Cuadernos de Economía (2023) 46, Issue 130 Page 21-30

Asociación Cuadernos de economía

Cuadernos de economía

www.cude.es

ARTÍCULO

Monetary Policy in Indonesia: Dynamics of Inflation, Credibility Index and Output Stability Post Covid 19: New Keynesian Small Macroeconomics Approach

Dede Ruslan[1*], Ahmad Albar Tanjung[2], Irsad Lubis[3], Kiki Hardiansyah Siregar[4], Ikbar Pratama[5]

[1]Universitas Negeri Medan, Sumatera Utara, Indonesia; drasruslan@unimed.ac.id; https://orcid.org/0000-0001-8536-357X
[2]Sekolah Tinggi Ilmu Manajemen Sukma, Sumatera Utara, Indonesia; https://orcid.org0000-0001-8185-7484
[3]Universitas Sumatera Utara, Sumatera Utara, Indonesia; https://orcid.org/0009-0002-9788-7439
[4]Universitas Pancabudi, Sumatera Utara, Indonesia; https://orcid.org/0009-0009-0689-2146
[5]Universitas Medan Area, Sumatera Utara, Indonesia https://orcid.org/0000-0002-7897-2737
[*] Correspondence: drasruslan@unimed.ac.id; ORCID: https://orcid.org/0000-0001-8536-357X

Jel Codes:

M14; N14

Keywords: Monetary authority, inflation, level of credibility, output stability, Keynesian small macroeconomics approach.

Abstract: This study uses the new Keynesian small macroeconomics approach to investigate how the inflation dynamics, level of credibility, and output stability influence the reaction function of the monetary authority. This study utilizes time series data from January 2021 through April 2022. The developed estimation model is based on the New Keynesian Small Macroeconomics model when examining the reaction function of monetary policy in Indonesia using the 3SLS Model estimation. The nominal interest rate is the primary instrument of the central bank's reaction function, which expressly incorporates the credibility index of the monetary policy included in the expected inflation model. The study results indicate that the credibility index of monetary policy converges with macroeconomic variables with an average credibility index, meaning that economic agents have a high degree of credibility with Bank Indonesia's monetary policy. Aspects of aggregate demand, the central bank's policy to stabilize prices through nominal interest rates that directly affect aggregate demand, and from the perspective of aggregate supply as a proxy, the new Keynesian Phillips curve model demonstrates that the model coefficient is significantly different from zero in situations where changes in demand are not immediately responsive to price increases.

Author Correspondence: drasruslan@unimed.ac.id
https://doi.org/10.32826/cude.v1i130.1003

1. Introduction

After more than five decades of the Great Moderation, the trend of inflation rates in both developed economy (AE) and emerging market (EM) countries has decreased, and inflation rates have increased over the past year (Figure 1). The Covid-19 pandemic has pressured many facets of life, including efforts to accelerate economic development, fraught with unpredictability. Inflation was higher than in previous decades (Song & Zhou, 2020). The global economy slowed more than anticipated and to a greater extent than anticipated. The cost-of-living crisis, constricting financial conditions in most regions, Russia's invasion of Ukraine, and the protracted COVID-19 pandemic have all weighed heavily on global economic growth prospects. Alam et al. (2023) forecast a rise in global inflation from 4.7 percent in 2021 to 8.8 percent in 2022, followed by a decline to 6.5 percent in 2023 and 4.1 percent in 2024.

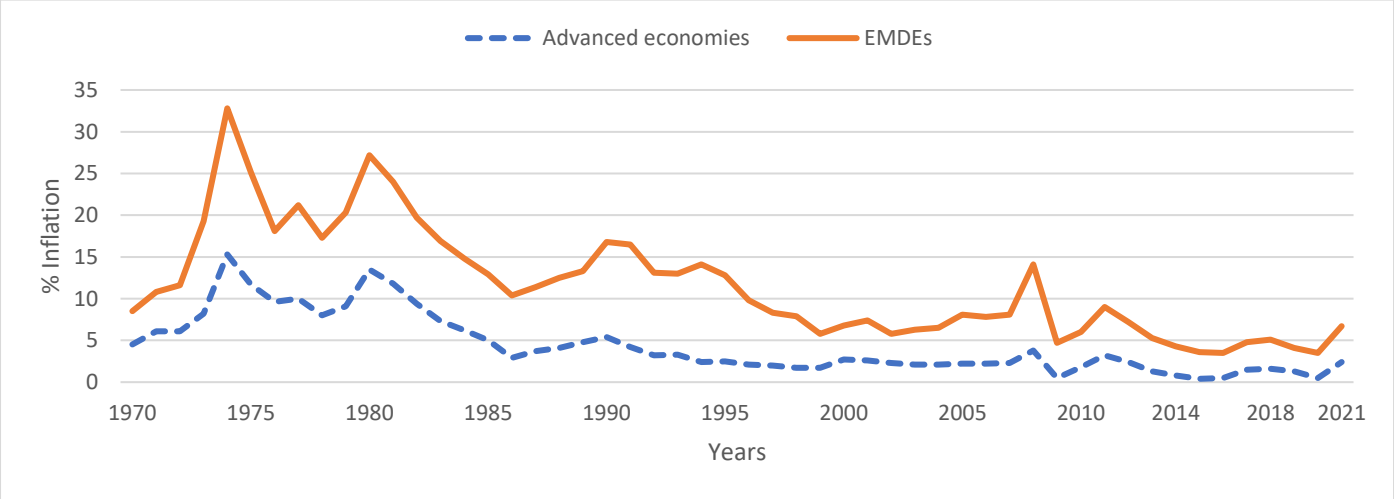

Figure 1: Inflation at advance economies and Emerging Market and Development Economies
Sources: International Monetary Fund

The COVID-19 pandemic has severely disrupted economic activity in Indonesia and around the globe. Lockdowns and the policy of Large-Scale Social Restrictions (PSBB) have impacted supply and demand via multiple channels that interact in a complex manner. As a result of economic actors' inability or unwillingness to consume and/or invest, the outbreak of the pandemic sharply reduced aggregate demand for the Indonesian economy (Ha, 2023). Given the substantial evidence of a flat Philip's curve and where it will continue, the rise in inflation in several developed nations has sparked a heated debate among macroeconomists (Mik & Nosko, 2023; Tambunan et al., 2022; Uddin & Rahman, 2022).

To maintain low and stable levels of inflation, the credibility of monetary policy is crucial to the success of monetary policy. This is because, in general, monetary policy activism is always confronted with credibility and uncertainty issues regarding monetary policy instruments. Establishing consistent and systematic expectations from monetary authorities establishes monetary policy credibility. Authority is the motivation for monetary policy to increase aggregate output above natural output. The monetary authority can attain this objective by creating an inflationary surprise. Inflation shocks will lead to a decrease in real salaries, thereby increasing labor demand. Monetary authorities with a policy inconsistent with time consistently generate an inflation bias (Chenet et al., 2021; Desson et al., 2020; Tambunan et al., 2022). An imperfect monetary policy transmission mechanism is uncertainty from monetary policy instruments. Non-rational expectations of uncertainty promote conservatism, specifically the conservative use of monetary policy instruments (Chenet et al., 2019). Increasing monetary policy efficacy and monetary authorities' capacity to stabilize the economy can reduce uncertainty. The credibility and unpredictability of monetary policy instruments will lead to activism-conservatism in monetary policy. The credibility and unpredictability of monetary policy necessitate a precise specification of the reaction function of the monetary authority (Kabundi & Mlachila, 2019; Tanjung et al., 2022). The credibility of monetary policy is associated with the activism and systematics of monetary policy instruments, while the uncertainty of monetary policy instruments is associated with the conservatism and systematics of monetary policy instruments (Montes & Ferreira, 2019; 2020). The credibility and unpredictability of monetary policy suggest applying a model with the parameters of credibility and uncertainty integration. Increased uncertainty will reduce the inflation bias and the ability of monetary authorities to stabilize the economy (Gayaker et al., 2021).

