveness and transmission in the economy. Consequently, this paper will undertake research on the asymmetric effects of financial development and monetary policy on the transmission channels of monetary policy in Nigeria.

The literature has examined the connection between a central bank's monetary policy operations, financial development, and monetary transmission mechanisms, either jointly or separately. For instance, studies like Alfaro et al. (2003), Singh et al. (2008), Zwolankowski (2011), Nyamongo and Ndirangu (2013), Apanisile and Osinubi (2019), Oyadeyi and Akinbobola (2020), Auer (2022), Meneses-González et al. (2022), and Nguyen et al. (2022) have investigated the role of financial development on the transmission mechanism. On the other hand, a second set of studies, such as Loayza and Schmidt-Hebbel (2002), Kuttner and Mosser (2002), Boivin et al. (2010), Mishra et al. (2010), Havranek and Rusnak (2013), Ascarya (2012), Bashagi et al. (2019), and Oyadeyi and Akinbobola (2022), have focused on money transmissions and the pass-through process. In addition, a third set of studies, like Bernanke and Gertler (1995), Minguez (1997), Alfaro et al. (2003), Ogun and Akinlo (2010), Lerskullawat (2016, 2018a, 2018b), Babilla (2022), and Farajnezhad (2022), have focused on the connection between financial development and the credit channel.

As a result, studies on this issue are not new. However, the concern that the paper will address is the asymmetric changes in financial development and central bank's monetary policies and how they affect money transmission in Nigeria. This is because linear models cannot show the entire relationship due to structural changes and short-term volatility in economic cycles.

Furthermore, Raza et al. (2016) were of the view that, when the period of study includes the global financial crisis of 2007–2008, nonlinearities such as financial and structural factors and asymmetric behavior were found to have caused bank liquidation and brought about other constraints, negatively impacting market dynamics. Therefore, the asymmetric behavior of financial development and central bank monetary policy actions may have contributed to the weakness of some of these monetary policy channels in Nigeria, which has often been overlooked in previous research. In addition, a linear relationship on the topic will not adequately capture financial developments within the stock market, which can be highly volatile (Adediran et al. 2024). This also extends to the exchange rate market, which is also often volatile. According to Sheikh et al. (2020), nonlinear long-run relationships between the performance of the capital market and exchange/currency rates were disrupted during the global financial crisis.

Therefore, this paper aims to investigate how the nonlinear effects of financial development and monetary policy influence the monetary transmission mechanism in Nigeria. This is because understanding proper monetary policy conduct in the economy requires that authorities have a firm grasp on the factors that influence the monetary transmission mechanism (European Central Bank 2010). The remaining sections of this paper are laid out as follows. The second section presents an empirical discussion of the literature, while the third presents the methodology and discusses the data sources and measurements. In the fourth section, we discussed estimation and the discussion of the results, and, in the final section, we offered some potential next steps for further research.

2. Review of the Literature

Bean et al. (2002) explored the effects of financial frictions on the monetary transmission mechanism. Both the bank lending channel and the credit channel were found to be active in the countries studied, and the paper also found that financial frictions played a significant role in the dissemination of monetary policy. Zwolankowski (2011) explored the role of financial crisis and financial system stability on the transmission of monetary policy in the US. The paper suggested that the allocation of capital has been affected due to the ease at which investors have access to bank loans and an excessive propensity to risk. Furthermore, the paper found that the financial system imbalance was caused by an expansion of innovative instruments that had very difficult risk profiles within the financial system.

The relationship between the financial structure, the institutional quality, and the transmission of monetary policy was the subject of a meta-analysis conducted by Bhattacharya et al. (2019). The paper argued that financial development is crucial to the success of monetary policy and that the financial accelerator indicator is vital to the successful transmission of monetary policy on growth in output. Meneses-González et al. (2022) examined the impacts of financial development on monetary transmission mechanisms across 43 countries from 2000 to 2019. The paper employed the strategy of Brandao-Marques et al. (2020) in specifying the Taylor rule. The paper proved that financial development does strengthen the monetary transmission mechanism with respect to deposit rates but does not influence the lending rate.

Using a conventional New Keynesian framework, Auer (2022) analyzed how financial integration affects the propagation of monetary policy, extending the work of Woodford (2010) by including financial markets within the global integration process and considering how they impact monetary transmission. The findings showed that financial integration does not weaken the effectiveness of monetary policy in influencing output and prices. The paper also discovered that the presence of the exchange rate and asset price channels

strengthened monetary policy because their positive effects outweighed the negative effects of the interest rate channel. Lerskullawat (2018a) used quarterly data from 1991 to 2016 to analyze the impact of banking competition and banking stability on the lending channel of monetary policy. The paper discovered that monetary policy has a sizeable impact on the lending channel, with the effect being greater for institutions with a larger asset base than those with a smaller one. Furthermore, the results demonstrated that monetary policy in Thailand is unable to affect the lending channel because of banking competition and banking stability.

Lerskullawat (2016) analyzed the effects of developments in the banking industry and capital markets on money transmission through bank lending. This paper analyzed 89 commercial banks from 1999 to 2011 across five ASEAN countries (Indonesia, Malaysia, the Philippines, Singapore, and Thailand). The results demonstrated that a central bank's policy exerts a sizable impact on the banking sector through the lending channel, although this impact was less pronounced for strong, capitalized, and highly liquid banks. However, the channel was directly affected by bank size. The paper concludes that changes in the banks and capital market operators reduce the impact of a central bank's policies on bank lending. Using quarterly data from 1992 to 2011, Lerskullawat (2018b) analyzed the impact of lending from commercial banks and the role the financial sector plays in lending in Thailand. Lerskullawat (2018b) found results that are consistent with those found in Lerskullawat (2016) for Thailand. That is, the size of the bank had an immediate impact on lending (through bank loans) and changes in the banking industry and the capital markets dampened the central bank's influence on the lending channel.

Ahiadorme (2022) empirically investigated the distribution role of growth in the financial sector and how it influences monetary policy transmission from monetary policy to inequality in 32 Sub-Saharan African (SSA) countries spanning the years 2000 to 2017. The findings suggested that a country's monetary policy is important and significantly influences income inequality, while financial development worsens the disequalizing effects of a central bank's policy shocks. The paper concluded that, even though the central bank's monetary policy and developments in the financial sector exert redistributive effects, the latter tends to contribute more to inequality in Sub-Saharan Africa. Nguyen et al. (2022) analyzed how financial development affected money transmission within a multiple-tool regime in Vietnam. The paper focused on the period spanning 2007 to 2020 and focused on commercial banks in Vietnam. The paper found that financial advancement hinders bank lending. The paper also showed that the influence of financial development on bank loan supply was heterogeneous across the banks, and the results were consistent across the sample when tested for robustness.

Using a dynamic stochastic general equilibrium (DSGE) approach, Apanisile and Osinubi (2019) analyzed the impact of advancements within the financial sector on the efficiency of money transmissions in Nigeria. The research results demonstrated the importance of advanced developments in enhancing the transmission pathways through which a central bank's policies affect economic activities. The paper found that the expectations channel was the greatest in stimulating prices in Nigeria, while the credit channel was the strongest in stimulating output. Using a New Keynesian DSGE framework, Apanisile (2021) explored how remittance inflows affected money transmission. The paper suggested that the bulk of remittances are not remitted within the formal financial system, but they are passed through the informal financial system in Nigeria, thereby implying that the bulk of remittance inflows are consumed, rather than invested in productive activities. The paper finally found remittance inflow not to be inflationary for Nigeria, while it weakens the effectiveness of the central bank's policies in Nigeria.

The effects of Nigeria's growing financial sector on the country's money transmission system were studied by Oyadeyi and Akinbobola (2020). They used a variety of metrics to probe how progress in the financial sector influences money transmission. The paper used the ARDL and structural break approach to establish whether advancements in the financial sector and its joint effect with the central bank's policies had significant effects

on the monetary transmission mechanism. Capital market, bond market, and financial liberalization indicators all played less of a role in the transmission process than banking sector indicators. The paper also hints that the traditional interest rate channel is where financial development has the greatest impact, while the exchange rate channel is where it has the least.

In summary, the literature review has been able to carry out an exposition on the links between financial development, monetary policy, and monetary transmission mechanisms across the different regions of the world. Some of the common themes from this survey is that financial development plays a critical role in the monetary transmission process. Furthermore, the use of the New Keynesian framework in providing information on monetary transmission mechanisms is paramount. In addition, several methods have been used to analyze this relationship, ranging from DSGE methods to ARDL methods in country-specific contexts and system GMM methods for panel studies. However, to push the frontiers of knowledge, this study explores the nonlinear effects of financial development and monetary policy on the monetary transmission mechanism in Nigeria. This is important as it helps policymakers to understand the nuances between these relationships, enabling the provision of robust policy frameworks for monetary policy operations in Nigeria.

3. Methodology, Data Sources, and Measurements

3.1. Theoretical Framework

The New Keynesian Framework

Financial development and the efficacy of monetary policy are critical components in understanding the broader dynamics of economic growth and stability. The monetary transmission mechanism, which describes how policy actions affect the economy, is central to this discussion. A robust theoretical framework for analyzing these relationships is the New Keynesian framework. The New Keynesian framework integrates microeconomic foundations into macroeconomic models, emphasizing nominal rigidities such as price stickiness and wage rigidity. These concepts are pivotal in explaining why markets do not always clear instantaneously and why monetary policy can have significant real effects on the economy.

A fundamental aspect of the New Keynesian framework is the incorporation of rational expectations. Economic agents, whether consumers, firms, or investors, form expectations about future economic conditions based on available information, influencing their current decisions. These expectations are crucial in shaping the impact of monetary policy. For instance, if economic agents anticipate lower future interest rates, they might increase their current spending and investment, stimulating economic activity. Monetary policy rules, such as the Taylor rule, are often embedded within the New Keynesian framework. These rules guide how central banks should adjust interest rates in response to deviations from target inflation and output gaps, providing a systematic approach to monetary policy. The interaction between these rules and the economic behavior of agents forms the backbone of the monetary transmission mechanism.

The monetary transmission mechanism in the New Keynesian framework operates through several channels. The interest rate channel is primary, where central banks influence short-term interest rates through policy instruments. Changes in these rates affect borrowing costs, investment decisions, and consumer spending, thereby impacting economic activity. Lower interest rates generally stimulate the economy, while higher rates tend to dampen it. The credit channel highlights the role of financial intermediaries in the transmission mechanism. Changes in monetary policy affect banks' lending behavior, influencing the availability and cost of credit for businesses and households. A well-functioning credit channel ensures that policy changes are effectively transmitted to the broader economy.

The exchange rate channel is another critical pathway, where monetary policy impacts exchange rates, affecting the competitiveness of exports and imports. For example, a lower interest rate may lead to currency depreciation, boosting export demand, while a higher

rate can cause currency appreciation, making exports more expensive. Expectations play a vital role in the transmission mechanism. If economic agents expect future monetary policy actions to be expansionary, they might increase their spending and investment today, affecting current economic activity. This expectations channel underscores the importance of credible and predictable monetary policy. Finally, the wealth effect channel operates through changes in asset prices, such as stocks, bonds, and real estate, influenced by monetary policy. Changes in asset prices affect household wealth and, consequently, their consumption patterns, further impacting economic activity.

Financial development enhances the effectiveness of these transmission channels. Well-developed financial markets facilitate efficient resource allocation, improving the responsiveness of investment and consumption to monetary policy changes. Strong and resilient financial intermediaries, including banks and non-bank financial institutions, enhance the credit channel's effectiveness by ensuring that changes in policy rates are transmitted to borrowers. Sound regulatory and institutional frameworks support financial stability, ensuring that monetary policy achieves its desired effects without being undermined by financial instability.

