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Post-Pandemic Inflationary Pressure and Global Commodity Price Shocks in Indonesia: An ARDL Estimation

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Abstract: *The volatility of world commodity prices has emerged as a major force of macroeconomic stability in the developing economies, especially those with food and energy as the main components in the spending of households. Being among the biggest economies that largely rely on commodity imports, Indonesia is extremely vulnerable to price shocks caused by externalities, particularly in the aftermath of the pandemic when inflationary pressures were at their height. In this analysis, the focus is on the transmission of global food and crude oil price shocks into the domestic inflation processes in Indonesia. The study used the annual data from 1988 to 2023, from the World Bank World Development Indicators (WDI) and the World Bank Pink Sheet to explain inflationary behaviour. The Autoregressive Distributed Lag (ARDL) model using the bounds test has been employed to check the long-run as well as short-run effects. The findings indicate that global oil price shocks have a major impact on increasing inflation in the short run, but food prices and exchange rate depreciation have a lesser but positive impact. Interest rates and growth of GDP have minimal short-run effects, and this indicates that the current episode of inflation in Indonesia is mainly caused by external cost-push and not by domestic demand. In the long run, the global food process shows a deflationary effect on inflation. The implication of these results is the necessity of better measures of food and energy price stabilization, exchange-rate management, diversification of imports, and enhancement of domestic productivity. The study adds a novel piece of evidence regarding the inflation behaviour in the post-pandemic period in Indonesia and the significance of resilience-oriented policy in dealing with the risks of inflation caused by commodities.*

Keywords: *Indonesia, Inflation, Commodity price shocks, ARDL model, post-pandemic*

Abstrak: Volatilitas harga komoditas dunia telah muncul sebagai kekuatan utama stabilitas makroekonomi di negara-negara berkembang, terutama yang memiliki makanan dan energi sebagai komponen utama dalam pengeluaran rumah tangga. Sebagai salah satu negara dengan perekonomian terbesar yang sangat bergantung pada impor komoditas, Indonesia sangat rentan terhadap guncangan harga yang disebabkan oleh eksternalitas, terutama setelah pandemi ketika tekanan inflasi berada pada puncaknya. Dalam analisis ini, fokusnya adalah pada transmisi guncangan harga pangan global dan minyak mentah ke dalam proses inflasi domestik di Indonesia. Studi ini menggunakan data tahunan dari tahun 1988 hingga 2023, dari World Bank World Development Indicators (WDI) dan World Bank Pink Sheet untuk menjelaskan perilaku inflasi. Model Autoregressive Distributed Lag (ARDL) menggunakan uji batas telah digunakan untuk memeriksa efek jangka panjang maupun jangka pendek. Temuan menunjukkan bahwa guncangan harga minyak global berdampak besar pada peningkatan inflasi dalam jangka pendek, tetapi harga pangan dan depresiasi nilai tukar memiliki dampak yang lebih kecil namun positif. Suku bunga dan pertumbuhan PDB memiliki dampak minimal dalam jangka pendek, dan ini menunjukkan bahwa episode inflasi saat ini di Indonesia terutama disebabkan oleh dorongan biaya eksternal, bukan oleh permintaan domestik. Dalam jangka panjang, proses pangan global menunjukkan efek deflasi terhadap inflasi. Implikasi dari hasil ini adalah perlunya langkah-langkah yang lebih baik untuk stabilisasi harga pangan dan energi, pengelolaan nilai tukar, diversifikasi impor, dan peningkatan produktivitas domestik. Studi ini menambahkan bukti baru mengenai perilaku inflasi pada periode pasca-pandemi di Indonesia dan pentingnya kebijakan berorientasi ketahanan dalam menghadapi risiko inflasi yang disebabkan oleh komoditas.

Kata kunci: Indonesia, inflasi, guncangan harga komoditas, model ARDL, pasca pandemi

Graphical Abstract:

INTRODUCTION

The issue of inflation is one of the long-standing macroeconomic issues of the developing economies, especially when it is instigated by the global instability of commodities. Food and energy markets have seen acute price fluctuations in recent years, particularly under the COVID-19 crisis when supply chain failures and demand rejuvenation have caused high levels of inflation across the world. Inflation in the globe reached its highest point in decades in 2022 with oil and food prices being the main drivers; (International Monetary Fund (IMF) 2022). In a food-dependent economy such as Indonesia, with food representing more than 40 percent of CPI basket, these shocks are immediately translated into domestic prices to nullify purchasing power and therefore, inflation control has become one of the primary macroeconomic priorities (Bank Indonesia 2023); (FAO 2025). Recent reports also note that the component of energy and food are also the main contributors to variability in inflation particularly when there is global stress (Álvarez, Luis J. ; Hurtado, Samuel; Sánchez, Isabel; Thomas 2009). The more recent empirical studies indicate that the macroeconomic effects of oil price shocks are persistent and that food-price shocks have a disproportionate impact on the developing economies (Cashin, Paul; Mohaddes, Kamiar; Raissi, Maziar; Raissi 2014); (Pangesti , Anggityas Werdining; Darsono, Darsono; Antriyandarti 2023) (Choi, Sangyup; Furceri, Davide; Loungani, Prakash; Mishra, Saurabh; Poplawski-Ribeiro 2017). Regarding methodology, ARDL and co-integration models have been extensively applied to understand the responses of inflation to commodity shocks such as (Hosseini, Hossein Mirshojaeian; Kaneko 2011) that utilised ARDL to determine the transmission of international price volatility into domestic inflation in developing economies, which confirmed both short-run and long-run pass-through effects. There is also an indication that the new dynamics of inflation

following the pandemic have been more responsive to disruptions that occur in the world, and nations have to improve their structures in managing inflation (Aizenman, Joshua; Ito, Hiro; Park, Donghyun; Saadaoui, Jamel; Salah Uddin 2026). Despite the existing literature on the topic of the relationship between commodities and inflation, there is a paucity of literature on Indonesia that considers long-horizon global price indexes as well as macro-transmission variables in a single empirical model.

