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Price Stickiness-Income Inequality Nexus, Impact on Monetary Policy in Nigeria

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Abstract

This study examines the impact of price stickiness-income inequality nexus, om monetary policy in Nigeria from 1984 to 2023. The model formulated depicts monetary policy rate (MPR) as the dependent variable while gross domestic product (GDP), nominal exchange rate (NER), inflation (INF), interest rate (INT), consumer price index (CPI) as a measure of price stickiness and income inequality (IND) are independent variables. These data were sourced and extracted from CBN Statistical Bulletin. The study employed the OLS, Cochrane Orcutt and the chain rule to find the transmission mechanism. The ADF test reveals that the variables were all stationary at level. The study recommends that Monetary authorities are also encouraged to decrease the MPR. This will allow the banks to have enough cash to give to industries, the manufacturing sector and especially the small and medium enterprise. This will thus lead to creating of jobs to will lead to a balance or reduction in the income inequality It decreases interest rate and therefore encourages lending and investment and by extension, increase in output. Monetary authorities must however be wary of the tendency of an increase in money supply to lead primarily to inflation. Monetary authorities must ensure viable productive potentials in the economy respond positively to the rise in money supply.

INTRODUCTION

Nigeria, like many other developing economies, has struggled with price stickiness, which has hindered the effectiveness of monetary policy in achieving macroeconomic stability. Price stickiness refers to the phenomenon where prices are slow to adjust to changes in market conditions, leading to inflationary pressures and reduced economic growth. In Nigeria, price stickiness has been exacerbated by factors such

as exchange rate volatility, supply chain disruptions, and rigidities in the labor market. The Nigeria's economy has been characterized by persistent inflationary pressures, exchange rate volatility, and sluggish economic growth. The Central Bank of Nigeria (CBN) has employed various monetary policy tools to stabilize the economy, but the effectiveness of these policies has been hindered by price stickiness.

Price stickiness has made it challenging for monetary policy to achieve its objectives, as prices are slow to adjust to changes in market conditions (Cravino et al., 2020. Schmitt-Grohé & Uribe, 2004). The CBN's monetary policy interventions have been ineffective in addressing Nigeria's macroeconomic challenges due to price stickiness. The stickiness of prices has limited the pass-through of monetary policy to the real economy, making it challenging to achieve macroeconomic stability. With persistent inflation rate which has remained above 10% since 2015, despite monetary policy tightening (CBN, 2023). Exchange rate volatility of which Naira has depreciated by over 200% since 2015, with frequent fluctuations (CBN, 2023) and a sluggish economic growth with GDP growth rate with an average of around 2% since 2017, below the African average (World Bank, 2023). Price stickiness in Nigeria is rather slow to adjust to changes in market conditions, with a price adjustment coefficient of 0.3 (Oyedokun, 2020). Policy plunging has been evident in Nigeria, with frequent changes in policy direction, including the introduction of multiple exchange rates and trade restrictions (IMF, 2023). Unemployment has risen to 43.3% in 2023, with youth unemployment exceeding 50% (NBS, 2023). All these has made monetary policy to be ineffective in addressing Nigeria's macroeconomic challenges, with a monetary policy transmission mechanism that is weak and unpredictable (Ononugbo, 2012; Obafemi & Ifere, 2015).

Nigeria's economy has been grappling with the challenges of price stickiness, income inequality, and ineffective monetary policy. Price stickiness, which refers to the phenomenon where prices are slow to adjust to changes in market conditions, has been a persistent feature of the Nigerian economy (Ihimoyan et al., 2022). This has led to inflationary pressures, reduced economic growth, and increased income inequality. Income inequality, in turn, has exacerbated price stickiness, creating a vicious cycle that undermines the effectiveness of monetary policy. Price stickiness in Nigeria is exacerbated by information asymmetry, menu costs, strategic complementarity, supply chain disruptions, and labor market rigidities, leading to inflationary pressures and reduced economic growth, which in turn undermines the effectiveness of monetary policy transmission, creating a vicious cycle that makes it challenging to achieve macroeconomic stability. Additionally, Nigeria's monetary policy faces challenges such as ineffective transmission mechanism, exchange rate volatility, and fiscal dominance, which are further complicated by the country's specific factors like exchange rate volatility, supply chain disruptions, and labor market rigidities.

The interaction between price stickiness and monetary policy in Nigeria is characterized by a self-reinforcing cycle, where sticky prices limit the pass-through of monetary policy to the real economy, while tightening monetary policy exacerbates price stickiness, leading to higher prices and reduced economic growth. The Central Bank of Nigeria's (CBN) efforts to stabilize the economy through monetary policy interventions have been hindered by the nexus of price stickiness and income inequality. The stickiness of prices has limited the pass-through of monetary policy to the real economy, while income inequality has reduced the effectiveness of monetary policy transmission. Furthermore, policy plunging, characterized by frequent changes in policy direction, has created uncertainty and undermined the credibility of monetary policy.

Despite the Central Bank of Nigeria's (CBN) efforts to stabilize the economy through monetary policy interventions, price stickiness has persisted, undermining the

effectiveness of these policies. Though the Central Bank of Nigeria has implemented and employed various has tools, including 11 rate hikes between 2016 and 2023, with limited impact on inflation and economic growth (CBN, 2023), interest rate adjustments and foreign exchange interventions, to manage inflation and stimulate economic growth. However, these efforts have been hindered by the stickiness of prices, which has limited the pass-through of monetary policy to the real economy. monetary policy measures.

Specifically, the problem this study seeks to address is how does the nexus of price stickiness and income inequality impact the effectiveness of monetary policy in Nigeria? What are the implications of the price stickiness-income inequality nexus for monetary policy design and implementation in Nigeria? This study thus aims to investigate the complex relationships between price stickiness, income inequality, and monetary policy in Nigeria, with a focus on understanding the implications of policy plunging for macroeconomic stability. For the purposes of empirical analysis, a time frame of 44 years (1981-2020) was used. With the data gathered from reliable sources such as World bank data bank, Central Bank of Nigeria (CBN) statistical bulletin, National Bureau of Statistics (NBS).

Literature Review

Price Stickiness

Price stickiness, or sticky prices, refers to the tendency of prices to remain constant or to adjust slowly despite changes in the cost of producing and selling the goods or services. This stickiness means that changes in the money supply have an impact on the real economy, inducing changes in investment, employment, output, and consumption.

Price stickiness (or sticky prices) can also be said to be the resistance of market price(s) to change quickly despite changes in the broad economy that suggest a different price is optimal. "Sticky" is a general economics term that can apply to any financial variable that is resistant to change. When applied to prices, it means that the prices charged for certain goods are reluctant to change despite changes “in input cost or demand patterns. When prices cannot adjust immediately to changes in economic conditions or in the aggregate price level, there is an inefficiency in the market that is, a market disequilibrium.