In applying the New Keynesian framework to analyze financial development, monetary policy, and the monetary transmission mechanism, examining the relative importance of various transmission channels in different financial development contexts allows for a nuanced understanding of the interplay between financial development and monetary policy effectiveness. In essence, the New Keynesian framework offers a comprehensive approach to analyzing the complex relationships between financial development, monetary policy, and the monetary transmission mechanism. By understanding these dynamics, policymakers can better design and implement monetary policies that promote economic stability and growth.

3.2. Estimation Technique

This paper adopted the nonlinear autoregressive distributed lag (NARDL) model as proposed by Shin et al. (2014) to study the asymmetric impacts of financial development and monetary policy on the monetary transmission mechanism. The nonlinear autoregressive distributed lag (NARDL) method is a highly suitable estimation technique for examining the asymmetric impacts of financial development and monetary policy on various monetary policy channels. The NARDL method was chosen for numerous reasons, which are rooted in its capacity to accurately capture the intricate dynamics that define these economic relationships. The NARDL method's capacity to capture asymmetric relationships is a primary reason for its adoption. These asymmetries may not be adequately represented by conventional linear models, as they presume uniform responses to changes in independent variables. Conversely, the NARDL method enables the estimation of positive and negative changes separately, thereby enabling a more nuanced comprehension of how economic variables react to increases and decreases in monetary policy interventions and financial development.

Another substantial advantage of the NARDL approach is its ability to model both short-term dynamics and long-term relationships within a single framework. The exhaustive capture of the diverse effects of monetary policy is essential, as they can evolve over a variety of time horizons. The NARDL method enables the simultaneous analysis of short- and long-term effects, providing a comprehensive understanding of the temporal dynamics of the monetary transmission mechanism. Additionally, the NARDL method is proficient in managing nonlinearities in economic relationships. A modelling approach that can incorporate the complexities of the relationships between financial development, monetary policy, and the monetary transmission mechanism is required due to the documented nonlinear effects. The NARDL model's capacity to incorporate nonlinear modifications guarantees a more precise and realistic depiction of these interactions, thereby resolving a lacuna that is frequently disregarded in existing linear studies. Lastly, the NARDL method's applicability is further enhanced by its resilience to the integration properties of variables.

The estimation process is frequently complicated by the varied orders of integration that economic data frequently exhibit. If the variables are not integrated of order two [I(2)], the NARDL method can be implemented, regardless of whether they are integrated of order zero [I(0)], order one [I(1)], or a combination of both. This adaptability facilitates the estimation process and improves the reliability of the results, particularly when dealing with intricate macroeconomic data.

In addition, the NARDL method offers invaluable insights from a policy perspective. To develop effective interventions, policymakers must possess a sophisticated comprehension of the interplay between monetary policy and financial development. The NARDL method's comprehensive examination of asymmetric and nonlinear effects provides practical advice for customizing monetary policies to unique economic conditions, thereby increasing their efficacy and averting the potential drawbacks of a one-size-fits-all approach. Finally, the NARDL method is empirically well supported in the literature, with a plethora of studies illustrating its efficacy in capturing asymmetries and nonlinearities in economic relationships. The NARDL method is a viable option for investigating the asymmetric effects of monetary policy and financial development, because it provides analysis with credibility and reliability.

Therefore, this paper starts by specifying the linear form of the model.

$$mtm_t = \theta_0 + \theta_1 mpr_t + \theta_2 fd_t + \theta_3 x_t + \mu_t \tag{1}$$

where *mtm* represents the monetary transmission mechanism, *fd* represents financial development, *mpr* represents the monetary policy rate, and x represents the control variables meant to capture other important factors that affect the regressand, aside from the main regressors stipulated in Equation (1). Following the works of Lacheheb and Sirag (2019) and Parvin (2022), this paper disaggregates Equation (1) into its nonlinear form.

$$mtm_t = \theta_0 + \theta_1 mpr_t^+ + \theta_2 mpr_t^- + \theta_3 fd_t^+ + \theta_4 fd_t^- + \theta_5 x_t + \mu_t \tag{2}$$

The positive changes are fd_t^+ and mpr_t^+, while the negative changes are fd_t^- and mpr_t^-. They both account for the nonlinear impacts of financial development and a central bank's policy. These are respecified in Equations (3)–(6):

$$mpr_t^+ = \sum_{i=1}^{k} \Delta mpr_t^+ = \sum_{i=1}^{k} \max(\Delta mpr_i, 0) \tag{3}$$

$$mpr_t^- = \sum_{i=1}^{k} \Delta mpr_t^- = \sum_{i=1}^{k} \min(\Delta mpr_i, 0) \tag{4}$$

$$fd_t^+ = \sum_{i=1}^{k} \Delta fd_t^+ = \sum_{i=1}^{k} \max(\Delta fd_i, 0) \tag{5}$$

$$fd_t^- = \sum_{i=1}^{k} \Delta fd_t^- = \sum_{i=1}^{k} \min(\Delta fd_i, 0) \tag{6}$$

To derive the error correction representation of Equation (2), therefore, we have the following:

$$\begin{aligned} \Delta mtm_t = {} & \beta_0 + \sum_{i=1}^{j} \lambda_i \Delta mtm_{t-i} + \sum_{i=0}^{k} \gamma_1^+ \Delta mpr_{t-i}^+ + \sum_{i=0}^{k} \gamma_2^- \Delta mpr_{t-i}^- + \sum_{i=0}^{k} \gamma_3^+ \Delta fd_{t-i}^+ + \sum_{i=0}^{k} \gamma_4^- \Delta fd_{t-i}^- \\ & + \sum_{i=0}^{k} \gamma_5 \Delta x_{t-i} + \beta_1 mtm_{t-1} + \beta_2 mpr_t^+ + \beta_3 mpr_t^- + \beta_4 fd_t^+ + \beta_5 fd_t^- + \beta_6 x_t + \varepsilon_t \end{aligned} \tag{7}$$

where j and k are the lag orders; $\theta_1 = \frac{\beta_2}{\beta_1}, \theta_2 = \frac{\beta_3}{\beta_1}, \theta_3 = \frac{\beta_4}{\beta_1}$, $\theta_4 = \frac{\beta_5}{\beta_1}$, and $\theta_5 = \frac{\beta_6}{\beta_1}$ are the long-run asymmetric effects, and $\sum_{i=1}^{k} \gamma_i$ are the short-run asymmetric effects.

3.3. Data Sources and Measurements

Annual data from 1986 to 2023 are used in this paper. The all-share index was used as a proxy for the asset price channel. The credit growth to the private sector was used as a proxy for the credit channel. The nominal exchange rate was used as a proxy for the exchange rate channel. The consumer price index was used as a proxy for the inflation expectations channel, while the average lending rate was used as a proxy for the interest rate channel. These five channels make up the monetary transmission mechanism channels in this study. In addition, financial system indicators, such as those for the banking industry, the stock market, the bond market, and the general financial system, were also used as proxies for the financial development indicators. Table 1 displays the information in greater detail.

Table 1. Summary of the variable measurements and data sources.

Variables	Measurement of Variables	Sources of Data
Monetary Transmission Mechanism (MTM) Indicators	Asset Price Channel (APC) = Growth Rate of All-Share Index Credit Channel (CC) = Growth Rate of Private Sector Credits Exchange Rate Channel (EXC) = Growth Rate of Nominal Exchange Rate Inflation Expectations Channel (IEC) = Growth Rate of the Consumer Price Index Interest Rate Channel (INT) = Average of Prime Lending Rate and Maximum Lending Rate	Central Bank of Nigeria (2023) (CBN) Bulletin
Financial Development (FD) Indicators	Financial Sector Development (FSD) = $\frac{\text{Broad Money Supply}}{GDP}$ Financial Depth by Activity (FDPA) = $\frac{\text{Private Sector Credit}}{GDP}$ Financial Depth by Size (FDPS) = $\frac{\text{Total Deposit Money Banks Asset}}{GDP}$ Financial Innovation (FIN) = $\frac{Debt\ Stock}{GDP}$ Financial Deepening by Size (FDES) = $\frac{Stock\ Market\ Capapitalization}{GDP}$ Financial Deepening by Activity (FDEA) = $\frac{Stock\ Market\ Value\ Traded}{GDP}$ Financial Efficiency (FEF) = $\frac{Stock\ Market\ Value\ Traded}{Stock\ Market\ Capitalization}$	Central Bank of Nigeria (2023) (CBN) Bulletin
Monetary Policy (MPR)	MPR = Monetary Policy Rate	CBN Bulletin (2023)
Liquidity Ratio (LR)	LR = Liquidity Ratio	CBN Bulletin (2023)
Loan-to-Deposit Ratio (LDR)	LDR = Loan-to-Deposit Ratio	CBN Bulletin (2023)
Savings Rate (SR)	SR = Savings Rate	CBN Bulletin (2023)

Source: author's compilation, 2024. Note: the measures of financial development were derived from the database of Beck et al. (1999, 2000).

3.4. Theoretical Expectations among the Variables

Table 2 summarizes the a priori expectations among the variables used to examine the impact of financial development and monetary policy on the monetary transmission mechanism.

Table 2. Summary of theoretical expectations among the variables.

Variables	APC	CC	EXC	IEC	INT
Financial Depth (Size)	-	+	+	-	-
Financial Depth (Activity)	-	+	+	-	-
Financial Sector Development	-	+	+	-	-
Financial Innovation	+	+	+	+	+
Financial Deepening (Size)	+	+	+	+	+
Financial Deepening (Activity)	+	+	+	+	+
Financial Efficiency	+	+	+	+	+
Monetary Policy	-	-	+	+	+

Source: author's compilation, 2024. Note: The '+' sign indicates a positive relationship while the '-' sign indicates a negative relationship between the variables.

4. Estimation Analysis and Results

4.1. Preliminary Analyses

This paper begins the analysis with a preliminary investigation of the descriptive features of the data. From Table 3, the mean and median values of the variables showed good consistency as their values are very close and lie within the maximum and minimum values. Financial deepening by activity showed the least variability at 0.93, while the exchange rate channel displayed the most variability at 58.87. The skewness statistic showed that all the variables were positively skewed except for the loan-to-deposit ratio, which was negatively skewed; the kurtoses of the asset price channel, credit channel, exchange rate channel, inflation expectations channel, interest rate channel, financial deepening by size, financial deepening by activity, financial efficiency, monetary policy rate, and liquidity ratio were greater than 3. This suggests that their distribution has higher peaks than the average. The kurtoses of the financial sector development, financial depth by size and activity, financial innovation, loan-to-deposit ratio, and savings rate were, however, all less skewed than the normal distribution.

Table 3. Descriptive characteristics of the variables.

	APC	**CC**	**EXC**	**IEC**	**INT**	**FSD**	**FDPS**	**FDPA**
Mean	22.55	26.39	25.51	19.44	21.08	16	24.32	12.09
Median	25.52	20.16	7.5	12.72	20.44	13.12	23.05	8.64
Maximum	130.94	127.55	323.53	72.84	30.5	24.9	40.32	22.75
Minimum	−45.77	−29.22	−5.77	5.39	11.25	8.46	11.23	5.81
Std. Dev.	35.29	28.81	58.87	17.57	3.54	5.46	7.69	5.63
Skewness	0.49	1.33	3.94	1.74	0.3	0.33	0.21	0.48
Kurtosis	3.82	6.04	19.66	4.7	4.3	1.45	2.14	1.48
Jarque–Bera	2.46	24.51	509.42	22.46	3.1	4.28	1.38	4.86
Probability	0.29	0.34	0.56	0.71	0.21	0.12	0.55	0.09
Sum	812	950	918	700	759	576	875	435
SSD	43,587	29,045	12,1296	10,811	438	1044	2067	1109
Observations	36	36	36	36	36	36	36	36
	FDES	**FDEA**	**FIN**	**FEF**	**MPR**	**LR**	**LTD**	**SR**
Mean	12.34	0.85	9.06	5.94	13.64	48.55	65.97	6.89
Median	10.84	0.6	8.56	5.48	13.5	46.09	66.06	4.14
Maximum	38.01	4.2	16.49	17.56	26	104.2	96.82	18.8
Minimum	3.09	0.04	3.1	1.02	6	26.39	37.56	1.41
Std. Dev.	8.5	0.93	3.4	3.62	3.76	14.99	13.52	5.31
Skewness	0.81	1.93	0.78	0.86	0.81	1.62	−0.05	0.94
Kurtosis	3.33	6.84	2.92	4.16	5.1	6.85	2.7	2.31
Jarque–Bera	4.14	44.49	3.67	6.48	10.52	37.98	0.15	5.97
Probability	0.13	0	0.16	0.04	0.01	0	0.93	0.05
Sum	444	31	326	214	491	1748	2375	248
SSD	2527	30	405	459	495	7869	6401	987
Observations	36	36	36	36	36	36	36	36

Source: author's compilation, 2024.