Despite an abundant body of literature on the prices of commodities and inflation, there is still very limited literature that specifically investigates Indonesia, especially those studies that examine long-horizon global price indices, and domestic macro-transmission channels on a single empirical platform. The majority of the available literature separates oil shocks or food shocks and does not consider them in combination and much of the earlier work is also limited in time, that is, in the time scale; it also excludes variables which are important in the Indonesian situation like interest rate adjustments, exchange rate pass-through, or changes in the output. It implies that the evidence base is expanding at the international level(Cashin, Paul; Mohaddes, Kamiar; Raissi, Maziar; Raissi 2014); (Pangesti, Anggityas Werdining; Darsono, Darsono; Antriyandarti 2023) but few studies analyzing Indonesia-specific integrated models exist, in particular, those that measure both the short-run and long-run inflation responses to external shocks in a consistent structure. Hence, there is an apparent gap in the knowledge of the way global commodity shocks are transmitted into the domestic inflation process in Indonesia in the short and long term, so a recent measurement of the subject has relevance in terms of policy and scholarly discussion.

To fill this gap, the current paper empirically analyzes how global crude oil prices and global food prices impact consumer price inflation per annum in Indonesia in the short-run and the long-run to the application of Autoregressive

Distributed Lag (ARDL) bounds-testing approach between 1988 and 2023. Exchange rate movements, interest rate policy and GDP growth are included as transmission variables as it is a model that shows the relationship between external shocks and domestic macroeconomic conditions. This combined methodology is able to trace the effects of inflation over time and at the same time record the forces of supply at a global scale and domestic mechanisms of adjustment. Through providing a long-span dataset which encompasses significant crisis periods such as Asian crisis and global financial crisis, as well as pandemic and recent commodity surges, the study presents new data which can be used in post-pandemic inflation behaviour, commodity-market vulnerability, and Indonesian price stability strategy.

Although the empirical evidence on this issue has shown that the resilience of commodity prices is observed compared to the CPI movements (Vyas 2025), not many studies have empirically estimated the issue at hand to the population of Indonesia, which quantifies the global oil and food shocks and domestic macro-transmission channels in both directions using long-horizon data. This paper bridges that gap. This research has a large policy implication. Achieving greater success in Indonesia in terms of inflation-targeting regime, empirical knowledge of external food and oil shock transmission into domestic prices becomes essential in making choices on monetary tightening, subsidy distribution, exchange-rate defence, and food-security systems. It is anticipated that the results will be useful in macroeconomic planning, as they will show the nature of inflation as being cost-push-driven or demand-related. Academically, the article is novel in that it uses a single ARDL model with global price variables and local macro-controlling variables (macro-control) in a long-horizon sample, as opposed to single-commodity and short-period analyses investigated in previous studies. Therefore, the research has both theoretical and practical merits as well as contribution to fiscal and monetary officials.

As far as the research problem is concerned, two core research questions are formulated: (RQ1) How do global oil price shocks impact inflation in Indonesia both in the short and the long-run? (RQ2) What are the short-run and long-run effects of global food price shocks on inflation in Indonesia? Accordingly, the study will seek to: (OBJ1) estimate the impact of oil prices in the world over short and long term using ARDL; and (OBJ2) estimate the impact of food prices in the world over short and long term. Following the existing theory and evidence, the research has the following hypotheses: (H1) Global oil price shocks have a significant positive impact on inflation both in the short and long term; (H2) Global food price shocks have a significant positive impact on inflation in the short and long term. This introduction provides the background of the analysis by explaining the significance of the subject, reviewing the literature of relevance, outlining areas of research gaps, and stating the direction of the study. The theoretical background and methodology are provided by the following sections, and the findings of the empirical research and recommendations to address the inflation issue in Indonesia are included.

Theoretical Framework

This paper has been based on the imported cost-push inflation theory, which attributes inflation to increased costs of production and inputs, which are imported. Contrasting with the New Keynesian or demand-pull models that focus on the aggregate demand and expectations, the cost-push model focuses on the role of the rise in producer prices, especially energy and food prices, in increasing the cost of production, and in turn consumer prices. The framework is especially applicable when it comes to developing and import-dependent economies like Indonesia where foreign price shocks can have a powerful effect on domestic dynamics of inflation. The transmission mechanism in this work is conceptualized in the following way:

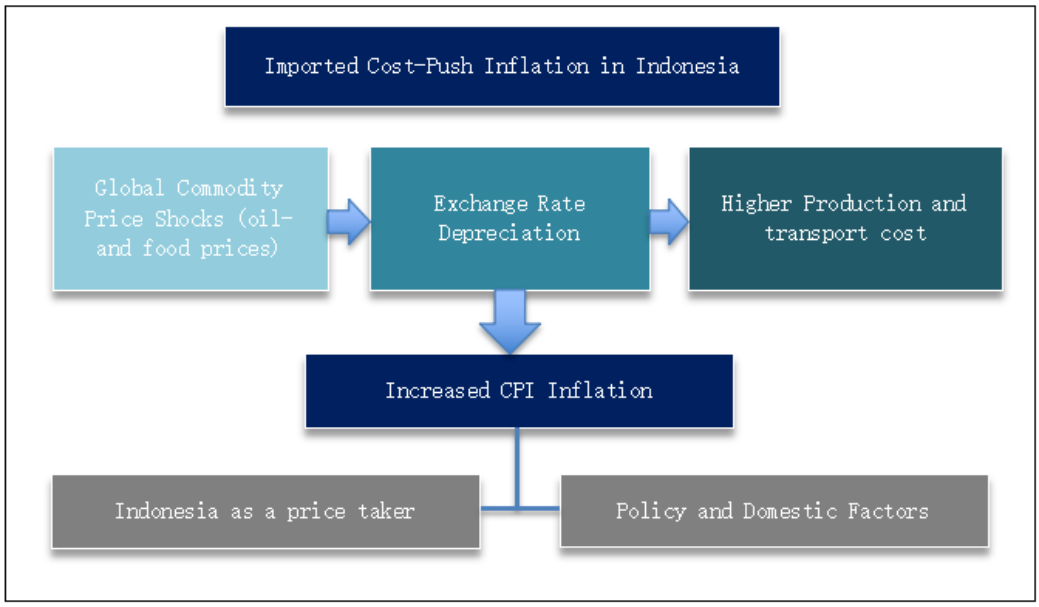

Figure 1: Conceptual Framework: Relationship between variables
Source: Author's own creation

Commodity price shock in the world market - fluctuations in the exchange rates - increase in production and transportation expenses - consumer price index (CPI) inflation. A rise in the prices of food and oil in the world markets increases the cost of imports among domestic producers. When they are combined with exchange rate depreciation, then the costs become even more exacerbated, and prices of goods and services increase. These increased costs are transferred to the consumers by the firms leading to cost-push inflation. It can be seen through this channel the direct and indirect impacts of the global commodity markets on domestic prices. This framework is particularly applicable to Indonesia since Indonesia is a price taker in the international commodity markets. Given that it relies on the imported food and energy products, the changes in the global prices are also mostly exogenous and not under the control of the domestic market. This paper therefore involves the global food prices, the price of crude oil, and the exchange rate as important explanatory variables to get the external effects of transmission. It also has interest rates and GDP growth in order to contain domestic

monetary and demand-side factors. Through this framework, the study analytically connects global shocks and domestic inflation by observable transmission channels enhancing the theoretical basis of the empirical model.

METHODS

Research Design and Data Sources

The design of this study is a quantitative study based on a time-series econometric research design that investigates the causes of inflation. Annual time-series data are used to both describe short-run dynamics and long-run relations among macroeconomic variables and reduce the short-term volatility. The research employs the annual information consisting of a total of 36 observations, with the sample time being based on the availability of similar data for all variables.

All variables are retrieved using internationally accepted and publicly available databases in order to achieve data reliability and comparability. Inflation data are obtained through the World Bank World Development Indicators (WDI), and these are measured as the level of inflation rate based on the GDP deflator (Bajrami et al. 2025). The price data of foods are taken at World Bank Commodity Price Data (Pink Sheet), where the Food Price Index is used to represent the pressures of food costs domestically. The explanation of this index is provided in Table 1. The World Bank Pink Sheet is also used to obtain crude oil prices, and it is measured by the average crude oil price, which is a simple average of the Brent, West Texas Intermediate (WTI), and Dubai crude benchmarks (Shang et al. 2022; Azhgaliyeva, Kapsalyamova, and Mishra 2022). The World Bank WDI database provides exchange rate data, lending interest rates, and growth rates of GDP (Lim et al. 2021; Gagnon and Ihrig 2004). The exchange rate is converted in terms of the official exchange rate, which is given in terms of local currency units per US dollar.

The interest rate is also expressed as the lending interest rate, which is a percentage, and the economic growth was given as the annual growth rate in terms of GDP (Lawson Igbinovia and Michael Igbinovia 2023; Aslam and Farvaque 2022).

Variable Definitions and Transformation

The dependent variable is inflation, which is kept at the level to maintain its meaning of being a rate of change of the overall price level (Gagnon and Ihrig 2004). The choice of the explanatory variables is informed by the well-developed economic theory and previous empirical research on the dynamics of inflation. Crude oil prices and food prices are converted to natural logarithms so that the effects of scale are minimized, and coefficients can be interpreted as elasticities. Cost-push inflationary pressures that are associated with a shift in the costs of food are captured in log-transformed food prices and are especially relevant in an economy where a large portion of household consumption is composed of food. Extrinsic energy price shocks are captured as a log-transformed oil price comprising the cost of production, the cost of transport, and the prices in general. The exchange rate has also been represented in the logarithmic form in order to analyse the exchange rate pass-through effect on inflation. Conversely, the interest rate paid on a loan and the rate of growth in the GDP are kept at a constant level, in their original units, and as is usually adopted in the inflation literature.