Monetary Policy

Monetary policy has to do with the management of the money supply, the rate of interest and the exchange rate, although some economists treat changes in the exchange rate as a separate policy. The main monetary policy measure currently used in most countries, is changes in the rate of interest. The term monetary policy has been defined by experts from many perspectives. According to CBN (2006), monetary policy concept was defined as Any policy measure designed by the federal government through the CBN to control cost availability and supply of credit. It also referred to as the regulation of money supply and interest rate by the CBN in order to control inflation and to stabilize the currency flow in an economy.

Monetary policy includes all monetary and non-monetary decisions and measures aimed at affecting the monetary system. It is a policy employing the central banks control of the supply of money as an instrument for achieving the objectives of general economic policy (Epstein, 2007, Chugunov et al., 2021).

Theoretical framework

There are several theories and models that have been used in different studies which are related to price stickiness and monetary policy, but this paper will be limited to the classical theory of monetary policy and classic model of frictional good market.

The Classical Theory of Monetary Policy

The classical theory of monetary policy is embedded in the quantity theory propounded by Irving Fisher in 1911. The classical link between money, income and prices is explained under the framework of the quantity theory. According to classical theory, an increase in the supply of money leads to an increase in the general price level, while real variables such as real income, the rate of interest and the level of real economic activity remain constant. Thus, the classical transmission mechanism proceeds as follows: an increase in the money supply (given the constancy of both velocity of money and real output) will increase the level of liquidity in the system.

The increase in the level of liquidity leads to the demand for goods and services, which in turn results in rising prices. The money transmission mechanism in the classical monetary theory is explained using the quantity theory of money, expressed as:

MV = PQ

Where:

M = Money supply

V = Velocity of money circulation

P = Aggregate price level

Q = Level of real output/aggregate output

Assuming V and Q are constant, the price level (P) varies proportionately with the supply of money (M). With flexible wages, the economy was believed to operate at full employment levels. The labour force, the capital stock and technology also change only slowly over time. Consequently, the amount of money spent did not affect the level of real output so that a doubling of quantity of money will result simply in doubting the price level. This rising price reduce the real wage and provides incentives for employers to expand employment and pushes output towards equilibrium. Thus, an expansionary monetary policy is effective in restoring full employment in the classical system.

Classic model of frictional good markets

The classic model of frictional good markets was developed by Burdett and Judd in the year 1983. The model, based on search frictions, delivers price distribution and has proved useful in many other applications, including the large literature on labor markets following Burdett and Mortensen (1998).

To understand the Burdett-Judd model, it helps to first review the earliest search models, where buyers sampled sellers sequentially until they found one selling at a price below the highest price buyers were willing to pay. Burdett and Judd modify Diamond's (1971) classic search model, which, uncertainly, had no price dispersion. Burdett and Judd's apparently minimal change to the Diamond model is this: Rather than sampling prices one at a time, as Diamond had it, buyers in the Burdett-Judd model have a positive probability of sampling two or more prices at the same time. If all sellers set the same price, a buyer is indifferent to choosing one over another and must use some tie-breaking rule to pick. This, of course, gives an individual seller a huge incentive to shave his or her price to get the sale. In fact, Burdett and Judd find that, in the model's equilibrium, all sellers charge different prices: price dispersion.

When Burdett-Judd pricing is embedded into a monetary model, sellers post prices in Naira, since this is how buyers are paying. At any date, there is a range of posted prices for which sellers will get the same profit. While the model pins down the distribution of prices, it does not set the price for any individual seller. This is because low price generates less profit per sale, but makes up for that low profit

generation through sales volume, because a sale is more likely from any buyer who samples a low price. If the money supply increases, the equilibrium price distribution shifts up, but this new distribution can overlap with the previous range of prices. This means that some (but not all) sellers must change their prices. If an individual seller's price falls outside the range of prices that seller will charge after the increase of money supply, it must adjust; but if it is still in the range of new prices, it may not.

Sellers however do not have a unique target price. The model's equilibrium requires a distribution of prices, all of which yield the same profit. If sellers do not change their price when money supply increases, they indeed earn less profit per unit, but again they make it up on the volume. Hence, sellers can change prices infrequently in the face of continuous movements in economic conditions, even though they are allowed to change whenever they like at no cost. But the crucial point of the theory as stated by the proponent is that: Policy cannot exploit price stickiness because the distribution of relative prices is pinned down uniquely. The level of the money supply and the aggregate price level are irrelevant it is simply a choice of units. This is classical neutrality.

Empirical Literature

In the study by Cravino et al. (2018) the authors stated that monetary policy shocks can affect different types of agents differently. The distributional effects can have important consequences for policy effectiveness. Using US data, the study explores how shocks differentially affect the prices faced by households with different incomes. Their results suggest that middle-income households' consumption baskets have more volatile prices than those of high-income households, and they are therefore more exposed to monetary policy shocks.

Nakamura & Steinsson (2008) established five facts about prices in the U.S. economy in their study. This include (1) For consumer prices, the median frequency of nonsale price change is roughly half of what it is including sales (9–12% per month versus 19–20% per month for identical items; 11–13% per month versus 21–22% per month including product substitutions). The median frequency of price change for finished-goods producer prices is comparable to that of consumer prices excluding sales. (2) One-third of nonsale price changes are price decreases. (3) The frequency of price increases covaries strongly with inflation, whereas the frequency of price decreases and the size of price increases and price decreases do not. (4) The frequency of price change is highly seasonal: it is highest in the first quarter and then declines. (5) No evidence of upward sloping hazard functions of price changes for individual products. They proved that the first, second, and third facts are consistent with a benchmark menu-cost model, whereas the fourth and fifth facts are not. The findings regarding the frequency of price change, the relationship between the frequency of price increases and inflation, and the seasonality of price changes find strong support in a number of European countries

In a more recent study by Coibon et al. (2017), the authors study the effects of monetary policy shocks on the historical contribution to consumption and income inequality in the United States since 1980 as measured by the consumer expenditure survey. Using detailed micro-level data on income and consumption, the authors documented some of the different channels via which monetary policy shocks affect inequality, as well as how these channels depend on the nature of the change in monetary policy. The study finds out that contractionary monetary policy systematically increases inequality in labor earnings, total income, consumption and total expenditures. Furthermore, monetary policy shocks account for a non-trivial component of the historical cyclical variation in income and consumption inequality.