Previous studies, including those by Gayaker et al. (2021), Montes and Ferreira (2019), and Kabundi and Mlachila (2019), have examined the issue of monetary policy credibility, the problem of uncertainty in monetary policy instruments associated with dynamic inflation. Based on these findings, the monetary policy credibility index is in the limelight. Backward- and forward-looking agents can perceive the relationship between output and the credibility of monetary policy. The backward-looking agent contends that credibility is determined by the ability of the previous monetary policy to achieve its objectives. In contrast, the forward-looking agent believes that a credible monetary policy will be able to achieve its goals following inflation expectations. These studies highlight the significance of incorporating aspects of the credibility index into the endogenous model to evaluate these policies' effects on macroeconomic variables, particularly output stability. This study will investigate how inflation dynamics and the level of credibility and output stability influence the reaction function of the monetary authority using the new Keynesian small macroeconomics approach between January 2021 and April 2022.

2. Literature Review and Theoretical Model

When maximizing social welfare, monetary authorities always consider aggregate output and inflation. A quadratic function represents the general form of the Social Loss Function of the central bank, specifically:

$$L = (y - y^*)^2 + A\ \ \pi^2 \quad (1)$$

where y, y^*, π and A is the actual aggregate output, the aggregate output target, the inflation rate and the monetary authority's degree of aversion to inflation, and aggregate output deviation [A > 0], where A measures the monetary authority's cost of preventing inflation. The aggregate output model with inflation used is the Phillips Curve model from Lucas (1973), namely:

$$y = y_n + \beta\ \ [\pi - E(\pi)] \quad (2)$$

Where E(π), y_n, and β are inflation expectations, natural output, and the slope of the Phillips Curve, respectively. This model is a standard model of the credibility of the monetary policy transmission mechanism. Suppose the price equation is always a forward-looking framework that only depends on expected inflation and considers the trade-off between inflation and output in capturing inflation persistence on the other side (Granville & Zeng, 2019). In that case, inflation will depend on weighted expectations and lagged inflation, output gaps, and deviations from the real exchange rate, which reflect the credibility of the monetary policy transmission mechanism. Thus, Philip's inflation equation becomes the following:

$$\pi = \theta_1 E(\pi) + (1 - \theta_1)\pi_{-1} + \theta_2 \Delta y_{-1} + \theta_2 \Delta s_{-1} \quad (3)$$

where $E(\pi), \pi_{-1}, \Delta y_{-1} + \theta_2\ and\ \Delta s_{-1}$) are inflation expectations over the 4 quarters, respectively, changes in the consumer price index, past inflation, changes in the output gap, and deviation of real exchange rates. According to En et al. (2020), expected inflation is determined by examining the inflation target and the historical average inflation rate. Under the assumption that there is price level rigidity and that rational economic actors cannot adjust instantly to these changes, the following principles can be used to formulate inflation expectations in this study:

$$E(\pi) = (IC)\pi^* + (1 - IC)\pi_{+1} \quad (4)$$

IC is an indicator of the credibility of monetary policy, meaning that economic actors will have confidence in monetary policy. If economic actors believe in monetary policy, then IC = 1, and the actors will make their decisions based on the inflation target set by the central bank (π^*) and if they do not believe, then the expected inflation rate will be formed following the information provided. it has, thus implying that IC = 0 and expected inflation equals π_{+1}.

In various literature, two main tools are used to measure credibility problems. The first refers to the Bomfim et al. (2000) approach. The second measure of central banks' credibility refers to the gap between private sector inflation expectations and the inflation target. The index from Kabundi et al. (2019) defines credibility as the inverse function of the gap between inflation expectations and the inflation target. The index was extended by de Mendonça et al. (2009), opening this index by replacing the inflation target point with a target range and considering the possible loss of credibility for negative deviations. Various tools are used to calculate the credibility index of monetary policy, including the approach from the Cecchetti et al. (2002) index, namely:

$$IC = \begin{cases} 1 & jika\ \pi^e \leq \pi^* \\ 1 - \frac{1}{20\% - \pi^*}[\pi^e - \pi^*] & jika\ \pi^* < \pi^* < 20\% \\ 0 & jika\ \pi^e \geq 20\% \end{cases} \quad (5)$$

Where IC, $\pi^*, \pi^*$are the credibility index of monetary policy, inflation target, and inflation expectation. Meanwhile, the factors affecting the credibility index of monetary policy follow the model developed by Dovern et al. (2012), who found that the credibility of the central bank is explained by the inflation rate (π), inflation volatility (π^v) as a permanent shock to inflation, and monetary policy uncertainty as indicated by the square of the interest rate change (Δr_t^2) and the output gap (y_t).

In this study, monetary policy variables will be included in the monetary credibility index (IC) following the model developed by Laxton-Kane et al. (2002), namely:

$$IC = \frac{(RB - RB^H)^2}{(RB - RB^H)^2 + (RB - RB^L)^2} \quad (6)$$

Where RB is the long-term interest rate, with index H being the highest RB value and L being the lowest RB value. If the RB is high, it indicates that inflation is also high; consequently, the parameter value of the credibility index of monetary policy tends to be zero, IC = 0, and vice versa. If the RB is minimal, then the credibility of monetary policy is high, IC = 1. Thus, under equilibrium conditions, that is, if there are no deviations in output and the exchange rate, and with the credibility of a perfect monetary policy, the inflation rate will equal the target inflation rate.

In a state of disequilibrium characterized by output and exchange rate deviations, the central bank will stabilize the value of its currency to maintain the stability of the payment system; consequently, output and exchange rate will be determined endogenously. This relates to the central bank's utility function, which reflects policymakers' preferences in balancing output fluctuations and inflation. To achieve its objective of minimizing the social loss function, the Central Bank is always constrained by the supply-side model of the economy, which demonstrates a linear relationship between the output level and inflation. The IS equation is formed on the aggregate demand side by combining the expected intertemporal household consumption with the intertemporal budget constraint, which is solved using the Euler equation. Optimal household (private) consumption, C_t, is obtained by maximizing the expectations of intertemporal household utility and intertemporal budget constraint (Bortolomeo et al. (2003), which begins with the supposition of a closed economy through the following equation:

$$\hat{y}_t = \pi_1 E_t[\hat{y}_{t+1}] + \pi_2 \hat{y}_{t-1} - \alpha(r_t - E_t[\Delta p_{t+1}] - rr_t) + u_t \quad (7)$$

Equation (7) is a dynamic generalization of the IS curve derived from the consumer optimization problem, where $\hat{y}_t = y_t - y_t^0$ is the output gap, which is defined as the difference between actual output and potential output, r_t is the nominal interest rate, Δp_t is the inflation rate, and rr_t is the potential real interest rate. The IS equation is a forward-looking aggregate so that the output gap can be directly affected by the leadership gap, the last gap, changes in real exchange rates, real interest rates, and government spending from the aspect of interaction with fiscal policy. The real exchange rate using the purchasing power parity assumption can be calculated as follows:

$$re_t = e_t + p_t^* - p_t \quad (8)$$

Where $e_t, p_t^*\ and\ p_t$ are nominal exchange rates and foreign and domestic price levels, which can be proxied from the consumer price index.