The Jarque–Bera normality test showed that the probability values of the asset price channel, interest rate channel, financial sector development, financial depth by size, financial depth by activity, financial deepening by size, financial innovation, loan-to-deposit ratio, savings rate, and others follow a normal distribution. As presented in Table 4, this paper determined the correlation analysis of each financial development indicator and the various transmission channels. As a result, we examined whether or not the independent and dependent variables were correlated, and our findings indicated that no such strong correlation existed.

Table 4. Correlation matrix of the variables.

	APC	CC	EXC	IEC	INT
FSD	−0.4007	−0.2954	−0.2169	−0.3357	0.0175
FDPS	−0.4247	−0.1484	−0.1825	−0.4737	−0.1402
FDPA	−0.4841	−0.2929	−0.2019	−0.3306	−0.0325
FDES	−0.1625	0.0346	−0.3178	−0.4394	−0.2240
FDEA	−0.2423	0.1645	−0.2709	−0.3883	−0.3105
FIN	0.0549	−0.1850	0.2421	0.1209	0.1320
FEF	−0.3585	0.0477	−0.1454	−0.3753	−0.4105
MPR	0.2391	0.1475	0.2207	0.3806	0.6168
LR	−0.0830	−0.1127	−0.0044	−0.2572	0.0427
LTD	−0.1058	0.1972	−0.0387	−0.0674	−0.3642
SR	0.4358	0.0717	0.1758	0.6405	0.3167

Source: author's computation, 2024.

For the estimation of the unit root analyses, we used the augmented Dickey–Fuller test (Dickey and Fuller 1981) and the Phillip–Perron test (Phillips and Perron 1988). Table 5 shows that all the monetary policy channels were stationary at the first differenced form. The liquidity ratio, loan-to-deposit rate, and monetary policy rate were all stationary in level form. However, variables such as the savings rate and all the indicators of financial development were I(1). These results lend credence to adopting Shin et al.'s (2014) proposed asymmetric ARDL framework.

Table 5. Unit root tests.

Variable	Test	Levels		First Difference		Status
		T-Stats	*p* Value	T-Stats	*p* Value	
APC	ADF	−1.0345	(0.8531)	−4.2579	(0.0020) ***	I(1)
	PP	−1.0396	(0.8545)	−4.7403	(0.0005) ***	I(1)
CC	ADF	−1.0459	(0.7651)	−5.4409	(0.0001) ***	I(1)
	PP	−1.4109	(0.9651)	−5.4409	(0.0001) ***	I(1)
EXC	ADF	−1.0945	(0.5673)	−5.8309	(0.0000) ***	I(1)
	PP	−1.0679	(0.9874)	−5.8644	(0.0000) ***	I(1)
IEC	ADF	−0.9838	(0.7170)	−3.4238	(0.0170) ***	I(1)
	PP	−0.9059	(0.8864)	−7.1216	(0.0000) ***	I(1)
INT	ADF	−1.0234	(0.8965)	−5.9836	(0.0000) ***	I(1)
	PP	−1.3261	(0.6575)	−5.8795	(0.0000) ***	I(1)
MPR	ADF	−3.2488	(0.0254) **			I(0)
	PP	−3.3115	(0.0219) **			I(0)
FSD	ADF	−0.7732	(0.8143)	−5.3894	(0.0001) ***	I(1)
	PP	−0.5846	(0.8615)	−5.6467	(0.0000) ***	I(1)
FDPA	ADF	−0.7592	(0.8174)	−5.4099	(0.0001) ***	I(1)
	PP	−0.9273	(0.7675)	−6.0887	(0.0000) ***	I(1)
FDPS	ADF	−1.6934	(0.4255)	−4.0064	(0.0039) ***	I(1)
	PP	−0.8927	(0.7787)	−3.7814	(0.0070) ***	I(1)
FDEA	ADF	−2.3928	(0.1510)	−6.3114	(0.0000) ***	I(1)
	PP	−2.3002	(0.1775)	−10.049	(0.0000) ***	I(1)
FDES	ADF	−1.6866	(0.4290)	−6.6117	(0.0000) ***	I(1)
	PP	−1.4929	(0.5254)	−9.5341	(0.0000) ***	I(1)
FIN	ADF	−2.2189	(0.2035)	−5.2675	(0.0001) ***	I(1)
	PP	−2.1689	(0.2206)	−5.3354	(0.0001) ***	I(1)

Table 5. *Cont.*

Variable	Test	Levels		First Difference		Status
		T-Stats	*p* Value	T-Stats	*p* Value	
FEF	ADF	−2.5198	(0.1196)	−7.9572	(0.0000) ***	I(1)
	PP	−2.5198	(0.1196)	−11.129	(0.0000) ***	I(1)
LR	ADF	−3.2143	(0.0275) **			I(0)
	PP	−3.2143	(0.0275) **			I(0)
LTD	ADF	−5.3305	(0.0001) ***			I(0)
	PP	−3.0096	(0.0437) **			I(0)
SR	ADF	−0.8413	(0.7946)	−6.6165	(0.0000) ***	I(1)
	PP	−0.9513	(0.7595)	−6.6008	(0.0000) ***	I(1)

Source: author's computation, 2024. *** and ** represent significance at 1 and 5 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

4.2. Main Analyses

4.2.1. The Asymmetric Impacts of Development in the Broad Financial Sector on the Monetary Transmission Mechanism

This paper's first main analyses focus on the asymmetric effects of Nigeria's broad financial sector indicator (FSD) and monetary policy rate (MPR) on the country's monetary transmission mechanism. Table 6 shows that in the short run, negative changes in financial sector development will improve the asset price channel by 12.7 percent. Therefore, a drop in banking-related financial sector development should boost the value of companies' shares on the national stock exchange, while a rise in banking-related financial development would reduce the value of companies' shares by 3 percent. Furthermore, positive and negative shifts in monetary policy have impacts on movements in the asset price channel in Nigeria. Positive shifts in monetary policy reduce the asset price channel by 1.9 percent, while negative shifts increase asset prices by 1.2 percent. In the long term, a positive shift in financial sector development reduces the share price of firms, while a negative shift in financial sector development will increase the share price of listed firms on the nation's stock exchange. This outcome follows a priori expectations since activities within the capital market are affected by the interest rates on risk-free investments. If interest rates are high due to reduced money supply, then investors will prefer to withdraw their investments from the capital market and invest in risk-free assets at a higher interest rate, while, when rates are low, they will go for risky investments within the capital market. In addition, a reduction in the monetary policy rate positively affects the asset price channel in the long run for Nigeria and vice versa for a rise in the monetary policy rate. That is, a negative monetary policy change raises the share price on the nation's stock exchange by 9.7 percent, while a rise in the monetary policy reduces share prices by 2.2 percent.

Furthermore, the findings demonstrated that the credit channel responds to the short-term effects of both positive and negative shifts in financial sector development. That is, positive changes in financial sector development would improve credit creation by 4.9 percent, while negative changes in financial sector development would reduce credit creation by 0.55 percent. This channel also benefits from positive and negative shifts in monetary policy. To put it another way, if the central bank were to positively change its monetary policy, commercial banks would be forced to increase its lending rates, leading to a fall in credit creation as investors may find a rise in interest rates too costly, even though commercial banks have more incentive to increase their lending to the private sector through the credit channel. However, negative monetary policy changes reduce the interest rate on loans that commercial banks create, leading to a rise in the credit created and in the credit channel in the short run. In the long run, a positive change in financial sector development will positively impact the credit channel. This is because financial sector developments come with alternative means of accessing credit for businesses, thereby affecting the amount of credit that businesses take from mainstream banking activities, since they can raise capital from other markets such as the bond market, the capital market,

or other short- or long-term securities. Furthermore, the long-term results confirm the short-term findings because of the negative impact of monetary policy on the credit channel. A negative shift in monetary policy would thus prompt financial institutions to expand their lending to the private sector via the credit channel, resulting in higher short-term profits and longer-term returns.

Table 6. Asymmetric impacts of financial sector development on monetary transmission.

	APC	**CC**	**EXC**	**IEC**	**INT**
Short-Run Results					
D(FSD_POS)	−3.0876 (0.0351) **	4.9038 (0.0449) **	1.1827 (0.7526)	−0.4356 (0.0557) *	−0.4589 (0.0132) **
D(FSD_NEG)	12.7136 (0.0711) *	−0.5509 (0.0899) *	4.4216 (0.6777)	2.2874 (0.0549) *	0.1074 (0.0855) *
D(MPR_POS)	−1.9086 (0.0367) **	−3.1870 (0.0187) **	7.9996 (0.1248)	0.9956 (0.0472) **	0.6288 (0.0035) ***
D(MPR_NEG)	1.1508 (0.0567) *	0.1520 (0.0452) **	−2.2471 (0.7093)	−2.3543 (0.0125) **	−0.6143 (0.0156) **
D(LR)	−0.2619 (0.4711)	−0.7309 (0.0473) **	0.9108 (0.2695)	0.1755 (0.3623)	−0.0211 (0.5120)
D(LTD)	−1.2491 (0.0015) ***	0.3567 (0.3646)	−1.3228 (0.2139)	0.0397 (0.8529)	−0.0629 (0.1478)
D(SR)	11.7854 (0.0011) ***	−4.5726 (0.1847)	−5.2941 (0.3017)	3.4170 (0.0886) *	0.2536 (0.2857)
CointEq(-1)	−0.3221 (0.0000) ***	−0.2785 (0.0000) ***	−0.1974 (0.0000) ***	−0.0708 (0.0002) ***	−0.4083 (0.0000) ***
Bound Test Results	10.1797	8.3163	5.862075	4.2230	9.323850
Long-Run Results					
FSD_POS	−6.0094 (0.0001) ***	2.4502 (0.0081) ***	0.9877 (0.7517)	−0.4068 (0.0169) **	0.1996 (0.0102) **
FSD_NEG	9.6166 (0.0872) *	−0.4309 (0.0089) ***	3.6927 (0.6727)	6.6755 (0.0457) **	0.0762 (0.0486) **
MPR_POS	−2.2098 (0.0174) **	−2.4927 (0.0107) **	0.2296 (0.9602)	0.8922 (0.0427) **	0.7712 (0.0000) ***
MPR_NEG	9.7353 (0.0012) ***	0.1189 (0.0459) **	1.8767 (0.7111)	−5.0155 (0.0057) ***	−0.7518 (0.0014) ***
LR	0.6907 (0.0343) **	0.0152 (0.9570)	0.7606 (0.2535)	0.1639 (0.3658)	−0.0410 (0.1022)
LTD	−0.9448 (0.0019) ***	0.2790 (0.3500)	0.1780 (0.8250)	−0.2673 (0.1807)	0.0306 (0.2943)
SR	11.2595 (0.0000) ***	1.3012 (0.4740)	−4.4213 (0.3030)	4.8592 (0.0015) ***	0.1801 (0.2608)
C	−94.3896 (0.0066) ***	−34.7489 (0.3240)	58.6571 (0.5489)	−13.5145 (0.6211)	15.0409 (0.0001) ***
Wald Test	0.0070	0.0045	0.0373	0.0060	0.0045
Normality	0.1689	0.6913	0.0510	0.2078	0.0570
Serial Correlation	0.6476	0.2443	0.7755	0.0643	0.2720
Heteroscedasticity	0.2664	0.8457	0.9355	0.5914	0.7548

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

The exchange rate channel illustrates that positive and negative financial sector development changes, as well as positive or negative monetary policy changes, do not have a short-term relevance on the exchange rate channel. The long-run results also corroborate the short-run results, which state that these indicators do not impact the exchange rate channel in Nigeria.