Table 1. Food Price Index: Indicators and Construction

Indicator	Description	Role in Index Construction
Cereals Price Index	Prices of major cereals such as wheat, rice, maize, and barley	Represents staple food commodities; weighted by global trade shares
Vegetable Oils Price Index	Prices of edible oils such as palm, soybean, sunflower, and rapeseed oil	Captures the fats and oils components of food consumption
Dairy Price Index	Prices of milk, butter, cheese, and milk powder	Reflects animal-based nutrition and processed food inputs
Meat Price Index	Prices of beef, poultry, pork, and sheep meat	Represents protein-rich food commodities
Sugar Price Index	Prices of raw and refined sugar	Captures sweeteners used in direct consumption and food processing
Weighting Method	Trade-weighted average of international commodity prices	Ensures global representativeness based on export shares
Base Period	Index normalized to a base year (varies by dataset)	Allows comparison of price changes over time

Source: World Bank Commodity Price Data (Pink Sheet), World Bank (2024)

Table 1 explains the structure and design of the Food Price Index, which is used in the study. The index is a composite index that is based on the prices of internationally traded food commodities, which include cereals, vegetable oils, dairy products, meat, and sugar. The individual components compute the price fluctuations in the international markets, and each of them is weighted based on the relative significance in a global market. The index is created to reflect general trends in the prices of food in the world, not the price trends in individual countries. By its turn, it is a suitable proxy of external food price shocks that can be transmitted into local inflation, especially in food-importing countries.

Table 2. Variables, Measurement Units, and Data Sources

Variable	Unit of Measurement	Data Source
Inflation	Annual percentage (%)	World Development Indicators (WDI)
Food Price Index	Index	World Bank Commodity Price Data
Crude Oil Price	US dollars per barrel	World Bank Commodity Price Data
Exchange Rate	Local currency per US dollar	World Development Indicators (WDI)
Interest Rate	Lending interest rate (%)	World Development Indicators (WDI)
GDP growth rate	Annual GDP growth rate (%)	World Development Indicators (WDI)

Source: Author's own composition

The list of variables used in the empirical analysis, the units of measurement, and the sources of the data are provided in Table 2. The measurement of inflation is based on the consumer price index (CPI), which is used to gauge the inflation level in level form. The global Food Price Index, which is derived from the World Bank Pink Sheet, is used as a proxy of food prices and reflects global price changes of food commodities of major importance. The value of crude oil is calculated as an average crude oil price series in the World Bank Pink Sheet in US dollars. The exchange rate variable is the official exchange rate that is obtained from the World Bank World Development Indicators (WDI). The lending interest rate (percent per annum) is a proxy of interest rate variable, whereas the GDP growth rate (annual percent) measures economic activity. The fact that internationally comparable data sources are used makes the study period consistent and reliable. To minimize inconsistency and inaccuracy in this study, all data applied was taken from credible and publicly accessible international databases. The World Bank World Development Indicators (WDI) database was used to find the data on inflation, exchange rate, interest rate, and GDP growth. World Bank commodity price data (Pink Sheet) was used to retrieve the global price of food and crude oil. Also, the databases have now been mentioned under each table in order to enhance the transparency and replication of the study. They are highly employed in the literature of empirical macroeconomic studies, and they offer time-standardized measurements.

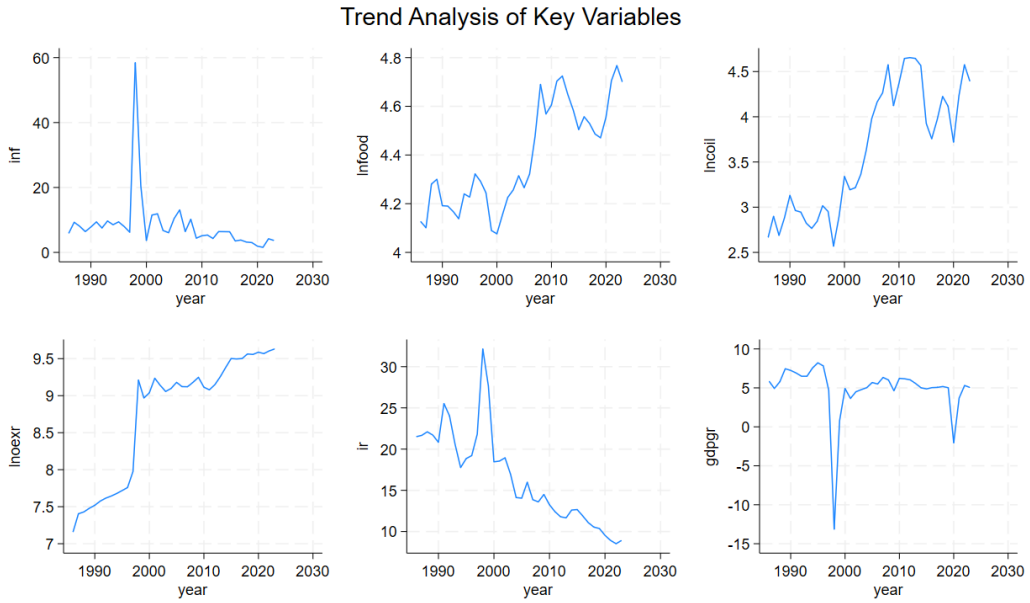

Figure 2. Trend Analysis of the variables of this study

Note: Author's own composition

Figure 2 shows the trend of how the major macroeconomic variables have progressed over the years. The inflation is very volatile, with a steep rise in the late 1990s, which was then relatively stable. The trend of food and oil prices is growing upwards, showing long-run price pressures. The exchange rate is consistently depreciated and this indicates external and structural imbalances. The interest rates reflect a falling pattern, indicating a change in the monetary policy to a more lenient one. In the long-run, GDP growth is cyclical, whereby during the crisis, the growth declines significantly and then rebounds. In general, the series present vivid trends and volatility, which validate the necessity of unit root testing and ARDL modelling, both of which reflect both short-run dynamics and long-run dynamics.