In reality, the central bank's objective is to stabilize the exchange rate while utilizing a floating exchange rate regime. This demonstrates that the exchange rate is an endogenous variable. Uncovered interest parity (UIP) is one of the most empirically examined theories in international financial literature that examines the relationship between interest rates and exchange rates. Engel et al. (2019) experimented by developing a monetary model based on Uncovered interest parity (UIP) and rational expectations. He also considered deviations from UIP/rational expectations, including foreign exchange risk premiums, personal information, and

expectations that are close to rational. Uncovered interest parity (UIP) is expressed as follows:

$$e_t = E(e_{t+1}) + i_t^* - i_t + \varepsilon_t \quad (9)$$

Where $e_t, E(e_{t+1}), i_t^*, i_t$ are nominal exchange rates, expected exchange rates, and changes in foreign and domestic interest rates. Taylor explains the instrument of interest rates in the Taylor rule, which states that it is preferable to use interest rates as the primary monetary instrument to maintain economic stability in the short term and attain a low inflation rate in the long term. Using an interest rate model, Avdjiev et al. (2019) determined that the central bank's reaction function in attaining its objectives is related to inflation. This model demonstrates that the lagged nominal interest rate determines the interest rate, which also incorporates the variable output differential and the real exchange rate.

3. Methodology

This study aims to analyze how the response of various macroeconomic variables to monetary policy shocks is below the level of credibility by focusing on how the function of the monetary authority's reaction is influenced by the dynamics of inflation and the level of credibility and output stability using the new Keynesian small macroeconomics approach from January 2021 to April 2022 post-covid 19. The developed analytical model is based on the new Keynesian approach with several assumptions, including first, that money is neutral; this entails that in the short-term model, there is a deviation from the real variable that disappears over time. Second, it assumes that economic agents' expectations are rational. Price rigidity prevents the market mechanism from attaining output potential immediately. To attain the price and output stability objective, the central bank must therefore intervene. The fact that the central bank intervenes indicates that a credible monetary policy is essential for attaining the desired inflation and output stability. Based on the above literature review, the following structural theoretical model was developed:

Model of Aggregate Demand:

$$y_t^{Gap} = \alpha_{11}E_t y_{t+1}^{Gap} + \alpha_{12}y_{t-1}^{Gap} + \alpha_{13}rr_t + \alpha_{14}\Delta RER_t + \alpha_{15}G_t + \varepsilon_t \quad M1$$

Where:

$$RER_t = NER_t + p_t^* - p_t$$

$$NER_t = E(NER_{t+1)}) - rr_t + rr_t^* + \varepsilon_t$$

$$rr_t = nr_t - E(\pi_t)$$

Model of Aggregate Supply:

$$\pi_t = \beta_{21}E(\pi_t) + (1-\beta_{21})\pi_{t-1} + \beta_{22}y_{t-1}^{Gap} + \beta_{23}\Delta RER_{t-1} + \varepsilon_t \quad M2$$

where:

$$E(\pi_t) = (IC)\pi^* + (1-IC)\pi_{+1}$$

$$IC = \frac{(RB-RB^H)^2}{(RB-RB^H)^2+(RB-RB^L)^2}$$

Model of Policy Rule Function:

$$nr_t = \delta_{31} + \delta_{32}i_{t-1} + \delta_{32}(\pi_t - \pi_t^*) + \delta_{33}y_t^{Gap} + \delta_{34}RER_t + \varepsilon_t \quad M3$$

The three equations above (M1, M2, and M3) are simultaneous dynamic models with the following types of expectations:

$$\Gamma Y_t = B(s)X_{t-s} + FY_{t+1}^e + \phi(k)Y_{t-k} + \varepsilon_t \quad M4$$

Where $\Gamma, B, F, \phi(k)$ are the expected parameters, with Y being a vector of endogenous variables which in the above model are $y_t^{Gap}, \pi, r \text{ and } rr$ while X is a vector of exogenous variables, which in the above model consist of $\Delta RER_t, g, \pi_t^* \text{ and } Y_{t-k}$ as a vector of endogenous variables.

Expectations are formed on all the information set at time t, namely:

$$Y_{t+1}^e = Y_{t+1} + v_{t+1} \quad M5$$

Substitute the equation M5 into M4 will result in the following equation:

$$\Gamma Y_t = B(s)X_{t-s} + F(Y_{t+1} + v_{t+1}) + \phi(k)Y_{t-k} + \varepsilon_t$$

or

$$\Gamma Y_t - \phi(k)Y_{t-k} - FY_{t+1} = B(s)X_{t-s} + Fv_{t+1} + \varepsilon_t \quad M6$$

Thus the reduced form will be generated, namely:

$$A(L)Y_t = B(L)X_{t-1} + \varepsilon_{t-1} + Fv_t \quad M7$$

$$Y_t = A^{-1}(L)B(L)X_{t-1} + A^{-1}(L)\varepsilon_{t-1} + A^{-1}(L)Fv_t \quad M8$$

$$Y_t = \Pi X_{t-1} + \Upsilon u_t \quad M9$$

Where $\Pi = A^{-1}(L)B(L)$; $\Upsilon = A^{-1}(L)$; $u_t = \varepsilon_{t-1} + Fv_t$

In the economics literature, equation (M9) is the final form in which the time trajectories of the exogenous and disturbance variables determine the current values of the endogenous variables. The variables and data used to estimate this model over 20 years from Q1 2001 to Q4 2022 are listed in the table below.

Table 1. Variable Description

Symbol		Information	Source
GDP	Y	Quarterly Real GDP (Nominal GDP/CPI) Base year 2007=100	Bank Indonesia
GAP GDP	y_t^{Gap}	Using Hodrick Prescott	Counted
NER	NER	Nominal Exchange Rate Rp/$ USD	Bank Indonesia
RER	RER	Real Exchange Rate	Counted
G	G	Goverment Expenditure	Bank Indonesia
p_t	PINDO	Indonesian CPI	Bank Indonesia
p_t^*	PUSA	USA CPD	IFS
π_t	INF	Inflation	Bank Indonesia dan dibandingkan dgn hasil perhitungan IHK
π^*	Inf_tg	Inflation Target	Bank Indonesia
$E(\pi)$	Inf_Ekp	Expected Inflation	Counted
IC	IC	Credibility Index	Counted
RB	RB	Interest Rates (Government Bonds))	Bank Indonesia
r	POIN	Policy interest rate (BI Rate)	Bank Indonesia
rr	RPOIN	Real Interest Rates (r - expected inflation)	Counted
rr_t^*	RPOIRUSA	USA Real Interest Rate	IFS

4. Results and Discussion

Descriptive statistical analysis was performed before validating the analysis model to obtain a summary or description of the study variables. These outcomes of descriptive statistics outline the characteristics of the studied variables' scope.