The inflation expectations channel demonstrates that negative and positive financial sector development changes, as well as negative and positive monetary policy changes, do impact inflation expectations for Nigeria in the short run. In line with the a priori expectations, a positive change in financial sector development reduces inflation expectations, since these advancements will provide efficient ways of understanding inflation expectation dynamics and vice versa for negative changes. In the long run, however, negative financial sector developments positively and significantly predict inflation expectations by 6.7 percent, while positive developments reduce inflation expectations by 0.41 percent. Furthermore, negative monetary policy changes reduce inflation expectations by 5 percent, while positive monetary policy changes increase inflation expectations by 0.89 percent. Since inflation and interest rates move in the same direction, this result is consistent with the a priori expectations, especially in an inflation-targeting economy like Nigeria, where the policy rate is the central monetary policy tool used by the central bank to determine the level of inflation.

The interest rate channel would be unaffected by either a positive or negative impact of financial sector development in the short run. The transmission of monetary policy through the interest rate channel is strengthened by both positive and negative monetary policy changes. This means that Nigerian banks will raise lending rates in response to changes in monetary policy, whether these changes are an easing or tightening, in an effort to increase profits and capitalize on the policy change. The long-term findings are consistent with the short-term findings, demonstrating that shifts in financial sector development do not affect the interest rate channel of monetary policy. The lending rate that banks charge customers will rise in response to shifts in monetary policy, whether those shifts involve loosening or tightening.

Finally, the asymmetries were analyzed using the Wald test. To put it another way, if the positive and negative asymmetries for financial sector development as a whole are equal, then we have a linear model, and, if they are different, then we have an asymmetric or nonlinear model. The null hypothesis that the positive and negative asymmetries for financial sector development are equal is rejected by the Wald tests for all five channels. The cointegration equation, also known as the error correction term, had a negative coefficient and was statistically significant at a level of 5 percent. This implies that short-term errors can be corrected in the long term. In addition, the bound test revealed that there is a long-run relationship among the variables, thereby implying cointegration among the estimated models. Finally, the results of the normality, serial correlation, and heteroscedasticity tests demonstrated that the models are accurate and trustworthy.

4.2.2. The Asymmetric Impacts of Financial Depth by Size on the Monetary Transmission Mechanism

From Table 7, the results demonstrate that an increase in financial depth by size would reduce the share prices of the asset price channel. That is, a percentage increase in financial depth by size would reduce share prices by 3.6 percent in the short term. This outcome is plausible, since an increase in bank size increases the levels of financial intermediation in an economy, thereby allowing capital market firms to seek alternative ways of raising funds from the banking system, rather than issuing equity or other debt instruments at the capital market. On the other hand, negative changes in financial depth by size would increase share prices by roughly 4 percent in the short term. Furthermore, negative (3.9 percent) and positive (-0.66 percent) changes in the policy rate affect growth in the share prices on the asset price channel. This short-run result was also corroborated by the long-run results, which showed that a positive increase in financial depth by size would reduce the share

price by roughly 3.94 percent, while negative changes raise it by 3.4 percent. Furthermore, the long-run results of monetary policy changes were in line with the short-run findings.

Table 7. Asymmetric impacts of financial depth by size on monetary transmission.

	APC	CC	EXC	IEC	INT
Short-Run Results					
D(FDPS_POS)	−3.6458 (0.0018) ***	5.0224 (0.0223) **	0.0426 (0.9856)	−2.7479 (0.0061) ***	−0.2723 (0.0159) **
D(FDPS_NEG)	4.0247 (0.0145) **	5.7617 (0.0442) **	−0.0941 (0.9827)	0.1135 (0.0953) *	0.1260 (0.0590) *
D(MPR_POS)	−0.65748 (0.0725) *	−0.4792 (0.0822) *	8.1413 (0.1258)	1.9630 (0.0101) **	0.7021 (0.0020) ***
D(MPR_NEG)	3.8669 (0.0113) **	2.9377 (0.0289) **	2.3654 (0.7144)	−2.6758 (0.0113) **	−0.5129 (0.0465) **
D(LR)	−0.5597 (0.1879)	−0.5108 (0.1561)	0.8296 (0.3083)	0.0043 (0.9815)	−0.0223 (0.4675)
D(LTD)	−1.2432 (0.0104) **	0.3769 (0.4069)	−1.2881 (0.2487)	0.0878 (0.7005)	−0.0652 (0.1621)
D(SR)	10.5483 (0.0009) ***	−4.3036 (0.1723)	−4.7749 (0.3342)	4.0498 (0.0391) **	0.3238 (0.1763)
CointEq(-1)	−0.1996 (0.0000) ***	−0.3308 (0.0000) ***	−0.1749 (0.0000) ***	−0.1535 (0.0001) ***	−0.4195 (0.0000) ***
Bound Test Results	8.1034	6.577522	6.3056	5.0069	7.431884
Long-Run Results					
FDPS_POS	−3.0393 (0.0015) ***	0.2714 (0.0327)**	−0.0362 (0.9856)	−0.5494 (0.0315) **	−0.0743 (0.0287) **
FDPS_NEG	3.3552 (0.0138) **	4.3294 (0.0389)**	−0.0801 (0.9827)	1.9452 (0.0115) **	0.0888 (0.0159) **
MPR_POS	−0.5481 (0.0270) **	−2.8651 (0.0378) **	−0.4151 (0.9270)	1.1816 (0.0249) **	0.7340 (0.0000) ***
MPR_NEG	9.0983 (0.0044) ***	1.9487 (0.0437) **	2.0133 (0.7154)	−4.4063 (0.0083) ***	−0.7517 (0.0024) ***
LR	0.6485 (0.0691) *	−0.3838 (0.1394)	0.7061 (0.2942)	0.2058 (0.2827)	−0.0157 (0.4699)
LTD	−1.0364 (0.0127) **	−0.3058 (0.4037)	0.1212 (0.8882)	−0.2652 (0.2160)	0.0365 (0.2708)
SR	8.7935 (0.0007) ***	2.4562 (0.2004)	−4.0642 (0.3391)	4.9119 (0.0002) ***	0.2281 (0.1527)
C	−45.2984 (0.2341)	21.3016 (0.5323)	54.3517 (0.5762)	−22.9585 (0.2857)	12.4426 (0.0003) ***
Wald Test	0.0097	0.0084	0.0098	0.0042	0.0066
Normality	0.4404	0.3561	0.0535	0.9643	0.0837
Serial Correlation	0.9674	0.0640	0.6970	0.1842	0.1100
Heteroscedasticity	0.9940	0.9169	0.9407	0.8409	0.6677

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

Both positive and negative shifts in financial depth by size have a short-term positive effect on the credit channel, increasing it by 5 percent and 5.8 percent, respectively. This finding has important policy implications, because it suggests that upward or downward shifts in the size of commercial banks improve the effectiveness of the credit channel of monetary policy. In the long run, both positive and negative financial development changes

affect the credit channel by 8.3 percent each. Therefore, the size of commercial banks has a lot of impact on the credit-creating abilities of these banks in the long run. As expected from the findings of Section 4.2.1, the credit channel benefits from the reduction in the central bank's monetary policy. To put it another way, if the monetary authorities were to negatively change their monetary policy, commercial banks would have more incentive to increase their lending to the private sector through the credit channel, resulting in higher revenues and profits. This study's findings corroborate those of others, including those by Levine et al. (2000), Da Silva (2002), Nourzad (2002), Beck et al. (2008), Lerskullawat (2018a, 2018b), Oyadeyi (2024b), and Oyadeyi et al. (2024). That is, increased bank size, bank depth, and degree of financial intermediation will improve market liquidity, portfolio diversification, and access to external funding as a result of an improved banking sector.

The results of financial depth by size on the exchange rate channel illustrate that negative and positive changes resulting from the sizes of commercial banks and negative or positive monetary policy changes do not seem to have any relevance on the exchange rate channel of monetary policy both in the immediate and the long term.

For the inflation expectations channel, the results suggest that positive changes to financial depth by size would decrease the level of inflation expectations in the economy by 2.7 percent in the short term. This implies that an increase in the size of commercial banks fosters a more efficient and sound financial system, since this increase provides a way of reducing inflation in an economy. On the other hand, negative financial depth changes would raise inflation expectations in the near term. This means that the less efficient the financial sector is, the less people will rely on it to predict future inflation expectations. In the long run, positive and negative changes in financial depth by size have the same effect on inflation expectations in line with the short-run findings in Nigeria. In addition, positive and negative monetary policy changes also have the same long-run effects as in the short run.

Adjustments in financial depth by size, both positive and negative, have significant effects on the interest rate channel in the short run. That is, a rise in financial depth by size would reduce interest rates by 0.27 percent, while a fall in financial depth by size would raise interest rates by 1.3 percent, vis-à-vis the interest rate channel. In addition, both expansionary and contractionary shifts in monetary policy have beneficial effects on the interest rate transmission mechanism. This means that a 0.7 percentage point increase in the lending rate would result from a positive adjustment in the monetary policy rate, while a 0.5 percentage point reduction in the lending interest rate would result from a negative adjustment of the monetary policy rate. The long-run estimates are also in line with the short-run results, showing that financial depth by size has the same effect on the interest rate channel of monetary policy, but to a higher degree compared to the short-run results. These findings align with those of Singh et al. (2008) for high-income nations and Lerskullawat (2018a, 2018b) for Thailand.

Finally, asymmetries were analyzed using the Wald test. In the absence of evidence to the contrary, a linear model assumes that the positive and negative asymmetries for financial depth by size are equal (the "null hypothesis"). The presence of asymmetries is confirmed by Wald tests for the five channels of monetary policy since the results reject the null hypothesis of a linear model. The cointegration equation, also known as the error correction term, had a negative coefficient and was statistically significant at a level of 5 percent. This implies that short-term errors can be corrected in the long term. In addition, the bound test revealed that there is a long-run relationship among the variables, thereby implying cointegration among the estimated models. Finally, the results of the normality, serial correlation, and heteroscedasticity tests demonstrated that the models are accurate and trustworthy. For the financial depth by activity, the results were in line with the outcomes of the estimates in Table 7. This implies that financial depth by size and financial depth by activity have the same effects on the five monetary policy channels. These results are presented in Appendix A, Table A1.

4.2.3. The Asymmetric Impacts of Financial Deepening by Size on the Monetary Transmission Mechanism

Table 8 presents the results of the asymmetric impacts of financial deepening by size on monetary transmission. The results of the asset price channel showed that positive changes in financial deepening had positive effects on share prices on the nation's bourse by 2.6 percent, while negative changes in financial deepening had negative effects on share prices on the nation's bourse by −0.6 percent. In addition, a rise in the monetary policy rate reduces share prices by −3.4 percent, while a fall in the monetary policy rate increases share prices by 0.7 percent. The long-run results were in line with the short- term findings.