The study sticky prices and monetary policy: evidence from disaggregated United States data" by Boivin et al. (2009) examined the effect of macroeconomic and sectoral disturbances by estimating a factor-augmented vector autoregression using a large set of macroeconomic indicators and disaggregated prices. The study shows that the recent evidence that disaggregated prices are volatile does not necessarily challenge the hypothesis of price rigidity used in a large class of macroeconomic models. Their main finding is that disaggregated prices appear sticky in response to macroeconomic and monetary disturbances, but flexible in response to sector specific shocks. The observed flexibility of disaggregated prices reflects the fact that sector-specific shocks account on average for 85 percent of their monthly fluctuations

Bils et al. (2003) in their study title sticky prices and monetary policy shocks, predict that monetary policy changes will affect relative prices and relative quantities in the short run because some prices are more flexible than others. Using United States (U.S.) micro data, the authors stated that the degree of price stickiness differs dramatically across consumption categories. This study exploits that diversity to ask whether popular measures of monetary shocks (for example, innovations in the federal funds rate) have the predicted effects. The result of the study shows that they do not. In addition, short-run responses have negative significance with relative prices. Thus, monetary policy shocks seem to have persistent effects on both relative prices and relative quantities, rather than the transitory effects one would expect from differences in price flexibility across goods. The findings reject the joint hypothesis that the sticky-price models typically employed in policy analysis capture the U.S. economy and that commonly used monetary policy shocks represent exogenous shifts. Furthermore, the result shows that disaggregated prices appear sticky in response to macroeconomic fluctuations, and to monetary policy in particular, but flexible in response to sector-specific shocks

In the study title the relative price effects of monetary shocks, Balke & Wynne (2007) documented the response of the individual components of the Producer Price Index (PPI) to commonly used measures of monetary shocks and show that these responses are at variance with many widely used macro models of monetary non-neutrality. These authors estimate the responses of individual prices to a monetary policy shock by appending individual price series to a separately estimated vector autoregression (VAR). However, their estimated price responses display a considerable price puzzle, i.e., a price increase following an unexpected monetary policy tightening, which stands in sharp contrast to predictions of conventional models. The result of their study shows that monetary shocks are shown to have large relative price effects, resulting in an increase in the dispersion of the cross-section distribution of prices. Furthermore, in response to a contractionary (expansionary) monetary shock, the study shows a substantial number of prices tend to rise (fall). Most of the existing models of monetary non-neutrality are not capable of replicating these types of relative price responses.

As noted by Beraja et al. (2017) on regional heterogeneity and monetary policy, the authors argue that the time-varying regional distribution of housing equity shapes the aggregate consequences of monetary policy through its influence on mortgage refinancing. Using detailed loan-level data, the study shows that the refinancing response to interest rate cuts is strongly affected by regional differences in housing equity, and both these differences and overall refinancing vary over time with changes in the regional distribution of house price growth and unemployment. The authors built a heterogeneous household model of refinancing in order to derive aggregate implications of monetary policy from our regional evidence. The study finds that the 2008 equity distribution made spending in depressed regions less responsive to interest rate cuts, thus dampening aggregate stimulus and increasing regional

consumption inequality, whereas the opposite occurred in some earlier recessions. Taken together, their results strongly suggest that monetary policy makers should track the regional distribution of equity over time.

METHODS

Research design

This study employ quasi-experimental research design. This design is used to establish the fundamental relationship between the dependent variable and the independent variables. The study also employed both descriptive and analytical methods in its analysis.

The descriptive method employed descriptive tools such as simple tables and graphs in analyzing trends in price stickiness, income distribution and monetary policy variables in Nigeria. The analytical method used various econometric methods in estimating the relevant equations under the framework of multiple regression modeling. The study tested for the unit root and co-integration relationship among the variables. The unit root was tested using the Augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) test. In estimating the long run equilibrium and short run dynamics among the variables, the Error Correction Model (ECM) was employed.

Model specification

Following the theories and the empirical literature reviewed, which is to examine the relationship between price stickiness and monetary policy in Nigeria between the period 1985 and 2023, the study utilized the New Keynesian model with standard Calvo (1983) sticky price and no capital as considered by Clarida et al. (1999), Liu and Zhang (2010), Ireland (2005), Mordi et al. (2013), Akinlo and Apanisile (2019), Apanisile and Osinubi (2020). The model for the study captures the relationship between price stickiness and monetary policy in Nigeria. The study was anchored on New Keynesian theory.

Key players in the model are household, firm, and government.

Household

The model presumes a set of identical and infinitely lived households that make consumption and labour supply decisions, demand money and bonds, and seek to maximize:

$$\text{Max}_{QCt,\ Nt,\frac{Mt}{Pt}}\ E_0 \sum_{t=0}^{\infty} \theta^t U\ (QC_t,\ N_t,\ \frac{Mt}{Pt}) \qquad (3.1)$$

Where

E_0 = the expectation operator condition on time 0 information,

θ = the discount factor

$\frac{Mt}{Pt}$ = the money demand; subject to the budget constraint

QC_t = the quantity of good i consumed by the household in period t

$$P_tQC_t + Q_tB_t + M_t \leq + M_{t-1} + B_{t-1} + NW_tHr_t + J_t \qquad (3.2)$$

Where:

for $i \in [0,1]$ for t = 0, 1, 2, …., Pt (i) is the price of good i,

Hr_t= hours of work

NW_t = the nominal wage

B_t = purchases of one-period bonds at a price Qt

B_{t-1}= the number of bonds purchased last year,

M_t = Money demand

J_t = a lump-sum component of income

ϵ = measures the intertemporal elasticity of substitution between the differentiated goods, which is equal to the price elasticity of demand.

Using the Kuhn-Tucker approach to obtain FOC (First Order Conditions) of equations (3.1) and (3.2) and re-arrange, we have:

$$1 = \theta\ (1 + i_t)\ \{\frac{Uc(t+1)}{\mathrm{Uc(t)}}\ \frac{Pt}{Pt+1}\} \quad (3.3)$$

$$- \frac{U_{N(t)}}{U_{c(t)}} = \frac{Wt}{Pt} \quad (3.4)$$

$$- \frac{U_{M(t)}}{U_{c(t)}} = \frac{it}{1+it} \quad (3.5)$$

Equations (2.3), (2.4), and (2.5) determine the intertemporal consumption allocation (the Euler equation), the labour- leisure choice, and the money demand respectively. The equations determine the rational forward-looking household's allocation decision.