Preliminary Data Analysis

Unit Root Testing and Stationarity

The time-series properties of all variables are analysed before the model estimation to prevent spurious results of regression. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests on a combination of several tests are used to determine stationarity. The use of many unit root tests additionally makes the analysis more robust because all tests are based on the various assumptions of the error structure and deterministic aspects. The findings show that the variables have mixed orders of integration, whereby some of the series are stationary at level I(0), and others become stationary after first differencing I(1). Notably, there is no single variable that is integrated at order two I(2), and this fulfils the required condition to use the Autoregressive Distributed Lag (ARDL) modelling structure.

Econometric Approach

Model Specification

To estimate the short-run and long-run effects of the food and oil prices on inflation, this study specifies the following equation:

$$inft=0+1lnfoodt+2lnoilt+3lnexcrt+4lnirt+5GDPt+t \quad (1)$$

Where inft is the dependent variable with a time-series component (*t*), and *lnfood and lnoil* are main explanatory variables, while other variables, such as *lnexcr, lnir,* and *GDP,* are control variables, and t is the error term of this model, which incorporates both external cost-push factors and dogmatic macroeconomic variables.

ARDL Bound Test Approach

As our data shows mixed integration properties of the selected variables, and the sample size is small, this study employs the Autoregressive Distributed Lag (ARDL) bound test approach. The selection of this approach is due to its ability to allow the inclusion of variables with different integrated orders, i.e., I(0) and I(1), and provides consistent and reliable estimates.

The ARDL approach is especially appropriate because it enables to captured objective estimates even at small samples. The form of the long-run inflation model is given as a response to food prices, crude oil prices, the exchange rate, interest rate, and GDP growth rate. To both estimate the long-run coefficients as well as the short-run dynamics, the ARDL model is reparametrized to an error correction model.

The ARDL error correction equation is expressed as follows:

$$\Delta inft=0+ i=1piXt+\lambda(inft-1-\theta Xt-1)+t \quad (2)$$

Where Δinf is the dependent variable (inflation) in first difference form, representing the short-run changes in the inflation rate, and avoiding the spurious regression analysis. The term i=1piXt represents the short-run effects of explanatory variables in this model, in which Xt is the vector of all explanatory and control variables and the term θXt-1 captures the instant and logged changes in the variables. The term (inft-1-θXt-1) represents the cointegrating relation in the long run between inflation and other variables, where the parameter vector represents and captures the long-run marginal effects of these variables on inflation. The coefficient is the error correction term (ECT), it measures the speed of adjustment towards the long-run equilibrium while following a short-run shock. The term t is the error term of this model.

Cointegration and Error Correction Mechanism

A cointegration ARDL bounds test is used to test the existence of a long-run equilibrium relationship between the variables. The calculated F-statistic is compared to the critical bounds values to determine whether cointegration exists. The null hypothesis of no cointegration is rejected, which proves that there is a stable long-run relationship between inflation and its determinants. After checking the cointegration, an Error Correction Model (ECM) is estimated. The ECT (error correction term) is used to describe how inflation reacts to short-run disturbances to reach its long-run equilibrium. A negative and statistically significant ECT signifies the approach and equilibrium to a model that is stable and thus asserts the stability of the estimated model.

Lag Selection and Estimation Procedure

The best lag lengths to the ARDL model are determined by using the Akaike Information Criterion (AIC), which strikes a balance between model fit and parsimony. This guarantees that there is no over-parameterization of the model when capturing the relevant dynamics. All the estimations are done in Stata, which offers a formidable implementation of ARDL bounds testing and error correction modelling.

RESULTS AND DISCUSSIONS

This part represents the results of the estimated models used in this study. Table 3 shows the descriptive statistics of the variable of this study. The mean of inflation (Inf) is relatively low (8.38), yet extremely high variability (Std. Dev. 9.08) and positive skewness (4.60), and high kurtosis (25.76), which shows that there are extreme inflationary periods. The mean of food prices is high (82.45), and

the dispersion is moderate; the distribution of food prices is fairly symmetric in nature, as indicated by low skewness (0.44) and low kurtosis (1.82). The mean of oil prices is moderate (47.14), the variability is large, and the skew is positive but mild, indicating that the prices may occasionally go high. The mean and standard deviation of the exchange rate (Exc) are both very large; that is, there are quite significant changes over time, and the distribution is slightly negative skewed and is relatively flat (low kurtosis). The interest rate (Ir) is moderately varying and slightly positive skewness, which means that higher values appear more frequently. The mean of the GDP growth is low (4.85) with negative skewness (-3.88) and high kurtosis (19.91), implying steep declines within some periods. All in all, many of the variables, especially inflation and GDP, exhibit a non-normal distribution, and the presence of extreme values depicting volatility of the macroeconomic environment is evident.