For the credit channel, a positive increase in financial deepening by size would increase the credit channel by roughly 2.1 percent in the short run, while a reduction in financial deepening activities will cause the credit channel activities to fall by 0.2 percent. Positive monetary policy changes, on the other hand, reduce the credit creation abilities of the credit channel by 3.4 percent, while a fall in monetary policy strengthens the credit channel by 2.8 percent. In the long run, the signs of the positive and negative changes in financial deepening and monetary policy are in line with their short-run results. Consistent with the theoretical expectations, the findings suggest that the growth in the size of the capital market implies greater financial deepening. As a result, banks are better able to diversify their funding sources, leading to greater bank loans and a reduction in the impact of policy interest rates transmitted through the bank credit channel.

The exchange rate channel showed that changes in financial deepening by size and the monetary policy rate, irrespective of the direction, do not have any relevance on the exchange rate channel both in the short run and the long run.

On the other hand, the results of the inflation expectations channel showed that positive changes in financial deepening by size would increase inflation expectations by roughly 1 percent in the short run. However, negative changes in financial deepening by size will reduce inflation expectations by roughly 2.2 percent in the short run. Furthermore, a positive monetary policy change will increase inflation expectations, while a negative monetary policy change will decrease inflation expectations in line with the theoretical underpinnings. In the long run, the positive changes in financial deepening by size would increase inflation expectations, in line with the short-run results, while the negative financial deepening changes would decrease inflation expectations. This implies improved financial deepening, which implies an expansion in alternative sources of funding for loan seekers, thereby increasing inflation expectations. Finally, the results of the monetary policy changes were also in line with the short-run results.

The interest rate channel findings showed that negative changes in the size measure of financial deepening negatively affect the interest rate channel by 0.2 percent in the short run, while positive changes in the size measure of financial deepening have a significant effect of 0.14 percent on the channel. On the other hand, positive changes in the policy rate strengthen the interest rate pass-through by 0.57 percent in the short run, while negative changes in the policy rate affect the interest rate pass-through in the short run by 0.31 percent. In the long run, the signs of negative and positive changes in financial deepening, as well as monetary policy, were in line with the short-run results. That is, a positive monetary policy change would strengthen the interest rate channel by 0.70 percent, while a negative policy rate change would also strengthen the interest rate pass-through by 0.52 percent. The findings are in line with the theoretical exposition. Consequently, a decrease in financial deepening by size is indicative of a lesser level of financial disintermediation, especially as it relates to the advancement of trading and investments from financial market instruments. As a result, the investors and depositors who save their funds have a lesser range of investment options, thereby reducing the elasticity of demand for deposits and loans and weakening the interest rate channel. This outcome corroborates previous findings (Mojon 2000; Sander and Kleimeier 2006; Gropp et al. 2007; Singh et al. 2008; Lerskullawat 2018a).

Table 8. Asymmetric impacts of financial deepening by size on monetary transmission.

	APC	CC	EXC	IEC	INT
			Short-Run Results		
D(FDES_POS)	2.6437 (0.0167) **	2.1160 (0.0417) **	−1.5623 (0.4742)	0.9031 (0.0880) *	0.1373 (0.0119) **
D(FDES_NEG)	−0.6246 (0.0824) *	−0.2117 (0.0919) *	−2.2751 (0.3662)	−2.1537 (0.0060) ***	−0.2050 (0.0363) **
D(MPR_POS)	−3.3731 (0.0109) **	−3.3971 (0.0304) **	7.6967 (0.1234)	1.3639 (0.0141) **	0.5681 (0.0094) ***
D(MPR_NEG)	0.6955 (0.0807) *	2.7585 (0.0143) **	2.2780 (0.7100)	−2.9695 (0.0001) ***	−0.3145 (0.0195) **
D(LR)	−0.3970 (0.2513)	−0.3951 (0.2340)	0.8143 (0.3028)	0.3734 (0.0046) ***	−0.0323 (0.2665)
D(LTD)	−0.5355 (0.1995)	0.4749 (0.2514)	−1.1872 (0.2515)	−0.0193 (0.8019)	−0.0914 (0.0439) **
D(SR)	8.6591 (0.0108) **	−7.4880 (0.0136) **	−5.6974 (0.2944)	−3.4760 (0.0000) ***	0.7603 (0.0124) **
CointEq(-1)	−0.3077 (0.0000) ***	−0.2942 (0.0000) ***	−0.1848 (0.0000) ***	−0.0681 (0.0000) ***	−0.3905 (0.0000) ***
Bound Test Results	13.2221	9.0526	6.0462	23.3441	7.1523
			Long-Run Results		
FDES_POS	1.6267 (0.0337) **	1.6350 (0.0585) *	−1.3186 (0.4729)	1.7129 (0.0092) ***	0.0987 (0.0123) **
FDES_NEG	−0.4776 (0.0210) **	−2.8666 (0.0042) ***	−1.9203 (0.3675)	−2.0163 (0.0080) ***	−0.1475 (0.0461) **
MPR_POS	−0.3922 (0.0827) *	−2.6249 (0.0366) **	−0.6839 (0.8756)	1.2769 (0.0278) **	0.6981 (0.0001) ***
MPR_NEG	5.1502 (0.0404) **	2.1314 (0.0161) **	1.9227 (0.7111)	−0.9360 (0.0289) **	0.5240 (0.0124) **
LR	0.1792 (0.5689)	−0.0026 (0.9922)	0.6873 (0.2915)	−0.2278 (0.0176) **	−0.0233 (0.2777)
LTD	−1.0724 (0.0015) ***	0.0141 (0.9603)	0.3102 (0.7068)	−0.0180 (0.8015)	0.0157 (0.5762)
SR	9.3821 (0.0001) ***	0.7622 (0.6220)	−4.8088 (0.2983)	2.7650 (0.0031) ***	0.3012 (0.0957) *
C	−41.4971 (0.3183)	−4.0255 (0.9079)	58.0264 (0.5660)	−14.3910 (0.2765)	13.1375 (0.0006) ***
Wald Test	0.0010	0.0259	0.0310	0.0105	0.0295
Normality	0.5933	0.2244	0.0581	0.3773	0.1733
Serial Correlation	0.5793	0.1005	0.6234	0.4100	0.1145
Heteroscedasticity	0.3089	0.6402	0.9337	0.3228	0.7696

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

The asymmetries were analyzed using the Wald test. The Wald test results revealed that nonlinearities exist in the relationship between financial deepening by size and the monetary transmission channels. The cointegration equation, also known as the error correction term, had a negative coefficient and was statistically significant at a level of 5 percent. This implies that the short-term errors can be corrected in the long term. In addition, the bound test revealed that there is a long-run relationship among the variables, thereby implying cointegration among the estimated models. Finally, the results of normality, serial

correlation, and heteroscedasticity tests demonstrated that the models are accurate and trustworthy. Finally, this paper also examined the effects of financial deepening by their activities and found that the results of financial deepening by activities were in line with the results of financial deepening by size, thereby proving that asymmetric changes in capital market developments by size and activities have the same effect on the monetary transmission mechanism both in the short and long run in Nigeria. This result of the effect of financial deepening by activity is presented in Appendix A, Table A2.

4.2.4. The Asymmetric Impacts of Financial Efficiency on the Monetary Transmission Mechanism

Table 9 presents the results of the asymmetric impacts of financial efficiency on the transmission of monetary policy. The results of the asset price channel showed that a positive change in financial efficiency would raise share prices of the asset price channel by roughly 4.4 percent, while a negative change in financial efficiency would reduce share prices by 7.3 percent in the short run. That is, a positive increase in financial efficiency due in part to capital market efficiency would increase share prices, while negative changes would reduce share prices on the nation's bourse. Positive monetary policy changes, on the other hand, have negative short-run impacts on share prices when capital market efficiency is considered, while negative monetary policy impacts share prices positively by 4.9 percent. This result is in line with the theoretical expectations, because a hike in interest rates would make investors take their funds to safe haven investments such as bonds and treasuries, since the capital market is more volatile and returns on investments are guaranteed in safe havens. The significant results of financial efficiency and monetary policy and their expected signs were also replicated in the long-run results, as presented in Table 9. The implication of the asymmetric impacts of financial efficiency within the capital market is that capital market efficiency increases the amount of investments that capital market operators raise internally, thereby allowing capital market firms to provide alternative ways of providing funds for investments.

For the credit channel, a positive change in financial efficiency vis-à-vis the capital market would improve the credit channel by roughly 4.6 percent in the short run. On the other hand, a decrease in financial efficiency would reduce credit activities by roughly 6.2 percent in the short run. However, a positive monetary policy change would reduce the credit channel by 4.5 percent, due to the impact of financial market efficiency, and a negative policy change increases credit channel activities by 0.79 percent. The significant effects of financial efficiency and monetary policy changes on the credit channel were also found to exist in the long run. Consistent with the theoretical expectations, the findings suggest that capital market efficiency leads to a rise in financial deepening. As a result, banks are better able to diversify their funding sources, leading to greater bank loans and a reduction in the impact of policy interest rates transmitted through the bank credit channel. For the exchange rate channel, it was demonstrated that shifts in financial efficiency and the monetary policy rate, in either direction, have no significant bearing on the exchange rate channel.

The results of the inflation expectations channel showed that upward and downward shifts in financial efficiency and monetary policy have significant impacts on inflation expectations in the short run and long run, in line with the a priori expectations. Positive shifts in financial efficiency and monetary policy have significant positive effects on inflation expectations, while negative shifts in financial efficiency and monetary policy have significant negative effects on inflation expectations in the short and long run. The results of the interest rate channel were in line with the inflation expectations channel both in the short and long run. This implies that positive shifts in financial efficiency and monetary policy have significant positive effects on the interest rate channel, while negative shifts in financial efficiency and monetary policy have significant negative effects on the interest rate channel in the short and long run.

Table 9. Asymmetric impacts of financial efficiency on the monetary transmission mechanism.

	APC	CC	EXC	IEC	INT
			Short-Run Results		
D(FEF_POS)	4.3961 (0.0112) **	4.5970 (0.0452) **	−3.7382 (0.3881)	0.7516 (0.0284) **	0.2709 (0.0159) **
D(FEF_NEG)	−7.2893 (0.0395) **	−6.2463 (0.0246) **	−6.3349 (0.1175)	−0.6387 (0.0189) **	−0.1338 (0.0472) **
D(MPR_POS)	−2.4750 (0.0224) **	−4.5417 (0.0095) ***	7.0991 (0.1754)	0.6332 (0.0254) **	0.5395 (0.0101) **
D(MPR_NEG)	0.0181 (0.0992) *	0.7875 (0.0357) **	−0.4623 (0.9386)	−2.3840 (0.0015) ***	−0.5762 (0.0162) **
D(LR)	−0.6762 (0.0667) *	−0.6391 (0.0714) *	0.4563 (0.5645)	−0.0672 (0.4455)	−0.0187 (0.5381)
D(LTD)	−0.3276 (0.4225)	0.5866 (0.1232)	−0.9388 (0.3486)	0.0174 (0.8634)	−0.0976 (0.0208) **
D(SR)	12.7878 (0.0001) ***	−6.0324 (0.0531) *	−4.1898 (0.5600)	−3.2894 (0.0005) ***	0.4562 (0.0582) *
CointEq(-1)	−0.4097 (0.0000) ***	−0.3940 (0.0000) ***	−0.2653 (0.0000) ***	−0.1293 (0.0000) ***	−0.4994 (0.0000) ***
Bound Test Results	6.6424	7.6034	5.8322	17.8995	8.1558
			Long-Run Results		
FEF_POS	3.1184 (0.0159) **	3.6065 (0.0139) **	−2.9544 (0.3920)	0.6656 (0.0315) **	0.2008 (0.0179) **
FEF_NEG	−1.1249 (0.0268) **	−0.9426 (0.0173) **	−5.0067 (0.1230)	−0.5655 (0.0196)	−0.0892 (0.0475) **
MPR_POS	−0.7319 (0.0297) **	−3.2580 (0.0102) **	−0.5919 (0.8834)	0.5607 (0.0234) **	0.7311 (0.0000) ***
MPR_NEG	4.8794 (0.0099) ***	0.5649 (0.0465) **	5.8459 (0.2194)	−0.0716 (0.0198) **	−0.6543 (0.0002) ***
LR	0.3460 (0.2218)	0.1264 (0.6320)	0.3606 (0.5600)	−0.1630 (0.0764) *	−0.0402 (0.0807) *
LTD	−0.7432 (0.0152) **	0.4208 (0.1013)	0.4861 (0.5324)	−0.1231 (0.1736)	−0.0004 (0.9860)
SR	9.0712 (0.0000) ***	0.9142 (0.6034)	−12.0393 (0.0339) **	3.2421 (0.0010) ***	0.3043 (0.0475) **
C	−50.7891 (0.1288)	−55.2904 (0.0877) *	150.0782 (0.1323)	−9.3429 (0.5074)	15.4665 (0.0000) ***
Wald Test	0.0008	0.0459	0.0359	0.0202	0.0147
Normality	0.3886	0.2766	0.0592	0.7845	0.0535
Serial Correlation	0.5719	0.4337	0.1279	0.5314	0.0807
Heteroscedasticity	0.6333	0.9747	0.3299	0.5444	0.9076