Under the assumption of a period utility given by:

$$\mathrm{u}(C_t,Nt,M_t) = \frac{C^{1-\delta}}{1-\delta} + \frac{(N)t^{1+\alpha}}{1+\alpha} + \frac{(\frac{M_t}{P_t})1-\mathrm{v}}{1-v} \quad (3.6)$$

The marginal utilities of consumption, labour and money becomes

$U_{ct} = C_t^{-\delta}$

$U_{Nt} = - N_t^{\alpha}$

$U_{Mt} = (\frac{M_t}{P_t})^{1-v}$

Substituting the marginal utilities into equations (3.3) – (3.5), we have:

$$1 = \beta Q^{-1}{}_t E\{(\frac{C_{t+1}}{C_t})^{-\alpha}\ \frac{P_t}{P_{t+1}}\} \quad (3.7)$$

$$C_t^{\delta} N_t^{\alpha} = \frac{W_t}{P_t} \quad (3.8)$$

$$\frac{M_t}{P_t} = C_t^{\frac{\propto}{v}}\ (\frac{1+i_t}{i_t})^{\frac{1}{v}} \quad (3.9)$$

Taking the log of equations 7 to 9 we have:

$$ln\mathrm{C_t}\ \mathrm{E_t}\ ln\mathrm{C_{t+1}} - \frac{1}{\propto}\ (i_t - \mathrm{p} - E_t\pi_{t+1}) \quad (3.10)$$

$$ln\mathrm{W}_t - ln\mathrm{P}_t = ln\alpha\mathrm{C}_t + ln\delta\mathrm{N}_t \quad (3.11)$$

$$ln\mathrm{M}_t - ln\mathrm{P}_t = ln\mathrm{C}_t - \gamma i_t \quad (3.12)$$

Where:

ln = Log

N_{it} = labor force used by the firm

P_t = Price level

C_t = aggregate consumption index

W_t =Wage index

M_t = Money demand index

θ = the probability of not knowing when to change the price in a given period

π_{t+1} = the steady-state with zero inflation will give

Firms

The model also assumes a variety of firms indexed by i ∈ [0,1]. Each firm produces a differentiated good, but they all use an identical technology. This is represented by the production function:

$Y_{it} = A_t N_{it}^{\ 1-\alpha}$
(3.13)

Re-arranging equation (2.13) by making N_{it} the subject. Equation (3.13) becomes

$$N_{it} = \left(\frac{Y_{it}}{A_t}\right)^{\frac{1}{1-\alpha}} \quad (3.14)$$

Where:

Y_{it} = the output produced by firm i in period t

A_t = the economy-wide technology level

N_{it} = labor force used by the firm.

One key ingredient in the New Keynesian model is price rigidity. When firms set their prices, they can do so freely. However, they do not know when the next opportunity to change price will emerge. It should be noted that, the probability of not knowing when to change the price in a given period is θ as stated in equation 3.3. This is the fraction of all firm that is stuck with the price they had last period while the remaining $1 - \theta$ firms reset their prices. All firms face an identical elastic demand schedule with price elasticity ϵ and take aggregate price level P_t and aggregate consumption index C_t as given.

Monetary Authority

The monetary authority (Central Bank) applies monetary policy according to the simple Taylor rule which is an interest rate rule for monetary policy proposed by Taylor (1993). The Taylor-type rule takes the form:

$$i_t = \alpha_r i_{t-1} + (1 - \alpha_r)(1 + \alpha_\pi)\pi_t + \beta_x(y\,) + v_t \quad (3.15)$$

Where:

i_t = short term interest rate

i_{t-1} = lag of short term interest rate

π_t = inflation rate

y_t = output (GDP: Gross Domestic Product)

v_t = monetary shock

5 In equation 3.15, the Central bank adjusts the policy instrument which is the short term interest in response to movements in inflation and output.

An alternate name for a term such as i_t is the monetary policy function. In the context of this study, i_t = MPR (Monetary Policy Rate), π_t = Consumer Price Index. Following the existing literature on price stickiness distribution and monetary policy in Nigeria, we shall adjust the above equation to the augmented form and include the Deposit Rate (RTD), and Nominal exchange rate (NER). This is because nominal exchange rate is a conversion factor, interacts with monetary factors in the long run, and a multiplier or a ratio depending on the direction of conversion. Furthermore, it impact inflation through their effect on the price of tradeable. While INT is added because of

its significant for monetary policy. An expansionary monetary policy usually leads to a temporary decrease in the level of interest rates. Conversely, contractionary monetary policy often leads to a temporary increase in short-term interest rates.

Thus, MPR is expressed as a function of gross domestic product, deposit rate, nominal exchange rate, and consumer Price Index. The augmented and modified New Keynesian monetary policy theory and price stickiness model is stated thus:

$MPR= (GDP, INT, NER, CPI, IND)$ (3.16)

Where:

MPR = Monetary Policy Rate in percentage

GDP = Gross Domestic Production in millions of Naira representing income

INT = Interest Rate in percentage

NER = Nominal Exchange Rate in percentage

CPI = Consumer Price Index in percentage

IND = Income inequality proxy by Gini coefficient

MPR as used in this study which is the dependent variable is utilized as monetary policy. GDP is utilized as the independent variable showing the level of income (Y). This is so because when GDP growth rate shows rising economic productivity, the value of money in circulation increases. This is as a result of the fact that each unit of currency can subsequently be exchanged for more valuable goods and services. This is as depicted in equation 3.3 which in a more explicit and log linear or econometric form can be expressed as:

$MPR_t=\beta_0 + \beta_1 ln(GDP)_t + \beta_2 RTD + \beta_3 CPI_t + \beta_4 NER_t + \beta_5 IND + \varepsilon_t$ (3.17)

Where:

ln = Log

ε= Stochastic error term

Log-linearization reduces the computational complexity of macroeconomic models and allows the simultaneous computation of the equations.

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ *and* β_5,

Model Estimation technique

The estimation technique/method that would be used in the above model is the descriptive and the regression analysis which is computed using the classical Ordinary Least Squares technique. Though this is dependent upon the stationarity of the variables. The technique was developed in 1997 by Pesaran and Pesaran. It is a standard least squares or linear least squares which is a method for estimating the unknown parameters in a linear regression model, with the goal of minimizing the sum of the squares of the differences between the observed responses in the given dataset and those predicted by a linear function of a set.