Table 2. Variables' descriptive statistics

	Mean	Median	Maximum	Minimum	Std, Dev,	Skew-ness	Kur-tosis	Jarque-Bera	Probability
Y_ACT	1918389	868715	2988637	1044997	604498	0.15	1.67	6.88	0.03
NER	11304.41	10267.50	16367	8285	2367.23	0.40	1.58	9.71	0.01
RER	9.11	911	9.60	8.86	0.14	0.62	4.31	11.92	0.00
G	155906.6	145837.60	305817.90	67026.02	63383.06	0.55	2.38	5.87	0.05
PINDO	131.73	130.48	196.41	61.05	40.18	-0.12	1.74	5.99	0.05
PUSA	103.34	104.19	136.44	80.58	13.86	0.22	2.48	1.68	0.43
INF	5.75	5.04	17.11	0.12	3.63	1.16	4.17	24.66	0.00
INF_TG	5.09	5.00	9.00	3.00	1.57	0.92	3.37	12.86	0.00
INF_EKP	5.62	5.00	11.48	2.99	2.26	1.01	3.12	14.99	0.00
IC	0.74	0.93	1.00	0.00	0.34	-1.19	2.81	20.98	0.00
RB	7.83	6.24	17.95	3.04	3.96	1.06	3.08	16.62	0.00
POIR	7.60	6.85	17.62	3.50	3.36	1.33	4.41	33.30	0.00
RPOIR	1.98	1.51	6.77	-0.73	1.54	1.16	4.05	23.67	0.00
RPOIRUSA	1.45	1.00	5.31	0.13	1.62	1.14	3.16	19.20	0.00

Source: Authors' finding

The table reveals that the skewness value of nearly all variables has a positive asymmetry value, except for the Indonesian CPI variable and the credibility index value, which have negative asymmetry values. Consequently, the stationarity test is conducted. The results of static tests are shown in Table 3.

Table 3. Stationary Test Results

	Unit Root	Prof ADF Test	Decision
Y_ACT➔y_t^{Gap}	Level	0.9929	Non-stationary
	1stDifference	0.0033	Stationary
NER	Level	0.8676	Non-stationary
	1stDifference	0.0001	Stationary
RER	Level	0.0449	Stationary
G	Level	0.4606	Non-stationary
	1stDifference	0.0000	Stationary
PINDO	Level	0.7866	Non-stationary
	1stDifference	0.0000	Stationary
PUSA	Level	0.9985	Non-stationary
	1stDifference	0.0237	Stationary
INF ➔ π_t	Level	0.0956	Non-stationary
	1stDifference	0.0000	Stationary
INF_TG	Level	0.7692	Non-stationary
	1stDifference	0.0000	Stationary
INF_EKP	Level	0.0891	Non-stationary
	1stDifference	0.0002	Stationary
IC	Level	0.0799	Non-stationary
	1stDifference	0.0000	Stationary
RB	Level	0.0323	stationary
POIR➔ [nr]	Level	0.0108	stationary
RPOIR	Level	0.0010	stationary
RPOIRUSA	Level	0.1081	Non-stationary
	1stDifference	0.0271	Stationary

Source: Authors' finding

According to the results of the stationary test, there are variables at both the level and the first difference. According to the 1stDifference data stationarity test outcomes for all variables (Table 3), these variables achieve stationarity at the 1st difference. Consequently, all variables utilized in the study demonstrate stationarity. To obtain unbiased analysis results and make sound decisions, it is necessary to have access to static data. Consequently, the 3SLs-based analysis model can be implemented. The credibility index of monetary policy is crucial to the effective implementation of monetary policy to maintain low and stable inflation. According to the calculations, the credibility value of Indonesia's monetary policy lies between 0 and 1, as shown in the graph below.

Based on the calculation of the credibility index using the method, the average credibility of Bank Indonesia's monetary policy during the observation period was between 0.74 and 0.75. This value exceeds the observations, which fall within the range of 0.5. This is a result of the Central Bank's increasing consistency in implementing its monetary policy to achieve low and stable inflation, which has led to a growing convergence of actual inflation to its inflation objective.

From the first quarter of 2010 to the fourth quarter of 2022, the credibility index for monetary policy in indonesia is near 1, indicating that economic actors have a great deal of faith in the central bank's policies at that time. Since 2006, the credibility of monetary policy in indonesia has increased. With ideal monetary policy credibility, the inflation rate will

equal the target inflation rate. This is also evident from the following graph comparing actual and desired inflation.