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

Finally, the asymmetries were analyzed using the Wald test, and the results revealed that asymmetries exist in the relationship between financial efficiency and the monetary transmission mechanism in Nigeria. The cointegration equation, also known as the error correction term, had a negative coefficient and was statistically significant at a level of 5 percent. This implies that short-term errors can be corrected in the long term. In addition, the bound test revealed that there is a long-run relationship among the variables, thereby implying cointegration among the estimated models. Finally, the results of the normality,

serial correlation, and heteroscedasticity tests demonstrated that the models are accurate and trustworthy.

4.2.5. The Asymmetric Impacts of Financial Innovation on the Monetary Transmission Mechanism

Table 10 examines the impact of financial innovation on the monetary transmission process in Nigeria. The results of the asset price channel showed that a rise in financial innovation as well as bond market development would raise the share prices on the nation's bourse by roughly 6.1 percent, while a fall in financial innovation would reduce share prices by 4.5 percent. On the other hand, positive monetary policy changes would reduce share prices by 0.6 percent, while negative monetary policy changes would raise share prices by 1.8 percent in the short run. The long-run results were in line with the short-run outcomes. This outcome is in line with the theoretical expectation as a rise in the advancements of the equity and bond sectors raises the level of financial innovation and foster more opportunities for capital market firms to invest in new financial instruments. These results also point towards a rise in liquidity within the financial markets and capital and an increase in assets for diversification and hedging.

The credit channel findings showed that both negative and positive changes in the bond market (financial innovation) and monetary policy have significant effects on the amount of credit provided to the private sector in the short run. That is, a positive shift in financial innovation and monetary policy will lead to a rise in the credit creation abilities of banks in Nigeria, while a negative shift in financial innovation and monetary policy will lead to a downward shift in the credit creation abilities of banks both in the long and short run. This outcome follows the a priori expectations, since a lower interest rate environment encourages firms to borrow more for investment and productive purposes. By implication, improvements in the bond markets mean more opportunities to provide credit to the private sector, thereby strengthening the credit channel over the short and long term.

For the exchange rate channel, the findings revealed that positive and negative changes in financial innovation and monetary policies do not affect the exchange rate channel of monetary policy in Nigeria.

For the inflation expectations channel, a positive change in financial innovation brought about by positive developments within the bond market will increase inflation expectations by roughly 3.3 percent, while negative changes in financial innovation brought about by negative developments within the bond market will reduce inflation expectations by roughly 7.6 percent in the short run. Positive changes in the policies of the central bank improve inflation expectations by roughly 0.01 percent, while negative changes in the policy rate reduce inflation expectations by roughly 1.58 percent. This outcome aligns with the theoretical expectation as the increase in the development of the bond markets will raise the level of financial innovation and increase opportunities for capital market firms to invest in new financial instruments and increase financial market liquidity, thereby raising inflation expectations. The long-run results agree with the short-run findings, with the result that financial innovation and monetary policy have the same short-run and long-run effects on inflation expectations in Nigeria.

For the interest rate channel, positive changes in financial innovation impact the interest rate pass-through by about 1 percentage point in the short run. Negative adjustments in financial innovation have a significant negative impact on the interest rate channel in the short run by 0.65 percent. For monetary policy shifts, negative shifts in the policy rate reduce the interest rate pass-through by about 0.45 percent in the short run, while a positive shift in the policy rate increases the interest rate pass-through by roughly 0.2 percent. These short-run results were in line with the long-run results, but to a higher degree for monetary policy changes and to a lesser degree for financial innovation, based on the coefficient of the results. Since changes in the equity and bond markets are expected to boost the level of financial innovation and foster opportunities for capital market firms to invest in new financial instruments, the outcome of positive developments in financial innovation and

the interest rate channel is consistent with the theoretical expectations. These findings further indicate a decline in the assets held for hedging and diversification and an increase in the liquidity and capital in the financial markets. With more options for banks to obtain funding, a rise in financial innovation has a direct bearing on the impact of the policy interest rate on bank loans via the interest rate channel, which is consistent with prior research (Altunbas et al. 2009; Aysun and Hepp 2011; Lerskullawat 2018b; Oyadeyi 2023b).

Table 10. Asymmetric impacts of financial innovation on the monetary transmission mechanism.

	APC	CC	EXC	IEC	INT
Short-Run Results					
D(FIN_POS)	6.1054 (0.0138) **	1.5541 (0.0661) *	14.7210 (0.1696)	3.2559 (0.0765) *	1.0401 (0.0185) **
D(FIN_NEG)	−4.4692 (0.0486) **	−1.8139 (0.0397) **	−2.8507 (0.5306)	−7.6357 (0.0004) ***	−0.6505 (0.0119) **
D(MPR_POS)	−0.6113 (0.0806) *	−2.0527 (0.0374) **	1.0252 (0.8510)	0.0142 (0.0848) *	0.1558 (0.0567) *
D(MPR_NEG)	1.7935 (0.0363) **	2.9525 (0.0089) ***	1.8966 (0.6863)	−1.5750 (0.0007) ***	−0.4504 (0.0537) *
D(LR)	−0.5211 (0.2300)	−0.7059 (0.0676) *	0.9955 (0.2039)	−0.1705 (0.0144) **	−0.0045 (0.8815)
D(LTD)	−0.8400 (0.0669) *	0.5498 (0.1889)	−0.3615 (0.6678)	0.1730 (0.1301)	−0.0648 (0.1344)
D(SR)	6.7470 (0.0147) **	−7.1185 (0.0545 *	4.0097 (0.5984)	−5.4456 (0.0084) ***	0.7533 (0.0203) **
CointEq(-1)	−0.1033 (0.0000) ***	−0.1901 (0.0000) ***	−0.2306 (0.0000) ***	−0.7800 (0.0001) ***	−0.4460 (0.0000) ***
Bound Test Results	4.8236	5.9487	5.2500	17.0832	6.7336
Long-Run Results					
FIN_POS	5.5340 (0.0137) **	1.3059 (0.0674) *	11.9624 (0.0732) *	2.5036 (0.0246) **	0.7193 (0.0234) **
FIN_NEG	−4.0509 (0.0417) **	−1.5242 (0.0378) **	−2.3165 (0.5321)	0.3750 (0.0485) **	0.1123 (0.0392) **
MPR_POS	−0.5541 (0.0788) *	1.7248 (0.0386) **	−7.5969 (0.1455)	−0.7703 (0.0231) **	0.4928 (0.0125) **
MPR_NEG	1.6256 (0.0376) **	2.4809 (0.0296) **	1.5412 (0.6865)	0.0808 (0.0182) **	0.5951 (0.0002) ***
LR	0.7410 (0.0859) *	0.0893 (0.7846)	0.8090 (0.1916)	−0.1508 (0.0036) ***	−0.0366 (0.1184)
LTD	−0.7613 (0.0790) *	0.4620 (0.1659)	−0.2938 (0.6628)	−0.0320 (0.5926)	0.0060 (0.8092)
SR	6.1154 (0.0139) **	−0.8464 (0.6504)	−3.0046 (0.4701)	0.3598 (0.7655)	0.2046 (0.2512)
C	−30.4438 (0.5516)	−4.0519 (0.9221)	46.4578 (0.6267)	13.0942 (0.3750)	14.1196 (0.0003) ***
Wald Test	0.0044	0.0495	0.0036	0.0084	0.0290
Normality	0.2178	0.6946	0.0563	0.8406	0.3557
Serial Correlation	0.8551	0.9053	0.1237	0.3279	0.2893
Heteroscedasticity	0.3599	0.3398	0.6702	0.1739	0.1112

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

Finally, the asymmetries were analyzed using the Wald test. The presence of asymmetries is confirmed by Wald tests for the five channels under investigation. The cointegration equation, also known as the error correction term, had a negative coefficient and was statistically significant at a level of 5 percent. This implies that short-term errors can be corrected in the long term. In addition, the bound test revealed that there is a long-run relationship among the variables, thereby implying cointegration among the estimated models. Finally, the results of the normality, serial correlation, and heteroscedasticity tests demonstrated that the models are accurate and trustworthy.

5. Conclusions

This paper emphasizes the significance of the nonlinear effects of financial development and monetary policy on Nigeria's monetary transmission process. This paper contributes to the growing body of literature on the topic by analyzing the asymmetric effects of seven financial development indicators across all five channels through which money is transmitted to economic activities. In addition, this paper makes a contribution to the literature by elucidating the role of the central bank in terms of monetary policy decisions and how these decisions affect money transmission. This paper adds to the growing body of evidence demonstrating the asymmetry between the influence of financial development on monetary policy decisions and the impact of these decisions on the transmission channels of monetary policy in Nigeria.

This paper uses annual data from 1986 to 2021 to ascertain that the asset price channel, credit channel, inflation expectations channel, exchange rate channel, and interest rate channel each play a unique and heterogeneous role in the transmission of changes in the financial development indicators. The findings revealed that the exchange rate channel does not respond to changes in monetary policy and financial development (with seven indicators as proxies for it) either in the long term or the short term. Furthermore, positive and negative changes in the financial development indicators and monetary policy have the expected effects on the five channels of monetary policy in Nigeria, with the significance of the results being weakest on the exchange rate channel. This implies that Nigeria's financial system is not yet at an advanced enough stage to foster developments in the exchange rate channel of monetary policy.

In general, the findings highlight the critical role of the different financial development indicators in the transmission of monetary policy changes and the role of the actions of the central bank within the transmission process. The evidence suggests that a more stable monetary policy is crucial for achieving monetary policy objectives, especially since Nigeria's financial system is not at an advanced enough stage to fully develop the full transmission process since its pass-through on the interest rate channel is incomplete and it has no effect on the exchange rate channel. Therefore, this paper recommends that policies must be driven towards developing a highly advanced financial system across the banking sector, capital market, bond market, and the overall financial sector. This is because a highly developed financial system improves the transmission of monetary policy decisions vis-à-vis the different channels. Improved capital market size, activity, and efficiency provide alternative ways of financing and investments for all financial market players, thereby deepening capital market penetration. Improved bond market activities also deepen financial disintermediation in the economy. Furthermore, improved banking size and activities strengthen the overall financial intermediation process, thereby improving the overall financial sector development.