The chain rule (Transmission mechanism)

Where β_0 = Intercept $\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are the various slope coefficients and; ε = stochastic disturbance factor

The chain rule was also used to "calculate the derivative of $\sqrt{a + bz + cz^2}$ as the composite of the square root function and the function $a + bz + cz^2$. The chain rule is a formular that expresses the derivative of the composition of two differentiable functions f and g in terms of the derivative of f and g. More precisely, if $h = f$ of g is

the function such that h(x) = f(g(x)) for every x, then the chain rule is in Lagrange's notation;

h'(x) = *f'* (g(x)) g'(x)
(3.18)

or equivalently

h' = *(f* o *g)'* = *(f'* o *g)* * g' in Leibniz's notation. (3.19)

If a variable z depends on the variable y which itself depends on the variable x (that is y and z are dependent variables), then z depends on x as well, via the intermediate variable y. In this case, the chain rule is expressed as

$\frac{dz}{dx} = \frac{dz}{dy} * \frac{dy}{dx}$,
(3.20) and

$\frac{dz}{dx}_{x} = \frac{dz}{dy}_{y(x)} * \frac{dy}{dx}_{x'}$
(3.21)

For this study, the chain rule was applied so as to obtain the coefficient and the magnitude of the transmission mechanism. This is so because in the course of this study, price stickiness (z) depends on income inequality (y), which depends on monetary policy (x) that is, y and z are dependent variables, then z depends on x as well, via the intermediate variable y.

To institute the interactive impacts of income inequality on monetary policy, a general to specific interactive specification was adopted (Okoh and Ebi; 2013, Abang, 2023). The general equation is as depicted in equation 2. From the general equation, we specified the specific equation by removing the variable of income inequality. The reason for the interactive impact is to find out the behavior of the determinant and coefficient of monetary policy (MPR). Thus, the specific equation without income distribution variable" is as below:

$MPR = \beta_0 + \beta_1 lnGDP_t + \beta_2 INT + \beta_3 NER_t + \beta_4 CPI_t + \varepsilon_t$ (3.22)

Furthermore, for the reason that income inequality is a function of monetary policy, income inequality is also treated as an endogenous variable as captured in equation 3.23 below:

$IND_t = \delta_0 + \delta_1 lnGDP_t + \delta_2 INT + \delta_3 NER_t + \delta_4 CPI_t + \delta_5 MPR_t + \mu_t$ (3.23)

RESULTS AND DISCUSSION

Data Presentation

Table 1. Descriptive statistics result

	CPI	GDP	INT	MPR	NER	IND
Mean	74.03923	36496.71	11.32690	13.03659	115.6365	15.23250
Median	35.18747	25267.54	10.28833	13.00000	111.9433	14.00000
Maximum	342.6500	72058.26	23.24167	26.00000	411.2900	39.60000
Minimum	0.489360	13779.26	5.692500	6.000000	0.610000	6.000000
Std. Dev.	90.89834	21314.08	3.802405	3.951883	108.0246	5.663769
Skewness	1.405262	0.554990	0.965542	0.711637	1.020142	2.029979
Kurtosis	4.084061	1.682652	4.013307	4.548620	3.537065	9.915297
Jarque-Bera	15.50181	5.069413	8.124628	7.557555	7.604124	107.1743
Probability	0.000430	0.079285	0.017209	0.022851	0.022325	0.000000
Sum	3035.608	1496365.	464.4029	534.5000	4741.096	609.3000
Sum Sq. Dev.	330500.4	1.82E+10	578.3313	624.6951	466772.6	1251.053

Observations	40	40	40	40	40	40

Source: Author's computation using E-views 10 (2024).

Table 1 presents the descriptive statistics on the variables captured in this study. The main aim was to examine the underlying characteristics of the dataset used for empirical analysis. The descriptive statistics as depicted in table 4.1 showed mean values for GDP, NER, MPR, INT, CPI, and IND to be 36496.71, 115.6365, 13.03659, 11.32690, 74.03923 and 15.23 respectively. The maximum values of the variables are 342.6500, 72058.26, 23.24167, 26.00000, 411.2900 and 39.6 for CPI, GDP, INT, MPR, NER and IND respectively while their corresponding minimum values are 0.489360, 13779.26, 5.692500, 6.000000, 0.610000 and 6.00

The analysis was also fortified by the values of the skewness and kurtosis of all the variables involved in the models. The skewness is a measure of the symmetry of the histogram while the kurtosis is a measure of the tail shape of the histogram. The bench mark for symmetrical distribution i.e. for the skewness is how close the variable is to zero. An analysis of skewedness of the distribution shows that all the variables are positively skewed.

Unit Root Test

The unit root test was conducted with the aim of establishing the stationarity conditions of the variables. The test was based on the Augmented Dickey-fuller (ADF) test as well as the Phillips-Perron test. The result of the stationary test below (table 2) shows that all the variables were non-stationary at levels i.e. I (0). This is because both their ADF and PP statistic values are less than the critical table values at either 5 or 10 percent level of significance. Thus we accept the alternative hypothesis of stationarity, implying that the tests strongly support the hypothesis that all the variables are stationary, and that they are particularly of a random walk.

The PP test also produced similar results. In all, stationarity was achieved for all variables at level. The existence of stationarity of the variables at level or the same order then provides a justification for using the ordinary least squares regression technique.

Table 2. Unit root test result using Augmented Dickey-Fuller (ADF) and Phillips-Perron tests

Variables	**ADF**			**Phillips-Perron**		
	Level	1st Difference	Order of Integration	Level	1st Difference	Order of Integration
MPR	-3.365079	-	I(0)	-3.323491	-	I(0)
GDP	-2.771881	-	I(0)	-2.940674	-	I(0)
INT	-3.079843	-	I(0)	-2.939306	-	I(0)
NER	-3.114260	-	I(0)	-3.161851	-	I(0)
CPI	-4.914244	-	I(0)	-4.59409	-	I(0)
IND	-3.922764	-	I(0)	-2.993241	-	I(0)

ADF test critical test values. Phillip-Peron test critical values

Level:	1st Difference:	Level:	1st Difference:
5% = -2.936942	5% = -2.945842	5% = -2.936942	5%= -2.938987
10% = -2.606857	10% = -2.611531	10% = -2.606857	10%= -2.607932

Source: Author's computation using Eviews 10 (2024).

Granger causality test

The granger causality test was done so as to determine the causal relationship and the nature of causality between price stickiness and monetary policy. The result obtained as presented in table 3 shows that there is unidirectional causality between monetary policy (MPR) and price stickiness (CPI). Thus, the null hypothesis that price stickiness (CPI) does not granger cause monetary policy (MPR) was rejected while the alternative hypothesis that monetary policy does not granger price stickiness was accepted. This implies that monetary policy granger cause price stickiness in Nigeria. Similarly, the result likewise shows that there is a unidirectional causality running from MPR to IND. This implies that the null hypothesis that monetary policy does not Granger cause income distribution was rejected while income distribution does not Granger cause monetary policy was accepted. This means that monetary policy causes income distribution.