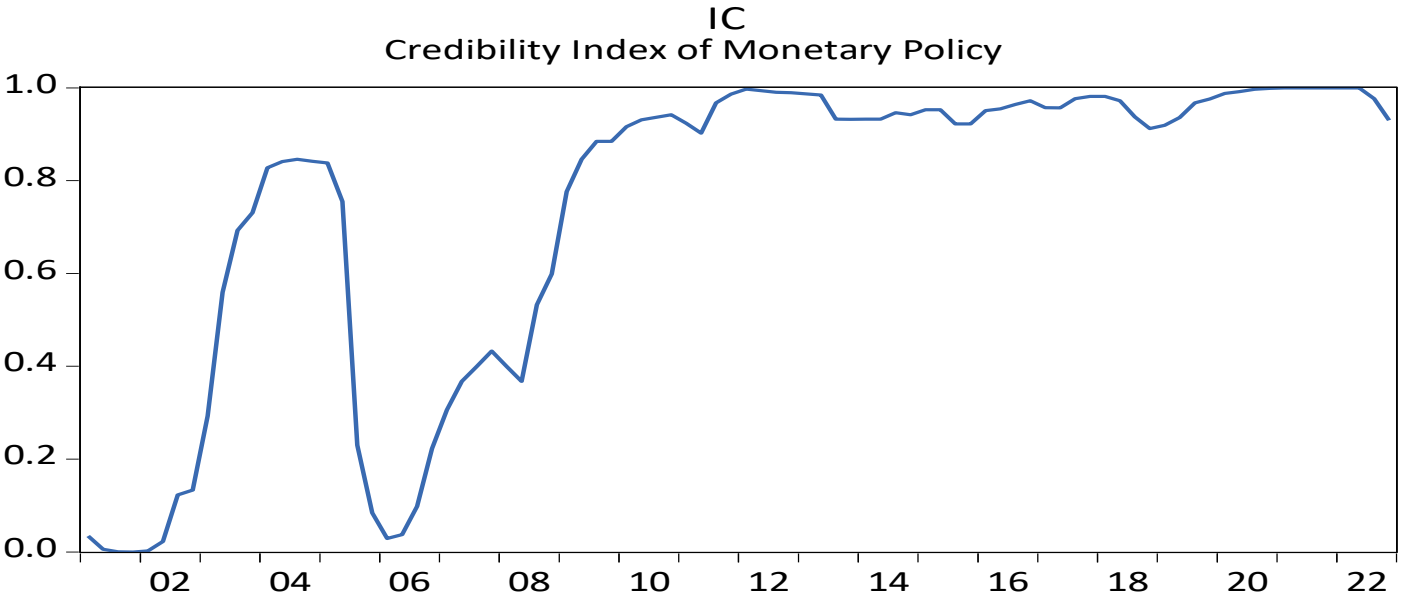

Figure 2. Credibility Index of Monetary Policy

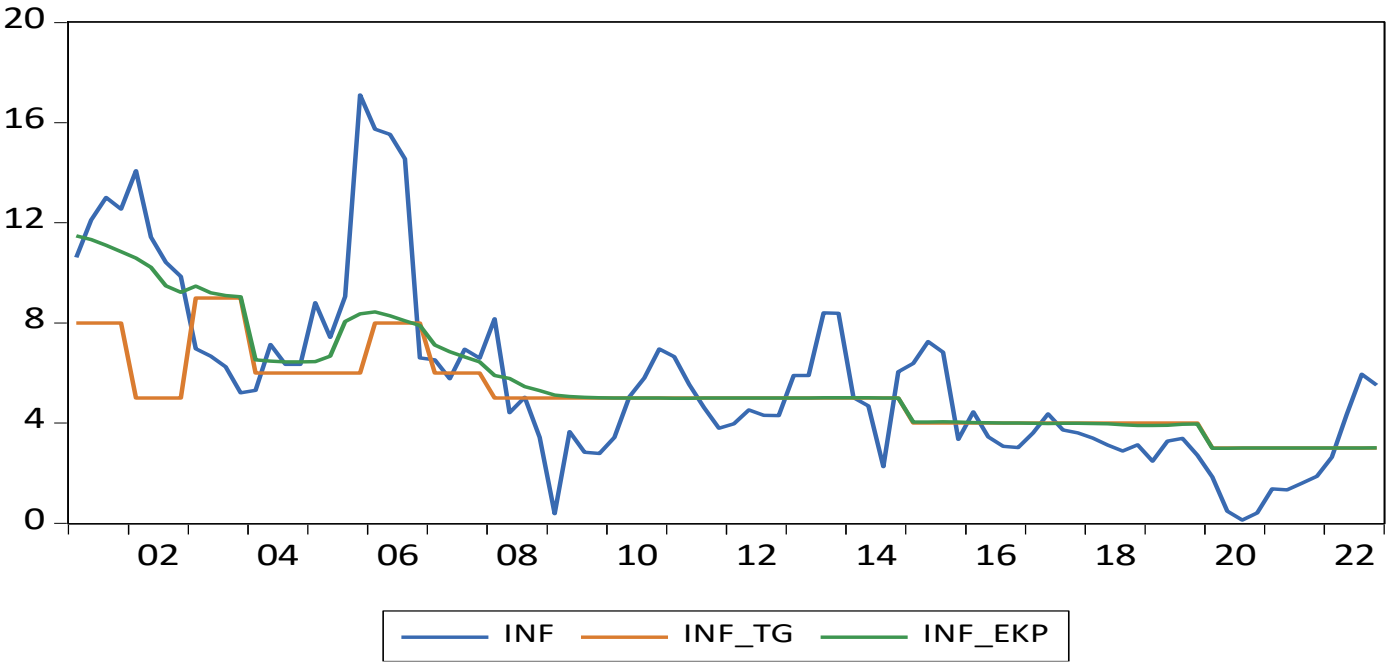

Figure 3. Inflation, Inflation target, and Expected Inflation

Indonesia's implementation of inflation targeting over the past decade has revealed a significant gap between actual inflation and Bank Indonesia's inflation objective (see Figure 3). It is believed that the lack of credibility in implementing Bank Indonesia's policies is one of the causes. Based on Figure 2, it can be seen that Bank Indonesia missed its inflation target in certain years, primarily during the initial period of implementing inflation targeting. However, during the implementation of the inflation target, the inflation deviation decreased, except for a few periods when a supply shock caused inflation pressure. Bank Indonesia's efforts to establish credibility and consistency in controlling inflation have positively impacted the economy, particularly price stability, despite allegations that it lacks full credibility. Based on Figure 2, the actual inflation rate over the past five years has tended to be stable and is within the inflation target range of Bank Indonesia.

5. Estimation Results from Models

Over the past decade, Indonesia's implementation of inflation targeting has revealed a substantial discrepancy between actual inflation and Bank Indonesia's inflation target (see Figure 3). The lack of credibility in implementing Bank Indonesia's policies is regarded as one of the causes. As depicted in Figure 2, Bank Indonesia missed its inflation objective for several years, most notably during the initial phase of implementing inflation targeting. Nevertheless, during the inflation target implementation, the inflation deviation decreased, except for a few instances where a supply shock-induced inflationary pressure. Despite allegations that it lacks full credibility, Bank Indonesia's efforts to establish credibility and consistency in its mission of controlling inflation have positively affected the economy, particularly price stability. Based on Figure 2, the actual inflation rate over the past five years has been relatively stable and within Bank Indonesia's inflation target range.

Table 4. Backward-Looking Model and Forward-Looking Model with the 3SLS Model

Aggregate Demand Model: $y_t^{Gap} = \alpha_{11}E_t y_{t+1}^{Gap} + \alpha_{12}y_{t-1}^{Gap} + \alpha_{13}rr_t + \alpha_{14}\Delta RER_t + \alpha_{15}G_t + \varepsilon_t$								
Forward-Looking Model					**Backward Looking Model**			
Variable	Coefficient	Std. Error	Prob.	Sign	Coefficient	Std. Error	Prob.	Sign
Constant	0.3294	0.1159	0.0049	**** 1%	0,0460	0,062864	0,4648	TS
$E_t y_{t+1}$	-0.0409	0.0147	0.0058	**** 1%				
y_{t-1}^{Gap}	0.1469	0.1090	0.1792	* 20%	0,256009	0,098808	0,0101	**** 1%
rr_t	-0.0033	0.0017	0.0507	*** 5%	-0,0019	0,001637	0,2388	TS
ΔRER_t	0.0757	0.0325	0.0206	*** 5%	0,061026	0,03174	0,0557	*** 5%
G_t	0.0225	0.0112	0.0440	*** 5%	-0,003556	0,00518	0,493	TS
Aggregate Supply (Inflation): $\pi_t = \beta_{21}E(\pi) + (1-\beta_{21})\pi_{t-1} + \beta_{22}y_{t-1}^{Gap} + \beta_{23}\Delta RER_{t-1} + \varepsilon_t$								
Constant	-0.3320	0,5066	0,5129	TS	0,7350	0,3477	0,0355	*** 5%
$E(\pi)$	0,3796	0,1361	0,0057	*** 5%				
π_{t-1}	0,6813	0,0814	0,0000	**** 1%	0,8622	0,0511	0,0000	**** 1%
y_{t-1}^{Gap}	-3,8723	9,2953	0,6773	TS	-3,8309	9,6638	0,6921	TS
ΔRER_{t-1}	2,5943	4,0904	0,5265	TS	2,4341	4,2523	0,5676	TS
Policy Rule Function Model : $nr_t = \delta_{31} + \delta_{32}nr_{t-1} + \delta_{32}(\pi_t - \pi_t^*) + \delta_{33}y_t^{Gap} + \delta_{34}RER_t + \varepsilon_t$								
Constant	-8,1662	5,0354	0,1061	** 10%	-5,2573	4,9620	0,2904	TS
nr_{t-1}	0,8502	0,0304	0,0000	***** 1%	0,8625	0,0296	0,0000	**** 1%
$(\pi_t - \pi_t^*)$	0,1564	0,0384	0,0001	***** 1%	0,1479	0,0380	0,0001	**** 1%
y_t^{Gap}	27,0564	9,9861	0,0072	**** 5%	36,5138	9,4187	0,0001	**** 1%
RER_t	0,9988	0,5591	0,0753	*** 10%	0,6698	0,5502	0,2246	TS

Source: Authors' findings from Eviews

The results of the estimation of aggregate demand indicate that, in the Forward-Looking model, all observed variables are consistent with theory and significant, except for the considerable output disparity at the 20% threshold. The central bank will respond to fluctuations in inflation and output (GDP) with policy rate adjustments. The significance of the expected path in the economy is accommodated by the application of a hybrid rational expectation approach, wherein both the value influences the value of several endogenous variables from economic agents in the previous period (backward-looking) and the expected value of these variables in the following period (forward-looking). Expectations impact the current period's variable output gap and inflation values. In determining the effectiveness of a forward-looking monetary policy, the ability of the monetary authority to anchor expected inflation is a crucial factor.