Simply put, this paper proved that financial development could enhance the transmission of monetary policy in a variety of ways. Certainly, the heterogeneous impact of financial development on monetary transmission mechanisms is not new (see, for example, Steiner and Galindo 2022; Meneses-González et al. 2022). As a result, the asymmetric impact of the financial development indicators on money transmission is symptomatic of some characteristics of financial markets and their institutions on their way toward advancement. Therefore, it is more likely that, as a financial system matures, monetary policy will have a

greater impact on the cost of short-term funding for banks without having any discernible effect on the rates at which businesses and households can borrow money. The limitations of this study stems from the fact that the data gathered on the financial development indicators and monetary transmission channels could not be collated from 1960 when the country gained its independence. These would have provided a more holistic view on these relationships since the country gained its independence. Nevertheless, future studies can explore these relationships across a panel framework in Sub-Saharan Africa, since the findings from this study are most likely to be reflective of the SSA region due to her inherent characteristics.

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Appendix A

Table A1. Asymmetric impacts of financial depth by activity on the monetary transmission mechanism.

	APC	CC	EXC	IEC	INT
			Short-Run Results		
D(FDPA_POS)	−6.7844 (0.0004) ***	6.3799 (0.0108) **	−2.3487 (0.6012)	1.9608 (0.0223) **	−0.3032 (0.0216) **
D(FDPA_NEG)	0.3896 (0.0921) *	−1.4319 (0.0690) *	2.3217 (0.8579)	−0.9208 (0.0573) *	0.4224 (0.0347) **
D(MPR_POS)	−0.9411 (0.0593) *	1.6671 (0.0326) **	10.1525 (0.7260)	−0.2076 (0.0793) *	0.7151 (0.0022) ***
D(MPR_NEG)	1.6381 (0.0483) *	0.2184 (0.0898) *	−7.5505 (0.3797)	−2.8328 (0.0004) ***	−0.5456 (0.0442) **
D(LR)	−0.6577 (0.1182)	−0.5880 (0.0818) *	0.0080 (0.9935)	0.1855 (0.0537) *	−0.0261 (0.4477)
D(LTD)	−0.8608 (0.0582) *	0.5507 (0.1732)	−1.4452 (0.2152)	0.0105 (0.9190)	−0.0902 (0.0561) *
D(SR)	9.7852 (0.0034) ***	−5.7803 (0.0425) **	−0.9428 (0.8984)	−2.3010 (0.0487) **	0.4966 (0.0474) **
CointEq(-1)	−0.3797 (0.0000) ***	−0.3553 (0.0000) ***	−0.2308 (0.0000) ***	−0.0870 (0.0000) ***	−0.4483 (0.0000) ***
Bound Test Results	7.0009	12.6647	5.8418	16.5853	7.1798
			Long-Run Results		
FDPA_POS	−4.9173 (0.0002) ***	−2.0939 (0.0993) *	−1.9082 (0.6067)	0.0175 (0.0974) *	−0.1689 (0.0184) **
FDPA_NEG	0.2824 (0.0921) *	−1.0566 (0.0690) *	−11.3888 (0.2298)	−0.8472 (0.0568) *	0.2916 (0.0348) **
MPR_POS	−0.6821 (0.0603) *	1.2301 (0.0315) **	−3.3948 (0.5114)	0.8345 (0.0199) **	0.7936 (0.0000) ***
MPR_NEG	6.8158 (0.0014) ***	0.1612 (0.0898) *	3.8391 (0.5320)	0.9148 (0.0337) **	−0.5925 (0.0026) ***

Table A1. *Cont.*

	APC	CC	EXC	IEC	INT
LR	0.3425 (0.2935)	0.0449 (0.8631)	0.0065 (0.9935)	−0.2570 (0.0466) **	−0.0180 (0.4530)
LTD	−1.0706 (0.0080) ***	0.0756 (0.7827)	0.8421 (0.4147)	−0.1229 (0.3026)	0.0067 (0.8346)
SR	9.9526 (0.0000) ***	0.5830 (0.6775)	−7.8507 (0.1484)	2.0023 (0.0363) **	0.3429 (0.0329) **
C	−55.5049 (0.1254)	−1.2785 (0.9673)	97.8919 (0.3072)	10.3327 (0.4855)	12.7629 (0.0003) ***
Wald Test	0.0061	0.0091	0.0073	0.0167	0.0191
Normality	0.5753	0.7944	0.0507	0.2230	0.1837
Serial Correlation	0.8928	0.0756	0.0707	0.2706	0.1019
Heteroscedasticity	0.7489	0.6222	0.4557	0.4333	0.7881

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

Table A2. Asymmetric impacts of financial deepening by activity on the monetary transmission mechanism.

	APC	CC	EXC	IEC	INT
Short-Run Results					
D(FDEA_POS)	19.6408 (0.0625) *	12.0357 (0.0067) ***	−8.0462 (0.5971)	0.1438 (0.0959) *	0.2931 (0.0336) **
D(FDEA_NEG)	−9.1832 (0.0485) **	−16.8598 (0.0067) ***	−12.0332 (0.3921)	−7.5395 (0.0223) **	−1.8166 (0.0718) *
D(MPR_POS)	−2.1543 (0.0128) **	−2.9745 (0.0486) **	7.6503 (0.1259)	1.1423 (0.0489) **	0.6072 (0.0057) ***
D(MPR_NEG)	3.5180 (0.0407) **	2.5904 (0.0157) **	3.0334 (0.5926)	−2.7979 (0.0002) ***	−0.5271 (0.0379) **
D(LR)	−0.6392 (0.0377) **	−0.4468 (0.1890)	0.6721 (0.4054)	0.1745 (0.0392) **	−0.0051 (0.8825)
D(LTD)	−0.1753 (0.5977)	0.4909 (0.1617)	−1.0981 (0.2751)	−0.0129 (0.8874)	−0.1145 (0.0134) **
D(SR)	12.8370 (0.0000) ***	−6.6088 (0.0327) **	−6.8694 (0.2185)	−2.9646 (0.0131) **	0.5293 (0.0420) **
CointEq(-1)	−0.3390 (0.0000) ***	−0.2479 (0.0000) ***	−0.1761 (0.0000) ***	−0.0120 (0.0000) ***	−0.4918 (0.0000) ***
Bound Test Results	9.8957	8.2307	6.1201	18.6988	6.2822
Long-Run Results					
FDEA_POS	30.8920 (0.0003) ***	9.6447 (0.0728) *	−6.8416 (0.5974)	9.0425 (0.0542) *	0.1964 (0.0324) **
FDEA_NEG	−16.3958 (0.0241) **	−13.5104 (0.0071) ***	−10.2317 (0.3957)	−7.4498 (0.0428) **	−0.2883 (0.0433) **
MPR_POS	−1.6089 (0.0137) **	−2.3836 (0.0515) *	−0.7434 (0.8644)	1.1287 (0.0794) *	0.7627 (0.0000) ***
MPR_NEG	6.8587 (0.0001) ***	2.0758 (0.0167) **	2.5792 (0.5943)	−1.0488 (0.2833)	−0.5816 (0.0018) ***

Table A2. *Cont.*

	APC	CC	EXC	IEC	INT
LR	0.2010 (0.4030)	0.1861 (0.5007)	0.5715 (0.3959)	−0.1471 (0.1078)	−0.0262 (0.3015)
LTD	−0.6104 (0.0182) **	0.3933 (0.1414)	0.2820 (0.7304)	−0.1486 (0.1104)	0.0003 (0.9896)
SR	9.5870 (0.0000) ***	0.6936 (0.6752)	−5.8410 (0.2234)	2.4035 (0.0169) **	0.3548 (0.0315) **
C	−77.7403 (0.0157) **	−27.6881 (0.4019)	82.0362 (0.4320)	−0.6786 (0.9656)	13.0640 (0.0004) ***
Wald Test	0.0234	0.0195	0.0466	0.0127	0.0104
Normality	0.2926	0.6853	0.0574	0.8302	0.9248
Serial Correlation	0.2293	0.3965	0.5897	0.5805	0.0922
Heteroscedasticity	0.9118	0.6712	0.9166	0.4426	0.6962

Source: author's computation. ***, **, and * represent significance at 1, 5, and 10 percent, respectively. The *p* value is reported in a parenthesis, while the coefficient is not in a parenthesis.

References

Adediran, Idris A., Phebian Bewaji, and Olajide O. Oyadeyi. 2024. Climate Risk and Stock Markets: Implications for Market Efficiency and Return Predictability. *Emerging Markets Finance and Trade* 60: 1908–28. [CrossRef]

Ahiadorme, Johnson W. 2022. Financial development and the redistributive channel of monetary policy. *Studies in Economics and Finance* 39: 279–96. [CrossRef]

Alfaro, Rodrigo, Helmut Franken, Carlos García, and Alejandro Jara. 2003. Bank Lending Channel and the Monetary Transmission Mechanism: The Case of Chile. Central Bank of Chile Working Paper No. 223. Santiago, Chile: Central Bank of Chile.

Altunbas, Yener, Leonardo Gambacorta, and David Marques-Ibanez. 2009. Securitisation and the bank lending channel. *European Economic Review* 53: 996–1009. [CrossRef]

Apanisile, Olumiyiwa T. 2021. Remittances, financial development and the effectiveness of monetary policy transmission mechanism in Nigeria: A DSGE approach (1986–2018). *Indian Economic Review* 56: 91–112. [CrossRef]

Apanisile, Olumuyiwa T., and Tolulope T. Osinubi. 2019. Financial Development and the Effectiveness of Monetary Policy Channels in Nigeria: A DSGE Approach. *Journal of African Business* 21: 193–214. [CrossRef]

Ascarya, Ascarya. 2012. Transmission Channel and Effectiveness of Dual Monetary Policy in Indonesia. *Bulletin of Monetary Economics and Banking* 14: 269–98.

Auer, Simone. 2022. Financial globalization and monetary transmission. *Review of International Economics* 31: 721–60. [CrossRef]

Aysun, Uluc, and Ralf Hepp. 2011. Securitisation and the balance sheet channel of monetary transmission. *Journal of Banking and Finance* 35: 2111–22. [CrossRef]

Babilla, Thierry U. K. 2022. Bank-lending channel of monetary policy transmission in WAEMU: An estimated DSGE model approach. *International Journal of Finance and Economics* 29: 1277–300. [CrossRef]

Bashagi, Asimwe, Deogratius Kimolo, and Mollel Sanga. 2019. Assessment of Monetary Policy Transmission Mechanism in Tanzania. Bank of Tanzania Working Paper No. 19. Dar es Salaam, Tanzania: Bank of Tanzania.

Bean, Charles, Jens D. Larsen, and Kalin Nikolov. 2002. Financial Frictions and the Monetary Transmission Mechanism: Theory, Evidence and Policy Implications. Working Paper Series No. 113. Frankfurt, Germany: European Central Bank.

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 1999. A New Database on Financial Development and Structure. The World Bank Financial Sector Discussion Paper [Online], 2. Available online: http://documents.worldbank.org/curated/en/164081468779345058/A-new-database-on-financial-development-and-structure (accessed on 15 March 2024).

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 2000. A New Database on the Structure and Development of the Financial Sector. *World Bank Economic Review* 14: 597–605. [CrossRef]

Beck, Thorsten, Enrique Feyen, Alain Ize, and Federico Moizeszowicz. 2008. Benchmarking Financial Development. The World Bank Policy Research Working Paper No. 4638. [CrossRef]

Bernanke, Ben S., and Mark Gertler. 1995. Inside the Black Box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives* 9: 27–48. [CrossRef]

Bernanke, Ben S., Mark Gertler, Mark Watson, Christopher A. Sims, and Benjamin M. Friedman. 1997. Systematic Monetary Policy and the Effects of Oil Price Shocks. *Brookings Papers on Economic Activity* 1: 91–157. [CrossRef]

Bhattacharya, Rudrani, Shruti Tripathi, and Sahana R. Chowdhury. 2019. Financial Structure, Institutional Quality and Monetary Policy Transmission: A Meta-Analysis. National Institute of Public Finance and Policy (NIPFP) Working Paper Series No. 274. Delhi, India: National Institute of Public Finance and Policy (NIPFP).