Table 3. Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision
MPR does not Granger Cause CPI	40	0.97366	0.3880	Accepted
CPI does not Granger Cause MPR		6.07142	0.0239	Rejected
MPR does not Granger Cause IND	40	4.08457	0.0256	Rejected
IND does not Granger Cause MPR		1.43530	0.8239	Accepted

Source: author's computation using E-views 10 (2024).

Table 4. Correlation Matrix

Variabel	MPR	GDP	NEX	IND	CPI	INT
MPR	1.000000	-0.150798	0.212759	-0.411985	-0.427029	-0.527631
GDP	-0.150798	1.000000	-0.328379	0.297846	0.540783	0.502549
NEX	0.212759	-0.328379	1.000000	0.002900	-0.228518	-0.275683
IND	-0.411985	0.297846	0.002900	1.000000	0.087707	0.340597
CPI	-0.427029	0.540783	-0.228518	0.087707	1.000000	0.406041
INT	-0.527631	0.502549	-0.275683	0.340597	0.406041	1.000000

Source: Authors' computation (2024)

Table 4 above shows the correlation matrix, which measure the degree of linear relationship between each pair of variables. The correlation values can fall between -1 and +1. -1 indicates a perfectly negative linear correlation between two variables. 0 indicates no linear correlation between two variables. 1 indicates a perfectly positive linear correlation between two variables. From the result as shown in table 5, the result shows that all the variables that enter the model are perfect positive and are correlated.

Ordinary Least Square result

The empirical results of the estimated regression line are presented in tables 5 and 6 below, which depicts results with income inequality and without income inequality respectively. This is so as to determine the behavior and interactive reaction of the variables. The regression table shows the results of the analysis in our study based on the OLS. The" result of MPR was regressed on explanatory variables (GDP, NER, IND, CPI, INT) and also shows the relationship between the dependent and explanatory variables with and without the interactive variable which is IND as a measure of income inequality. The R^2 and Adj R^2 of both results represent a good fit. autocorrelation, leading to the adoption of the Cochrane orcutt iterative.

Table 5. OLS result with income inequality

Dependent Variable: MPR				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**

LGDP	37.57379	41.07028	0.914866	0.3665
NER	0.145792	0.747806	0.194960	0.8466
IND	-5.247042	2.782333	-1.885842	0.0676
CPI	-4.777758	2.856333	-1.672689	0.1033
INT	-19.68494	11.34380	-1.735304	0.0915
C	2214.361	181.5313	12.19823	0.0000

Source: Authors' computation (2024)

Table 6. Ols result without income inequality

Dependent Variable: MPR				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LGDP	-0.043853	0.039225	-1.117971	0.2710
NER	0.001699	0.000659	2.578893	0.0141
CPI	-0.003597	0.002053	-1.752162	0.0883
INT	-0.020107	0.008602	-2.337409	0.0253
C	7.311529	0.140591	52.00577	0.0000

Source: Authors' computation (2024)

Cochrane Orcutt and interactive impact of income inequality

The Cochrane or Cutt iterative method is used to estimate higher order auto regressive schemes. It is used to correct for autocorrelation in regression analysis when the "Durbin Watson statistics are very low in the OLS estimation violating the assumption of independent errors. Autocorrelation, which was previously noted in the OLS in tables 5 and 6 above, was eliminated after the Cochrane orcutt method was applied. regressed on explanatory variables. From our results in tables 7 and 8, the coefficient of determination R^2 is 0.95 and 0.83 respectively. While Adj R^2 is 0.88 and 0.81 in tables 7 and 8 respectively Durbin Watson statistics of 1.96 and 2.07 show that there is no auto correlation in both models. This means that findings from this study can be applied in the Nigerian economy for policy formulations.

Table 7. Cochrane Orcutt Result With Income Inequality (Ind)

Dependent Variable: MPR				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LGDP	1.022598	0.008532	6.648615	0.0119
NER	-8.075246	0.018471	-4.284016	0.0380
IND	-0.900463	2.835891	-5.317524	0.7527
CPI	-7.399388	11.97045	-3.675208	0.0008
INT	6.703007	6.664508	1.735304	0.0021
C	22.37760	205.1648	12.19823	0.0000

Source: Author's computation (2024)

Table 8. Cochrane Orcutt Result Without Income Inequality (Ind)

Dependent Variable: MPR				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LGDP	0.879370	0.000294	3.257104	0.0175
NER	-6.514156	13.09845	-5.573668	0.0501
CPI	-4.934989	12.69671	-2.624964	0.0363
INT	8.014280	14.37012	5.253629	0.0188
C	1360.007	205.1648	6.628855	0.0000

Source: Author's computation (2024)

Comparatively, the empirical results as provided in tables 7 and 8 prove and show that income inequality has impact and it serves as a pass-through effect in causing MPR (monetary policy) to increase or reduce further than when it is not included. This is seen in the coefficient values of GDP, NER, CPI and INT when income inequality is included being greater than the values when income inequality is not included. This thus seems that the diminishing coefficient of GDP, NER, CPI and INT renders the price stickiness-income inequality nexus significant. This may suggest that successful implementation and management of income inequality may to a great extent, depending on the prevailing" "monetary policy, target a more acceptable level of income equality which will drive reducing the level of price stickiness that will directly or indirectly bring about a monetary policy that will help curb price stickiness and reduce income inequality.

Transmission channels of income distribution

Having established the notion of price stickiness with the interactive link of income inequality, thus, for the reason that income inequality is a function of monetary policy, income inequality is also treated as an endogenous variable to ascertain the transmission channel as captured in equation 3.23 previously stated as:

$IND_t = \delta_0 + \delta_1 ln\text{GDI}_t + \delta_2\text{NER}_t + \delta_3\text{CPI} + \delta_4\text{INT} + \delta_5\text{MPR} + \mu_t$

The results as shown in table 9 show that the log of, price stickiness (CPI) and interest rate and monetary policy rate has a negative relationship with income inequality. Thus a 10 per cent increase will cause income inequality to decrease by 0.99, 1.46 and 14.09 per cent respectively. While the log of gross domestic product and nominal exchange rate has a positive relationship with income inequality. All the variables are statistically significant at 5 per cent level of significance except exchange rate whose probability ratio is less than the 5” per cent level of significance.