The estimation results show that monetary policy in the short-term influences output. This is shown from the research results that the coefficient of the variable $r_t = -0.0033$ means that a 1 percent increase in the real interest rate will reduce the output gap (y_t^{Gap}) by 0.0033 percent. Likewise, the expectations of economic agents for the output gap reflect forward-looking as shown by the coefficient of the variable $E_t y_{t+1}$ =-0,049. Thus, the company's forward-looking behavior is dominant enough to determine future production quantities. The output gap is an important variable in policy, especially in predicting the inflation rate. The potential output level with a negative relationship significantly affects the output gap level. This implies that a negative output gap occurs when actual output is less than what can be produced in the economy at full employment, and this is shown when there is an increase in expectations of potential output. Meanwhile, the previous output gap (y_{t-1}^{Gap}) significantly and positively also affected the output gap. This means that when there is an increase in the previous output gap (y_{t-1}^{Gap}) the output gap (y_t^{Gap}) will also increase. The description of the estimation results is also supported by the data shown in the graph, where the potential output is calculated using the Hodrick-Prescot model. The deviation of the reel exchange rate (ΔRER_t) influences output. The coefficient value of this variable (ΔRER_t) with a coefficient value of 0.0757 means that an increase of 1 index point (ΔRER_t) will have an impact on increasing the output gap by 0.07 percent. The coefficient of the deviation of the real exchange rate follows Mundell Fleming's theory, which states a positive and significant relationship between the real exchange rate and output (Ribeiro et al., 2020). Likewise, the findings of Demir and Razmi (2022), who apply the Mundell-Fleming model, state that fiscal expansion will reduce output but cause real appreciation and that monetary expansion will increase output and cause real depreciation.

Government expenditure variable (G_t) also influences the output gap. The coefficient value of $G_t = 0.0225$ means that an increase in changes of 1 percent of government expenditure will increase the output gap by 0.0225 percent. The Central Bank's price stabilization policy through nominal interest rates directly affects aggregate demand. A decrease in nominal interest rates will increase consumption demand and the output gap. Fiscal policy through increasing government expenditure will also impact improving the output gap. On the other hand, the domination of the company's forward-looking behavior in determining the production quantity will also look at existing information, both central bank policies, fiscal policies, and changes in the real exchange rate.

Furthermore, from Table 4 related to aggregate supply in the New Keynesian Philips Curve, it shows that inflation is influenced by the rational expectations of economic agents with forward-looking weight, $E(\pi) = 0{,}3796$ smaller than backward-looking, π_{t-1}= 0.6813. This indicates the domination of backward-looking economic agents in the process of inflation. This is in line with the results of research conducted by Hakim and Bustaram (2019), which stated that inflation behavior in Indonesia was still backward looking during the implementation of Inflation Targeting Lite and changed to forward-looking after adopting Full-Fledged Inflation Targeting. This change is related to the increasing credibility of the central bank during the Full-Fledged Inflation Targeting period. However, it is inversely proportional to the research results of McKnight et al. (2020), showing that the New Keynesian Philips Curve (NKPC) equation which forms inflation in the ITF era, is dominated by forward-looking agent behavior.

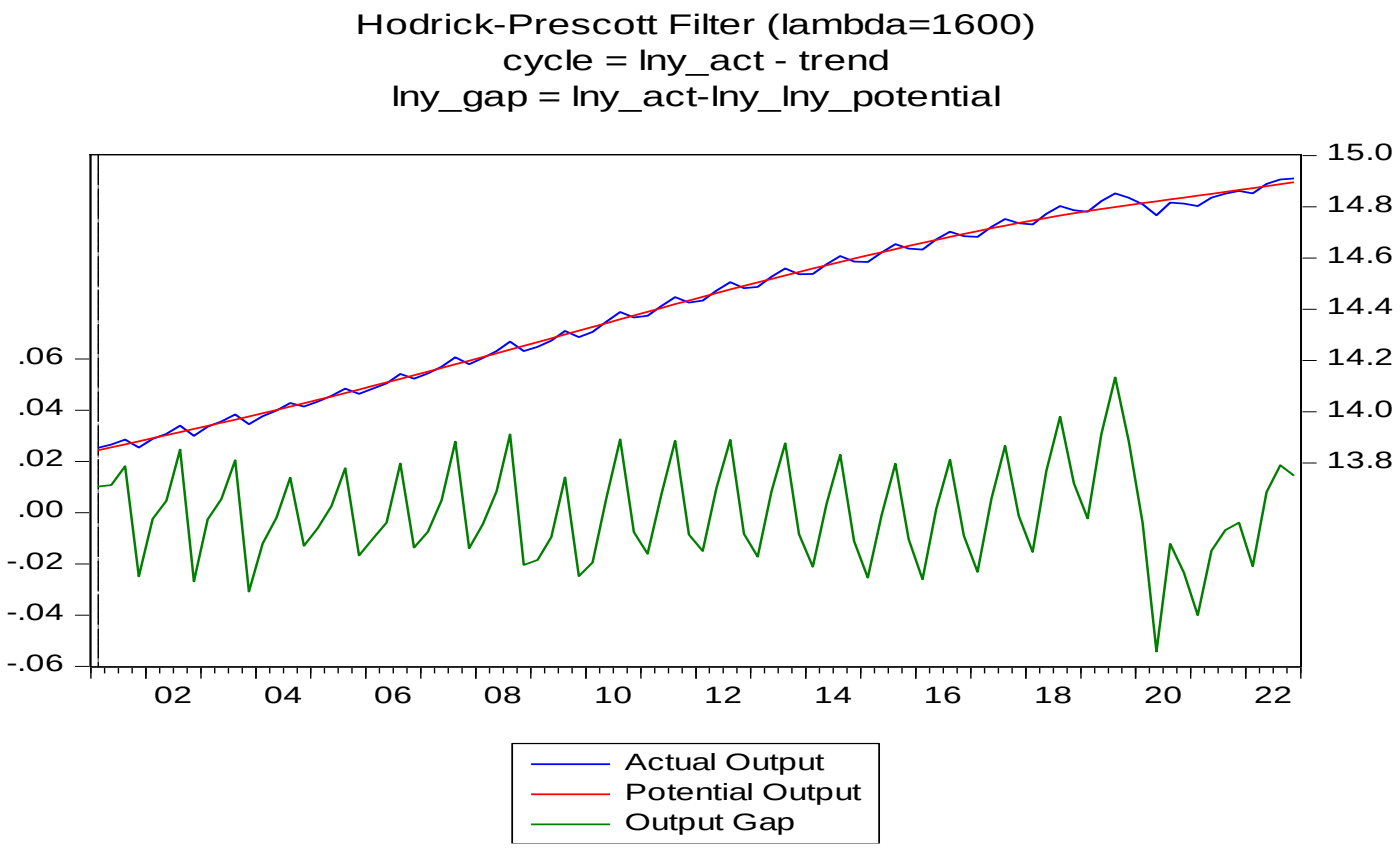

Figure 5: Actual Output, Potential Output with HP Model; Output Gaps

The results of testing the hypothesis of the New Keynesian Phillips Curve model in this open economy, which is reflected in the aggregate supply (inflation) model, indicate that the model's coefficients are substantially different from zero or not equal to zero. The Phillips curve phenomenon can be concluded to exist in the Indonesian economy. This condition indicates that entrepreneurs do not promptly respond to changes in demand by increasing prices. As a result, the central bank's policy of reducing nominal or long-term interest rates will be able to increase real output by increasing consumption.