Boivin, Jean, Michael T. Kiley, and Frederic. S. Mishkin. 2010. How Has the Monetary Transmission Mechanism Evolved Over Time? NBER Working Paper No. 15879. Cambridge, MA, USA: NBER.
Bordalo, Pedro, Nicola Gennaioli, Yueran Ma, and Andrei Shleifer. 2020. Overreaction in macroeconomic expectations. *American Economic Review* 110: 2748–82. [CrossRef]
Brandao-Marques, Luis, Gaston Gelos, Thomas Harjes, Ratna Sahay, and Yi Xue. 2020. *Monetary Policy Transmission in Emerging Markets and Developing Economies*. Technical Report 20/35. Washington, DC: International Monetary Fund.
Central Bank of Nigeria. 2023. *CBN Statistical Bulletin and Annual Report*; Lagos: Central Bank of Nigeria. Available online: http://www.cbn.gov.ng (accessed on 17 June 2024).
Da Silva, Gisele F. 2002. The impact of financial system development on business cycles volatility: Cross-country evidence. *Journal of Macroeconomics* 24: 233–53. [CrossRef]
Dickey, David, and Wayne Fuller. 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica* 49: 1057–75. [CrossRef]
European Central Bank. 2010. *Monetary Policy Transmission in the Euro Area, a Decade after the Introduction of the Euro*. Frankfurt: European Central Bank. Available online: https://www.ecb.europa.eu/pub/pdf/other/mb201005en_pp85-98en.pdf (accessed on 3 March 2024).
Farajnezhad, Mohammad. 2022. Examine the credit channel of the monetary policy transmission mechanism in an emerging market economy: The case of South Africa. *Journal of Money and Business* 2: 149–64. [CrossRef]
Gropp, Reint, Christoffer K. Serensen, and Jung-Duk Lichtenberger. 2007. The Dynamics of Bank Spreads and Financial Structure. European Central Bank Working Paper Series No. 714. Available online: http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp714.pdf (accessed on 15 March 2024).
Havranek, Tomas, and Marek Rusnak. 2013. Transmission Lags of Monetary Policy: A Meta-Analysis. *International Journal of Central Banking* 9: 39–75.
Kireyev, Alexei. 2015. How to Improve the Effectiveness of Monetary Policy in the West African Economic and Monetary Union. IMF Working Paper /15/99. Washington, DC, USA: International Monetary Fund.
Kuttner, Kenneth N., and Patricia C. Mosser. 2002. The Monetary Transmission Mechanism: Some Answers and Further Questions. *Economic Policy Review, Federal Reserve Bank New York* 8: 15–26.
Lacheheb, Miloud, and Abdalla Sirag. 2019. Oil price and inflation in Algeria: A nonlinear ARDL approach. *The Quarterly Review of Economics and Finance* 73: 217–22. [CrossRef]
Lerskullawat, Attasuda. 2016. Effects of banking sector and capital market development on the bank lending channel of monetary policy: An ASEAN country case study. *Kasetsart Journal of Social Sciences* 38: 9–17. [CrossRef]
Lerskullawat, Attasuda. 2018a. Banking Competition, Banking Stability and the Lending Channel of Monetary Policy: The Case of Thailand. *Southeast Asian Journal of Economics* 6: 41–60.
Lerskullawat, Attasuda. 2018b. Financial development and the lending channel of monetary policy transmission: Evidence from Thailand. *International Journal of Monetary Economics and Finance* 11: 224–34. [CrossRef]
Levine, Ross. 1997. Financial development and economic growth: Views and agenda. *Journal of Economic Literature* 35: 688–726.
Levine, Ross. 2005. Finance and growth: Theory and evidence. In *Handbook of Economic Growth*. Edited by Philippe Aghion and Steven N. Durlauf. Amsterdam: Elsevier, pp. 866–934.
Levine, Ross, Norman Loayza, and Thorsten Beck. 2000. Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics* 46: 31–77. [CrossRef]
Loayza, Norman, and Klaus Schmidt-Hebbel. 2002. Monetary Policy Functions and Transmission Mechanism: An Overview. World Bank Working Papers. Washington, DC, USA: World Bank, 1–20.
Meneses-González, Maria F., Angelica M. Lizarazo-Cuellar, Diego F. Cuesta-Mora, and Daniel Osorio-Rodríguez. 2022. Financial Development and Monetary Policy Transmission. Borradores de Economía. Working Paper No. 1219. Bogotá, Colombia: Bank of Colombia.
Minguez, Jose M. G. 1997. The Balance-Sheet Transmission Channel of Monetary Policy: The Cases of Germany and Spain. Working Papers 9713. Madrid, Spain: Banco de España.
Mishkin, Frederic S. 1995. Symposium on the Monetary Transmission Mechanism. *Journal of Economic Perspectives* 9: 3–10. [CrossRef]
Mishkin, Frederic S. 2004. *Economics of Money Banking and Financial Markets*, 7th ed. Addison Wesley Series in Economics. Boston: Addison Wesley.
Mishra, Prachi, Peter Montiel, and Antonio Spilimbergo. 2010. Monetary Transmission in Low-Income Countries. IMF Working Paper 10/223. Washington, DC, USA: IMF.
Mojon, Benoit. 2000. Financial Structure and the Interest Rate Channel of ECB Monetary Policy. European Central Bank Working Paper Series. Frankfurt, Germany: European Central Bank, vol. 40, pp. 1–45.
Nguyen, Thanh P., Thi T. H. Dinh, and Ngoc T. Tran. 2022. Financial development and monetary policy transmission in a multiple-tool regime: The case of Vietnamese commercial banks. *Cogent Business & Management* 9: 2135218. [CrossRef]
Nourzad, Farrokh. 2002. Financial development and productive efficiency: A panel study of developed and developing countries. *Journal of Economics and Finance* 26: 138–48. [CrossRef]

Nyamongo, Esman, and Lydia Ndirangu. 2013. *Financial Innovations and Monetary Policy in Kenya*. MPRA Paper No. 52387. Submitted to the African Economic Research Consortium (AERC) Biannual Research Workshop on Financial Inclusion and Innovation in Africa. Nairobi: Central Bank of Kenya.
Ogun, Taiwo P., and Anthony E. Akinlo. 2010. The Effectiveness of Bank Credit Channel of Monetary Policy Transmission: The Nigerian Experience. *African Economic and Business Review* 8: 15–29.
Oyadeyi, Olajide. 2022a. A systematic and non-systematic approach to monetary policy shocks and monetary transmission process in Nigeria. *Journal of Economics and International Finance* 14: 23–31. [CrossRef]
Oyadeyi, Olajide. 2022b. Interest Rate Pass-Through in Nigeria. *Journal of Economics and Development Studies* 10: 49–62.
Oyadeyi, Olajide. 2023a. Banking Innovation, Financial Inclusion and Economic Growth in Nigeria. *Journal of the Knowledge Economy*. [CrossRef]
Oyadeyi, Olajide. 2023b. Financial development, interest rate pass-through and interest rate channel of monetary policy. *Cogent Economics & Finance* 11: 2209952. [CrossRef]
Oyadeyi, Olajide. 2023c. Financial Development, Real Sector and Economic Growth in Nigeria. *SN Business & Economics* 3: 146. [CrossRef]
Oyadeyi, Olajide. 2023d. Financial inclusion, e-payments and economic growth in Nigeria. *International Journal of Financial Innovation in Banking*. [CrossRef]
Oyadeyi, Olajide, and Temidayo Akinbobola. 2020. Financial Development and Monetary Transmission Mechanism in Nigeria (1986–2017). *Asian Journal of Economics and Empirical Research* 7: 74–90. [CrossRef]
Oyadeyi, Olajide, Sodiq Arogundade, and Mduduzi Biyase. 2024. How did African Stock Markets react to the Russia-Ukraine crisis "black-Swan" event? Empirical Insights from Event Study. *Humanities and Social Sciences Communication* 11: 243. [CrossRef]
Oyadeyi, Olajide O. 2024a. Monetary Integration across West Africa: Is the Region Ripe for a Monetary Union? *SAGE Open* 14: 1–21. [CrossRef]
Oyadeyi, Olajide O. 2024b. The Velocity of Money and Lessons for Monetary Policy in Nigeria: An Application of the Quantile ARDL Approach. *Journal of the Knowledge Economy*. [CrossRef]
Oyadeyi, Olajide O., and Temidayo Akinbobola. 2022. Further insights on monetary transmission mechanism in Nigeria. *Journal of Economics and International Finance* 14: 11–22. [CrossRef]
Parvin, Rehana. 2022. The Relationship Between Bangladesh's Financial Development, Exchange Rates, and Stock Market Capitalization: An Empirical Study Using the NARDL Model and Machine Learning. *Pertanika Journal of Science & Technology* 30: 2493–508.
Phillips, Peter C. B., and Pierre Perron. 1988. Testing for a Unit Root in Time Series Regression. *Biometrika* 75: 335–46. [CrossRef]
Raza, Naveed, Syed J. H. Shahzad, Aviral K. Tiwari, and Muhammad Shahbaz. 2016. Asymmetric impact of gold, oil prices and their volatilities on stock prices of emerging markets. *Resources Policy* 49: 290–301. [CrossRef]
Sander, Harald, and Stefanie Kleimeier. 2006. Convergence of interest rate pass-through in a wider euro zone? *Economic System* 30: 405–23. [CrossRef]
Seth, Rama, and Vaanchitha Kalyanaraman. 2017. Effect of financial development on the transmission of monetary policy. *Theoretical Economics Letters* 7: 795–813. [CrossRef]
Sheikh, Umaid A., Muzaffar Asad, Zahid Ahmed, Umer Mukhtar, and David McMillan. 2020. Asymmetrical relationship between oil prices, gold prices, exchange rate, and stock prices during global financial crisis 2008: Evidence from Pakistan. *Cogent Economics & Finance* 8: 1757802. [CrossRef]
Shin, Yongcheol, Byungchul Yu, and Mathew Greenwood-Nimmo. 2014. Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in honor of Peter Schmidt*. Edited by R. Sickles and W. Horrace. New York: Springer, pp. 281–314. [CrossRef]
Shortland, Anja, and David Stasavage. 2004. What determines the monetary policy in the franc zone? Estimating a reaction function for the BCEAO. *Journal of African Economies* 13: 518–35. [CrossRef]
Singh, Sukudhew, Ahmad Razi, Norhana Endut, and Helmi Ramlee. 2008. *Impact of Financial Market Developments on the Monetary Transmission Mechanism*. BIS Papers chapter: Financial market developments and their implications for monetary policy. Basel: BIS, vol. 39, pp. 49–99.
Steiner, Roberto, and Arturo Galindo. 2022. Asymmetric interest rate transmission in an inflation-targeting framework: The case of Colombia. *Latin American Journal of Central Banking* 3: 100069.
Vrolijk, Coenraad. 1997. Derivatives Effect on Monetary Policy Transmission. IMF Working Papers 121. Washington, DC, USA: International Monetary Fund.
Woodford, Michael. 2010. Globalization and monetary control. In *International Dimensions of Monetary Policy*. Edited by J. Gali and M. J. Gertler. Chicago: University of Chicago Press, pp. 13–88.
Zwolankowski, Marek. 2011. The Financial Crisis, Financial System Instability and Monetary Transmission Mechanism. *Journal of International Studies* 4: 26–32. [CrossRef]