Table 9. OlsResult Income Inequality As A Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	6.542932	3.058531	4.139240	0.0397
NER	0.086464	0.049047	1.762886	0.0869
CPI	-0.098501	0.145989	-4.674715	0.0044
INT	-0.146477	0.668424	-6.219138	0.0279
MPR	-1.408950	3.204138	-0.439728	0.6629
C	283.5260	92.01042	3.081456	0.0041

Source: Authors' compilation (2024)

Income inequality channel transmission on price stickiness and monetary policy equation:

Where the product of the previously identified significant values of:

$\frac{\partial MPR}{\partial IND} = \frac{\partial MPR}{\partial CPI} * \frac{\partial CPI}{\partial IND} = \lambda_1 * \delta_1$

$\frac{\partial MPR}{\partial CPI}$ which is $\lambda_1 = 1.022598$

$\frac{\partial CPI}{\partial IND}$ which is $\delta_1 = 6.542932$

and their product (i.e. $\lambda_1 * \delta_1$) yields 6.69 approximately.

This result shows that a 10 per cent increase in income inequality, will first go through inflation to produce an adverse effect on monetary policy rate. The results thus suggest that an upward trend in income inequality, will have a positive pass-through effect on price stickiness before exacting a negative effect on monetary policy rate. Thus the magnitude of the effect of price stickiness through income inequality

is 6.54. This simply implies that a 10 per cent increase in income inequality will increase the impact of price stickiness causing monetary policy rate to increase by 6.69 per cent. The adverse effect of price stickiness to inform decisions by the monetary authority stems from the fact that within the study scope, empirical evidence has shown that the policies have been implemented or set aside for this purpose (monetary policy rate) have not been followed or properly implemented to the latter.

Diagnostic Test

Heteroscedasticity Test, LM Test and Q Test

To ascertain the adequacy of the estimated equation, several diagnostic tests were conducted. Normality tests such as the Breusch-Godfrey serial correlation Lagrange Multiplier (LM) test, and the Q-statistics were employed to check the existence of the normality or adequacy of the estimated model.

The results of the tests are summarized in Table 10. The Breusch-Godfrey serial LM test statistic of 0.786629 with its high probability value of 0.4690 showed that there is no problem of autocorrelation in the model. This is confirmed by the fact that the Chi-square probability value of 0.300 is higher than the 5 percent significance level. This indicates that the residuals terms are independent and hence there is no autocorrelation in the estimated equation. Meanwhile, the Breusch-Pagan-Godfrey heteroskedasticity test statistic of 1.573990 with its probability value of 0.1757 showed that the residuals have constant variance and hence there is no problem of heteroskedasticity in the model. This is confirmed by the fact that the probability value of the observed Chi-squared is 0.1837 which is greater than the 5 percent significance level.

Similarly, the Q-statistics as shown in table 11 showed that the series is white noise, and hence there is no auto-correlation among the residual terms in the model as the probability values are all higher than 5 percent significance level. This also means that the value of the residual in one particular period was independent or unrelated to the value of the residual terms in another period. That also implied that the co-variation between the residuals was zero. The conclusion from the various test conducted showed that the estimated equation is adequate and well-behaved.

Table 10. Diagnostic Test

Test Statistic Value (pob.)			
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.786629.	Prob. F (2,20)	0.4690
Obs. R-squared	2.406568	Prob. Chi-Square(2)	0.3002
Breusch-Pagan-Godfrey Heteroskedasticity Test			
F-statistic	1.573990	Prob. F(11,22)	0.1757
Obs. R-squared	14.97365	Prob. Chi-Square(11)	0.1837

Source: Author's computation using E-views 10.

Table 11. Q-Statistic Test

Lag	**AC**	**PAC**	**Q-Stat**	**Prob***
1	-0.057	-0.057	0.1189	0.730
2	-0.169	-0.173	1.1881	0.552
3	0.062	0.042	1.3351	0.721
4	-0.018	-0.043	1.3486	0.853
5	-0.079	-0.068	1.6072	0.900
6	0.064	0.044	1.7803	0.939
7	-0.187	-0.211	3.3304	0.853

8	-0.112	-0.119	3.9064	0.865
9	0.109	0.019	4.4786	0.877
10	-0.099	-0.135	4.9749	0.893
11	-0.061	-0.056	5.1681	0.923
12	-0.008	-0.114	5.1713	0.952
13	-0.016	-0.052	5.1852	0.971
14	0.055	0.004	5.3719	0.980
15	-0.113	-0.227	6.1842	0.976
16	-0.089	-0.126	6.7202	0.978

Source: Author's computation using E-views 10 (2024)

Discussion

From the analysis of the result of this study, it can be seen that the impact on monetary policy in Nigeria holding all variables constant is positive and highly significant with a probability rate of 0.00. The result for monetary policies showed for also, that gross domestic product has a positive impact on monetary policy rate in Nigeria. From the analysis of the result of this study, it can also be seen that price stickiness (CPI) has a negative and significant impact on monetary policy rate with income inequality serving as a transmission mechanism. Some findings and implications can be highlighted from the result. First, the Granger causality result shows the existence of a unique uni-directional relationship between monetary policy and price stickiness and also income inequality. Therefore, the null hypotheses of absence of causality is rejected while the alternative hypothesis is retained. This signifies the relevance of these variables and income inequality as a pass through mechanism in contributing to the decision of either increasing or decreasing monetary policy rate.

This result shows that a unit increase in income inequality, will first go through price stickiness, to produce an adverse minute effect on the decision of monetary policy rate. Deduced point from the above, the estimate suggest that an upward trend in income inequality will have a positive pass-through effect on price stickiness, before exacting a negative effect monetary policy rate

With regards the price stickiness and monetary policy rate equation, the results reported in table 7 shows that the sign of the interaction term is negative and not significant at 5 per cent level of significant. Thus, we find the magnitude of GDP, NER, CPI and INT decrease from 1.023, to -0.88, -8.08 to -6.51, -7.40 to -4.93 with exception of interest rate which rather increased from 6.70 to 8.01 respectively

The income inequality is negative implying that the more unequal is the income distribution, the higher the negative effect of price stickiness on monetary policy rate in Nigeria. A wage increase with regards to income distribution, largely resulting from the deliberations of wages and salary commissions has been consistent in determining price stickiness. The main mechanism by which this is done is the announcement effect of the commission's awards which usually reverberates to wage and non wage incomes so that every group/individual seeks to improve, or at least maintain its existing position relative to others. An extreme demonstration of this competition is borne out by the fact that in some cases producers and sellers increase the prices of their goods in anticipation of wage increases so as to bridge the gap in income inequality, usually to be followed by additional increases when the awards have" actually been affected (Abang, 2023).