Table 3. Descriptive Statistics

Statistics	**Variables**					
	Inf	***Food***	***Oil***	***Exc***	***Ir***	***GDP***
Mean	8.380	82.452	47.140	8222.108	16.540	4.850
Std.Dev.	9.083	17.869	31.097	4733.376	5.683	3.497
Min	1.560	58.930	13.060	1282.560	8.520	-13.126
Max	58.451	117.600	105.010	1523.880	32.154	8.220
Skewness	4.6000	0.440	0.584	-0.227	0.635	-3.880
Kurtosis	25.757	1.815	1.943	1.698	2.884	19.914
Obs.	38	38	38	38	38	38

Table 4 presents the findings of the Variance Inflation Factor (VIF) applied to determine whether there is multicollinearity among explanatory variables or not. Another widely used guideline is that values of VIF below 10 are used to show that

there is no severe multicollinearity. The findings indicate that F food (6.93), oil (5.75), exchange rate (7.02), interest rate (9.16), GDP (3.95), and all other variables have a VIF less than the critical value of 10. Even though the interest rate has the most significant VIF, it is within reasonable ranges. The moderate but not severe VIF of 6.56 also indicates that the coefficient estimates are accurate and there has not been the influence of high levels of linear relationship with the regressors, which distort the coefficient estimates.

Table 4. Multicollinearity Test

Variance Inflation Factor		
Variables	***VIF***	***1/VIF***
Food	6.93	0.144
Oil	5.75	0.173
Exc	7.02	0.142
Ir	9.16	0.1091
GDP	3.95	0.253
Mean VIF	6.56	.

Table 5. Correlation Matrix

Variables	***Inf***	***Food***	***Oil***	***Exc***	***IR***	***GDP***
Inf	1.00					
Food	-0.327	1.00				
	(0.044)					
Oil	-0.311	0.894	1.00			
	(0.057)	(0.000)				
Exc	-0.104	0.681	0.648	1.00		
	(0.533)	(0.000)	(0.000)			
IR	0.653	-0.793	-0.765	-0.725	1.00	
	(0.000)	(0.000)	(0.000)	(0.000)		
GDP	-0.785	0.043	0.136	-0.321	-0.301	1.00
	(0.000)	(0.796)	(0.415)	(0.049)	(0.066)	

The outcomes of the correlation in Table 5 indicate that there are a number of statistically significant associations between the variables. Inflation depends on the interest rate positively but negatively on GDP, which means that as inflation is high, so is the economic performance, and vice versa. There is a strong positive correlation between food and oil prices, that reflect that they are closely associated in terms of cost, and the association of both with the exchange rate is positive. The food prices, the oil prices, and the exchange rate are strongly negatively correlated with the interest rates. On the whole, the correlations are moderate to high, although they do not indicate perfect multicollinearity.

Table 6. Panel Unit Root tests

Augmented Dicky-Fuller (ADF) Unit Root Test								
	Specification	**Without Trend**			**Specification**			
Variable	lags	t-stat	p-value	Status	Lags	t-stat	p-value	Status
Inf	0.000	-4.73	0.000	stationary	1.00	-3.794	0.003	stationary
lnfood	0.000	-1.07	0.725	non-stationary	1.00	-1.452	0.557	non-stationary
lnoil	0.000	-1.20	0.676	non-stationary	1.00	-1.152	0.694	non-stationary
lnexcr	0.000	-1.68	0.442	non-stationary	1.00	-1.428	0.569	non-stationary
Ir	0.000	-1.13	0.703	non-stationary	1.00	-1.573	0.497	non-stationary
GDP	0.000	-4.30	0.000	stationary	1.00	-3.898	0.002	stationary
	Specification	**With Trend**			**Specification**			
Variable	lags	t-test	p-value	Status	Lags	t-stat	p-value	Status
Inf	0.000	-5.04	0.000	stationary	1.00	-4.295	0.003	stationary
lnfood	0.000	-2.33	0.417	non-stationary	1.00	-2.687	0.241	non-stationary
lnoil	0.000	-2.14	0.522	non-stationary	1.00	-2.228	0.474	non-stationary
lnexcr	0.000	-1.89	0.662	non-stationary	1.00	-1.595	0.795	non-stationary
Ir	0.000	-3.11	0.105	non-stationary	1.00	-4.196	0.005	stationary

GDP	0.000	-4.26	0.004	stationary	1.00	-3.905	0.012	stationary
Philip's Paron (PP) Unit Root Test								
	Specification	**Without Trend**			**Specification**			
Variable	lags	statistics	p-value	Status	Lags	t-stat	p-value	Status
Inf	0.000	-4.73	0.000	stationary	1.00	-4.731	0.000	stationary
lnfood	0.000	-1.07	0.725	non-stationary	1.00	-1.182	0.681	non-stationary
lnoil	0.000	-1.20	0.676	non-stationary	1.00	-1.361	0.621	non-stationary
lnexcr	0.000	-1.68	0.442	non-stationary	1.00	-1.668	0.447	non-stationary
Ir	0.000	-1.13	0.703	non-stationary	1.00	-1.451	0.557	stationary
GDP	0.000	-4.30	0.000	stationary	1.00	-4.412	0.000	stationary
	Specification	**With Trend**			**Specification**			
Variable	lags	statistics	p-value	Status	Lags	t-stat	p-value	Status
Inf	0.000	-5.04	0.000	stationary	1.00	-5.086	0.000	stationary
lnfood	0.000	-2.33	0.417	non-stationary	1.00	-2.410	0.374	non-stationary
lnoil	0.000	-2.14	0.522	non-stationary	1.00	-2.202	0.488	non-stationary
lnexcr	0.000	-1.89	0.662	non-stationary	1.00	-1.833	0.688	non-stationary
Ir	0.000	-3.11	0.105	non-stationary	1.00	-3.433	0.047	stationary
GDP	0.000	-4.26	0.004	stationary	1.00	-4.391	0.000	stationary