From the perspective of the monetary rule that employs the Taylor rule for the Policy Rule Function Model, it is used to respond to the Central Bank's optimal monetary policy for maintaining price stability. From the estimation results, the reaction of the central bank, which is proxied from the nominal interest rate, significantly depends on the previous nominal interest rate (nr_{t-1}), the difference between the actual inflation rate and the inflation target $(\pi_t - \pi_t^*)$ which also indicates the credibility index of monetary policy, output gap $\left(y_t^{Gap}\right)$ and reel exchange rate (RER_t). In carrying out its monetary policy, the Central Bank can smooth changes in interest rates, which are instruments of monetary control. This behavior is represented by the coefficient of the previous nominal interest rate, which is 0.8502 and lies between 0 and 1. This indicates that the higher the coefficient value of mmmmm, the central bank becomes very cautious (backward-looking), and changes in interest rates become very slow because changes in period t will be affected by the amount of interest rates in period t-1. Conversely, if the value of nr_{t-1} If it is close to zero, the central bank will be more aggressive (forward-looking) in implementing its monetary policy.

The coefficient of $(\pi_t - \pi_t^*)$=0,1564 is the impact of changes in the difference between inflation expectations and the inflation target on the nominal interest rate. This also shows the community's credit toward the monetary policy it implements. Where the value of the credibility index of monetary policy that lies between 0 and 1 can be indicated by the interest rate. Inflation is also high if the long-term interest rate (RB) is high. The parameter value of the credibility index of monetary policy tends to be zero, IC = 0.

Conversely, if the RB is low, monetary policy can be interpreted as credible, IC = 1. So under equilibrium conditions, if there are no deviations in output and the exchange rate, with the credibility of a perfect monetary policy, the inflation rate will equal the target inflation rate. The estimation results show that the coefficient of $(\pi_t - \pi_t^*)$ = 0,1564, which means that if expected inflation is 1 percent higher than the inflation target, the optimal monetary policy is to increase the nominal interest rate by 0.1564 percent or 15 basis points. Likewise, the coefficient value of the output gap y_t^{Gap} This implies that if the value of the output gap increases by 1 percent, then the central bank's reaction will increase the nominal interest rate by 27 basis points.

The estimation results for post-covid differ from the significant level but in the same direction. For the aggregate demand model, it is demonstrated that the output gap is significantly impacted by future output gap expectations (forward-looking) and government expenditure. On the aggregate supply side, it was shown that inflation was only substantially influenced by the previous year's inflation rate (backward-looking). In the meantime, the central bank's reaction function indicates that the central bank's policy is measured by the interest rate from the previous year, and the deviation between inflation and the inflation objective is highly significant. This indicates that the credibility of monetary policy can influence the nominal interest rate through control of inflation and variations in interest rates over the previous year.

6. Conclusions and Recommendations

This study aims to examine how the monetary authority responds by emphasizing the importance of the credibility of monetary policy in attaining an equilibrium level during a period of deflation or when the Indonesian economy is subjected to several external shocks. To accomplish this, a small macroeconomics model was developed using the new Keynesian small macroeconomics approach for two transitional periods: the overall period from 2001.1-2022.4 considering the forward-looking aspect of the model in comparison to the backward-looking model and the post-covid 19 time period from 2019.3 – 2022.4 with only forward-looking model observers.

Incorporating a rational expectation variable that considers the future (a forward-looking model) produces superior fit results than a model that only considers the past. However, economic actors consider history when making decisions, reducing the importance of the primary variable. The credibility index of monetary policy is expressly incorporated into the model, particularly in the inflation expectations specification. The results indicate that the credibility index of monetary policy converges with macroeconomic variables, such that if economic actors believe that the central bank is committed to a predetermined inflation target, then the inflation target will be identical to the inflation that occurred during that period and fluctuations in the credibility index of monetary policy. In this instance, most of the data indicates a value near a value between 0.8 and 1. This shows the agents' credibility with the monetary policy established by the central bank. Even though the coefficient on the deviation variable in the Policy Rules Function Model is much lower than that of the inflation target and the actors form their expectations with a greater focus on the past, it is sufficient for the central bank to gain half the credibility to meet the inflation target in a much shorter period. The central bank is cautious when determining interest rates, and its behavior becomes increasingly anticipatory from year to year. The 2001.1-2022.4 and post-covid 19 time periods yield identical results.

From the perspective of aggregate demand, the central bank's policy to stabilize prices through nominal interest rates directly affects aggregate demand, such that a decrease in nominal interest rates will increase the demand for consumption and further widen the output deficit. On the other hand, fiscal policy influences output growth through government expenditures. These results from January 2021 to April 2022 exhibit the same behavior. Still, the dominant factor in determining production quantities is always the availability of information regarding central bank policies, fiscal policies, and changes in the real exchange rate.

The aggregate supply aspect (New Keynesian Phillips Curve) demonstrates that the model's coefficient is substantially different from zero or not equal to zero. The Phillips curve phenomenon can be concluded to exist in the Indonesian economy. This condition indicates that entrepreneurs do not promptly respond to changes in demand by increasing prices. As a result, the central bank's policy of reducing nominal or long-term interest rates will be able to increase real output by increasing consumption.

Regarding the modeling aspect of this study, there are limitations, namely that the estimate for the equilibrium value using Hodrick-Precote is highly sensitive to econometric models and must therefore be compared to other methods. Theoretically, this model requires further development, particularly in formulating equilibrium output, interest rate, and inflation. In addition, the real exchange rate is still stated as an exogenous variable in this model; it would be preferable to develop this variable as an endogenous variable.

References

Alam, M. M., Aktar, M. A., Idris, N. D. M., & Al-Amin, A. Q. (2023). World Energy Economics and Geopolitics amid COVID-19 and post-COVID-19 Policy Direction: World Energy Economics and Geopolitics amid COVID-19. *World Development Sustainability*, *2*, 100048. doi: https://doi.org/10.1016/j.wds.2023.100048

Avdjiev, S., Du, W., Koch, C., & Shin, H. S. (2019). The dollar, bank leverage, and deviations from covered interest parity. *American Economic Review: Insights*, *1*(2), 193-208. doi: https://doi.org/10.1257/aeri.20180322

Bomfim, A. N., & Rudebusch, G. D. (2000). Opportunistic and deliberate disinflation under imperfect credibility. *Journal of Money, Credit and Banking*, *32*(4) ,707-721. doi: https://doi.org/10.2307/2601179

Cecchetti, S. G., & Krause, S. (2002). Central bank structure, policy efficiency, and macroeconomic performance: exploring empirical relationships. *Review-Federal Reserve Bank of Saint Louis*, *84*(4), 47-60. Retrieved from https://files.stlouisfed.org/files/htdocs/publications/review/02/07/47-60Cecchetti.pdf