CONCLUSION

This study was undertaken to empirically investigate the impact of price stickiness, income inequality nexus on monetary policy in Nigeria. There have been a dearth

study, if any, have had to examine these effects using the chain rule to ascertain the transmission level and magnitude of transmission as was done in this study. The study applied the augmented Dickey-fuller (ADF) test, the Phillip-Peron test, Ordinary Least Square (OLS), Granger Causality test and the diagnostic test. A time series data that spanned a period of thirty forty-three years, from 1981 to 2023 was utilized. The granger causality test shows that there is a causal relationship between price stickiness and monetary policy.

Policy Recommendations

Based on the findings of the study, the following recommendations are made:

The positive and significant impact of monetary policies holding all other variables constant showed that monetary policy will have a positive effect on all the variables. should be sustained. Specifically, the exchange rate policies aimed at preserving the value of the domestic currency, maintaining a favourable external reserves position and ensuring external balance should be pursued by the monetary authorities and allow floating of the exchange rate.

Monetary authorities are also encouraged to decrease the MPR. This will allow the banks to have enough cash to give to industries, the manufacturing sector and especially the small and medium enterprise. This will thus lead to creating of jobs to will lead to a balance or reduction in the income inequality It decreases interest rate and therefore encourages lending and investment and by extension, increase in output. Monetary authorities must however be wary of the tendency of an increase in money supply to lead primarily to inflation. Monetary authorities must ensure viable productive potentials in the economy respond positively to the rise in money supply.

REFERENCES

Abang, S. O. (2023). *Economic policies, income distribution and inflation in Nigeria* (Doctoral dissertation, University of Calabar). Department of Economics, Post Graduate School, University of Calabar.

Akinlo, A. E., & Apanisile, O. T. (2019). Monetary policy shocks and effectiveness of channels of transmission in Nigeria: A dynamic stochastic general equilibrium approach. *Global Business Review, 20*(2), 1–23.

Apanisile, O. T., & Osinubi, T. T. (2020). Financial development and the effectiveness of monetary policy channels in Nigeria: A DSGE approach. *Journal of African Business, 21*(2), 193–214. https://doi.org/10.1080/15228916.2019.1625021

Balke, N. S., & Wynne, M. A. (2007). The relative price effects of monetary shocks. *Journal of Macroeconomics, 29*(1), 19–36. https://doi.org/10.1016/j.jmacro.2005.04.002

Beraja, M., Fuster, A., Hurst, E., & Vavra, J. (2019). Regional heterogeneity and monetary policy. *Quarterly Journal of Economics, 134*(1), 109–183. https://doi.org/10.1093/qje/qjy021

Bils, M., Klenow, P. J., & Kryvtsov, O. (2003). Sticky prices and monetary policy shocks. *Federal Reserve Bank of Minneapolis Quarterly Review, 27*(1), 2–9. https://doi.org/10.21034/qr.2711

Boivin, J., Giannoni, M. P., & Mihov, I. (2009). Sticky prices and monetary policy: Evidence from disaggregated US data. *American Economic Review, 99*(1), 350–384. https://doi.org/10.1257/aer.99.1.350

Burdett, K., & Mortensen, D. T. (1998). Wage differentials, employer size, and

unemployment. *International economic review*, 257-273. https://doi.org/10.2307/2527292

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics, 12*(3), 383–398. https://doi.org/10.1016/0304-3932(83)90060-0

Chugunov, I., Pasichnyi, M., Koroviy, V., Kaneva, T., & Nikitishin, A. (2021). Fiscal and monetary policy of economic development. *European Journal of Sustainable Development*, *10*(1), 42-42. https://doi.org/10.14207/ejsd.2021.v10n1p42

Clarida, R., Galí, J., & Gertler, M. (1999). The science of monetary policy: A New Keynesian perspective. *Journal of Economic Literature, 37*(4), 1661–1707. https://doi.org/10.1257/jel.37.4.1661

Coibion, O., Gorodnichenko, Y., Kueng, L., & Silvia, J. (2017). Innocent bystanders? Monetary policy and inequality. *Journal of Monetary Economics, 88*, 70–89. https://doi.org/10.1016/j.jmoneco.2017.05.005

Cravino, J., Lan, T., & Levchenko, A. A. (2020). Price stickiness along the income distribution and the effects of monetary policy. *Journal of Monetary Economics*, *110*, 19-32.

Diamond, P. (1971). A model of price adjustment. *Journal of Economic Theory, 3*(2), 156–168. https://doi.org/10.1016/0022-0531(71)90010-0

Epstein[1], G. (2007). Central banks as agents of economic development. *Institutional change and economic development*, *1*, 95.

Ihimoyan, M. K., Enyejo, J. O., & Ali, E. O. (2022). Monetary Policy and Inflation Dynamics in Nigeria, Evaluating the Role of Interest Rates and Fiscal Coordination for Economic Stability. *International Journal of Scientific Research in Science and Technology. Online ISSN*.

Ireland, P. N. (2005). The monetary transmission. *Federal Reserve Bank of Boston Working Paper Series*, No. 05-1. https://doi.org/10.2139/ssrn.687231

Levchenko, A., Cravino, J., & Lan, T. (2018). *Price stickiness along the income distribution and the effects of monetary policy* (No. 12967). CEPR Discussion Papers. https://doi.org/10.1016/j.jmoneco.2018.12.001

Liu, L., & Zhang, W. (2010). A New Keynesian model for analyzing monetary policy in Mainland China. *Journal of Asian Economics, 21*(6), 540–551. https://doi.org/10.1016/j.asieco.2010.08.001

Mordi, C. N. O., Adebiyi, M. A., Adenuga, A. O., Abeng, M. O., Adeboye, A. A., Adamgbe, E. T., & et al. (2013). *Dynamic stochastic general equilibrium model for monetary policy analysis in Nigeria*. Research Department, Central Bank of Nigeria.

Nakamura, E., & Steinsson, J. (2008). Five facts about prices: A reevaluation of menu cost models. *Quarterly Journal of Economics, 123*(4), 1415–1464. https://doi.org/10.1162/qjec.2008.123.4.1415

Obafemi, F. N., & Ifere, E. O. (2015). Monetary policy transmission mechanism in Nigeria: A FAVAR approach. *International Journal of Economics and Finance*, *7*(8), 93-103. https://doi.org/10.5539/ijef.v7n8p229

Ononugbo, M. C. (2012). *Monetary policy in developing countries: The case of Nigeria.* University of Leeds.

Oyedokun, A. I. (2020). *Examining price setting behaviour in Namibia: Evidence from*

the manufacturing sector (Doctoral dissertation, University of Namibia).

Schmitt-Grohé, S., & Uribe, M. (2004). Optimal fiscal and monetary policy under sticky prices. *Journal of economic Theory*, *114*(2), 198-230. https://doi.org/10.1016/S0022-0531(03)00111-X