Table 6 shows the outcomes of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) panel unit root tests using specifications with and without a deterministic trend. Results indicate that inflation (Inf) and GDP are at a stationary level since the null hypothesis of the unit root is rejected at the 1% significance level in the two tests. But the food prices, oil prices, exchange rate, and interest rate are reported to be non-stationary at the level, even in specifications not including a trend, suggesting the presence of stochastic trends in these variables. The intrest rate variable shows non-stationary behaviours in the absence of trend, but it is

stationary when the trend is introduced, showing trend-stationary dynamics in this case. In general, the results show that the variables have a mixed order of integration, which demonstrates the use of the ARDL approach since it has the opportunity to include I(0) and I(1) variables and none of the variables is stationary at second difference i.e., integrated order two, I(2)(Zhang et al. 2021; Danish, Ozcan, and Ulucak 2021; Al-Shammari et al. 2023).

ARDL Long and Short-run results are presented in Table 7, and the estimated long-run and short-run coefficients of the ARDL (2, 1, 1, 1, 0, 0) model, where the inflation (Inf) is the dependent variable. This annual data with 36 observations is used to estimate the model, and it is found to fit the overall data, as represented by a high R-squared (0.958) and adjusted R-squared (0.942). The first column of Table 7 shows the long-run results. The coefficient associated with food is negative (-10.698) but statistically insignificant, which means that a 1% increase in global food prices is associated with approximately a 10.69 point decrease in the inflation rate while controlling for other factors in this model (Indonesia, Anugrah, and Indonesia 2018). The empirical result incurs the rejection of Hypothesis H2, which asserted that there would be a positive long-run relation between global food prices and inflation in Indonesia. This outcome has the value of a policy insight as opposed to being a weakness. The hardly significant long-run pass-through of world food prices can be an indication of the success of government actions like food price controls, import policy, subsidies, and the system of strategic food reserves. Such steps seem to have insulated domestic consumers against world food price shocks that have been constant. Also, the domestic food supply chains have also changed their structure, and better market stabilization mechanisms have contributed to the weakening of the transmission of international food prices into domestic inflation on a long-term basis. Thus, this finding indicates that Indonesia has acquired some

level of stability regarding external food price volatility, indicating how policy frameworks can help mitigate the pressure of imported inflation.

The empirical evidence shows that Hypothesis H1 is partly accepted. Although shock in the world oil prices has a positive and statistically significant effect on inflation in the short run, their effect on inflation is positive, but not significant in the long run. This implies that the price increment of oil directly increases the cost of production and transportation that is promptly transferred to the consumer, which is also in line with cost-push inflation theory. Nevertheless, it cannot be assumed that the inflationary effect of oil price shocks is long-lasting since it is absent.

The estimated long-run coefficient of oil is positive but statistically insignificant, representing that a 1% increase in global crude oil prices increases the inflation rate by 2.956 points, showing that oil price shocks do not always cause an inflationary trend in the case of Indonesia (Blanchard et al. 2008). The estimated long-run coefficient of exchange rate is positive but statistically insignificant, showing that 1% depreciation of the domestic currency increases inflation by approximately 2.48 points, indicating that exchange rate movements do not bring a long-run effect on inflation in Indonesia (Gagnon and Ihrig 2004).

The long-run estimated coefficient attached with interest rate is positive and statistically significant, showing that 1% point increase in lending interest rate increases inflation by approximately 0.77 points over the long run, suggesting that a higher lending interest rate causes higher inflation in Indonesia in the long term, which could be cost-push inflation or long-term accommodating monetary policies (Acquah et al. 2024), aligning the results of the study by Lawson Igbinovia & Michael Igbinovia (2023) The coefficient attached to the GDP growth rate is negative (-0.198) but insignificant (Acquah et al. 2024), showing that the economic

growth of Indonesia does not have any significant long-run impact on inflation (Bajrami et al. 2025).

The next column shows the results of short-run analysis, the coefficient attached with food prices is positive and statistically significant (at 1%), indicating that 1% increase in global food prices resulted in an immediate rise in domestic inflation, indicating that speedy price transmission from the international market to domestic prices, aligning the results with Ismaya and Anugrah, (2018). The short-run result in the case of crude oil prices is positive and statistically significant (at 1% level of significance), showing that 1% increase in crude oil prices leads to a considerable (14.29) increase in inflation in the short run in Indonesia.