Chenet, H., Ryan-Collins, J., & Van Lerven, F. (2019). Climate-related financial policy in a world of radical uncertainty: Towards a precautionary approach. *UCL Institute for Innovation and Public Purpose WP*, *13*, 1-10. doi: https://dx.doi.org/10.2139/ssrn.3520224

Chenet, H., Ryan-Collins, J., & Van Lerven, F. (2021). Finance, climate-change and radical uncertainty: Towards a precautionary approach to financial policy. *Ecological Economics*, *183*, 106-117. doi: https://doi.org/10.1016/j.ecolecon.2021.106957

de Mendonça, H. F., & e Souza, G. J. d. G. (2009). Inflation targeting credibility and reputation: the consequences for the interest rate. *Economic Modelling*, *26*(6), 1228-1238. doi: https://doi.org/10.1016/j.econmod.2009.05.010

Dedola, L., Georgiadis, G., Gräb, J., & Mehl, A. (2021). Does a big bazooka matter? Quantitative easing policies and exchange rates. *Journal of Monetary Economics*, *117*, 489-506. doi: https://doi.org/10.1016/j.jmoneco.2020.03.002

Demir, F., & Razmi, A. (2022). The real exchange rate and development theory, evidence, issues and challenges. *Journal of Economic Surveys*, *36*(2), 386-428. doi: https://doi.org/10.1111/joes.12418

Desson, Z., Weller, E., McMeekin, P., & Ammi, M. (2020). An analysis of the policy responses to the COVID-19 pandemic in France, Belgium, and Canada. *Health Policy and Technology*, *9*(4), 430-446. doi: https://doi.org/10.1016/j.hlpt.2020.09.002

Dovern, J., Fritsche, U., & Slacalek, J. (2012). Disagreement among forecasters in G7 countries. *Review of Economics and Statistics*, *94*(4), 1081-1096. doi: https://doi.org/10.1162/REST_a_00207

Engel, C., Lee, D., Liu, C., Liu, C., & Wu, S. P. Y. (2019). The uncovered interest parity puzzle, exchange rate forecasting, and Taylor rules. *Journal of International Money and Finance*, *95*, 317-331. doi: https://doi.org/10.1016/j.jimonfin.2018.03.008

Gayaker, S., Ağaslan, E., Alkan, B., & Çiçek, S. (2021). The deterioration in credibility, destabilization of exchange rate and the rise in exchange rate pass-through in Turkey. *International Review of Economics & Finance*, *76*, 571-587. doi: https://doi.org/10.1016/j.iref.2021.07.004

Granville, B., & Zeng, N. (2019). Time variation in inflation persistence: New evidence from modelling US inflation.

Economic Modelling, *81*, 30-39. doi: https://doi.org/10.1016/j.econmod.2018.12.004

Ha, L. T. (2023). A wavelet analysis of dynamic connectedness between geopolitical risk and renewable energy volatility during the COVID-19 pandemic and Ukraine-Russia conflicts. *Environmental Science and Pollution Research*, 1-16. doi: https://doi.org/10.1007/s11356-023-26033-1

Hakim, R., & Bustaram, I. (2019, March). Inflation expectation and consumption expenditure in Indonesia. In *IOP Conference Series: Earth and Environmental Science*, *243*(1), 012060. IOP Publishing. doi: https://doi.org/10.1088/1755-1315/243/1/012060

Jiang, Y., Feng, Q., Mo, B., & Nie, H. (2020). Visiting the effects of oil price shocks on exchange rates: Quantile-on-quantile and causality-in-quantiles approaches. *The North American Journal of Economics and Finance*, *52*, 101-111. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1062940820300589

Kabundi, A., & Mlachila, M. (2019). The role of monetary policy credibility in explaining the decline in exchange rate pass-through in South Africa. *Economic Modelling*, *79*, 173-185. doi: https://doi.org/10.1016/j.econmod.2018.10.010

Laxton-Kane, M., & Slade, P. (2002). The role of maternal prenatal attachment in a woman's experience of pregnancy and implications for the process of care. *Journal of Reproductive and Infant Psychology*, *20*(4), 253-266. doi: https://doi.org/10.1080/0264683021000033174

Lucas, R. E. (1973). Some international evidence on output-inflation trade-offs. *The American Economic Review*, *63*(3), 326-334. Retrieved from https://www.fep.up.pt/docentes/pcosme/s-e-1/1-AER-63-3-326.pdf

McKnight, S., Mihailov, A., & Rumler, F. (2020). Inflation forecasting using the New Keynesian Phillips Curve with a time-varying trend. *Economic Modelling*, *87*, 383-393. doi: https://doi.org/10.1016/j.econmod.2019.08.011

Mišík, M., & Nosko, A. (2023). Post-pandemic lessons for EU energy and climate policy after the Russian invasion of Ukraine: Introduction to a special issue on EU green recovery in the post-Covid-19 period. *Energy Policy*, *177*, 113-126. doi: https://doi.org/10.1016/j.enpol.2023.113546

Montes, G. C., & Ferreira, C. F. (2019). Does monetary policy credibility mitigate the effects of uncertainty about exchange rate on uncertainties about both inflation and interest rate? *International Economics and Economic Policy*, *16*, 649-678. doi: https://doi.org/10.1007/s10368-018-0419-5

Montes, G. C., & Ferreira, C. F. (2020). Does monetary policy credibility mitigate the fear of floating? *Economic Modelling*, *84*, 76-87. doi: https://doi.org/10.1016/j.econmod.2019.03.010

Ribeiro, R. S., McCombie, J. S., & Lima, G. T. (2020). Does real exchange rate undervaluation really promote economic growth? *Structural Change and Economic Dynamics*, *52*, 408-417. doi: https://doi.org/10.1016/j.strueco.2019.02.005

Şen, H., Kaya, A., Kaptan, S., & Cömert, M. (2020). Interest rates, inflation, and exchange rates in fragile EMEs: A fresh look at the long-run interrelationships. *The Journal of International Trade & Economic Development*, *29*(3), 289-318. doi: https://doi.org/10.1080/09638199.2019.1663441

Song, L., & Zhou, Y. (2020). The COVID-19 pandemic and its impact on the global economy: what does it take to turn crisis into opportunity? *China & World Economy*, *28*(4), 1-25. doi: https://doi.org/10.1111/cwe.12349

Tambunan, S., Wijaya, M., Siregar, A., & Pratama, I. (2022). The Effectiveness of Risk Management on Quality of Financial Statements with Profitability as a Mediator in Banking Companies. Cuadernos de Economía, 45(128), 165-175.

Tambunan, S., Siregar, A., Wijaya, M., & Pratama, I. (2022). The Impact Of Corporate Governance On The Integrated Reporting Quality Of Indonesian Listed Firms: Moderating Role Of Csr Disclosure And Corporate Sustainability. International Journal of Economics and Finance Studies, 14(4), 252-274.

Tanjung, A. A., Ruslan, D., Lubis, I., & Pratama, I. (2022). Stock Market Responses to Covid-19 Pandemic and Monetary Policy in Indonesia: Pre and Post Vaccine. Cuadernos de Economía, 45(127), 120-129.

Uddin, I., & Rahman, K. U. (2022). Impact of corruption, unemployment, and inflation on economic growth evidence from developing countries. *Quality & Quantity*, *57*, 1-21. doi: https://doi.org/10.1007/s11135-022-01481-y