Table 7. ARDL (2,1,1,1,0,0) Regression

Dependent variable: Inflation (inf)		
Variables	***Long-run***	***Short-run***
lnfood	-10.698 (6.681)	
lnoil	2.956 (2.307)	
lnexcr	2.480 (1.854)	
Ir	0.774*** (0.263)	
GDP	-0.198 (0.371)	
		0.263***(0.067) 14.294***(6.783) 3.247(2.218) 29.044***(6.123)
Constant		9.644(39.818)
Number of obs.	36	36
R-square	0.958	
Adj R-squared	0.942	
Root MSE	2.7846	
ECT (speed of adjustment)		**-1.056***(0.113)**

Note: *, **, and *** imply statistical significance at 10% and 1% levels, respectively.

Table 8. Bound test result for cointegration

Test	*10%*		*5%*		*1%*		*p-value*	
	I(0)	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
F	2.514	3.484	3.058	4.584	4.386	6.369	0.000	0.000
T	-2.510	-3.817	-2.880	-4.264	-3.644	-5.185	0.000	0.000

Table 9. Diagnostic, Cointegration, and Robustness

Residual Diagnostic Tests			
Test	**X2-stat**	**p-value**	**Status**
Breusch-Pagan (BP)	0.62	0.429	Homoscedasticity
LM	41.45	0.663	No serial problem
Jarque-Bera (Normality)	1.97	0.372	Residuals are normal
Model Specification			
Test	**Statistic**	**p-value**	
Ramsey RESET	11.94	0.000	Correct Functional form

These results confirm the cost-push inflation, as increases in crude oil prices raise the cost of production, energy prices, and transportation costs, which are further passed to consumers (Hamilton 2009). The estimated results in terms of the exchange rate in the short run indicate positive but insignificant effects, suggesting that a 1% depreciation of the exchange rate leads to a significant increase (3.24) in the inflation rate in Indonesia. It means that the depreciation of currency on the domestic level increases the price level domestically.

The coefficient attached to the interest rate is also positive and statistically significant (at 1% level of significance), showing that a 1% increase in the exchange rate brings a 29.04 point increase in the inflation rate in Indonesia, indicating that changes in rates of lending exert instant impact on price levels, aligning the results

with Pagn, (2006). There is a positive but insignificant coefficient on GDP growth rate, indicating that, in this model, the short-run impact of output growth on inflation is not very strong. 1% increases in GDP growth rate show a positive increase in the inflation level, reflecting the demand-pull inflation in Indonesia. In times of economic growth, an increase in aggregate demand is faster than production capacity, especially when the economy is facing rigidities in the labour market and supply limitations (Gordon 2011).

The short-run coefficients show that the variation in the main macroeconomic variables will affect the short-term fluctuation of inflation due to the demand-side and cost-side pressures (Batabyal and Killins 2021). The importance of short-run shocks in the dynamics of inflation is demonstrated by. Error Correction Term (ECT) The error correction term (ECT) is negative, and the error is significantly high at the 1% mark with a coefficient of (-1.056). This is an affirmation of the existence of long run cointegrating relationship between the variables. The scale of the ECT suggests that unbalanced changes in the long run are corrected fast, and over 100 percent of the disequilibrium is corrected in one period, which is a very strong and fast process. Model Adequacy The fact that the root mean square error (RMSE = 2.7846) is relatively low also shows that the model is adequate. Generally, the results indicate that although interest rates affect inflation in the long run, the short-term effects of the inflation process are mainly influenced by short-term shifts in the macroeconomic indicators, and there is a high likelihood of the economy returning to the long-run equilibrium.

The results of the ARDL bounds test indicate that the F-statistic and the t-statistic both have values greater than the upper bound I(1) critical value at the 10% and 5% and 1% levels, and the p-values are 0.000. This results in the obvious rejection of the null hypothesis of no cointegration. Thus, it shows that the long-run

relationship between the variables is stable, which proves the relevance of the ARDL-ECM model.

The diagnostic tests of the residues affirm the sufficiency of the model estimated. The Breusch-Pagan (BP) test has an insignificant p-value, meaning that there is no heteroskedasticity and the error variance is the same throughout the observations. The Lagrange Multiplier (LM) test also does not reject the null hypothesis; there is no correlation in the serial when controls of the null hypothesis. Moreover, the Jarque-Bera test indicates that the residuals are normally distributed, and this fact favours the validity of statistical inferences. As far as model specification is concerned, the evidence offered by the Ramsey RESET test suggests that the functional form of the model is specified properly and therefore, no important variables are not included, or nonlinearities are wrong. Collectively, the above findings indicate that the model meets some of the key classical regression requirements and the estimated coefficients are reliable and strong in policy and empirical interpretation.

CONCLUSION

This research paper empirically investigated both the short-run and long-run determinants of inflation based on the ARDL bounds testing model during the period in which the data were analysed. As a model of inflation, it was presented as a function of the international food prices, crude oil prices, the exchange rate movements, interest rates, and the GDP growth, with annual data that was mostly derived from the World Bank World Development Indicators and the World Bank Commodity Price Data (Pink Sheet).

The ARDL bounds test establishes the fact that there is a long-run cointegrating relationship between inflation and its explanatory variables. This observation suggests that the long-term movement of inflation and its important

macroeconomic and external determinants are together, irrespective of the short-run movement. The extremely important and negative error correction term once again proves the correctness of the long-run equilibrium, as well as shows that inflation is very quick in returning to the steady-state given a short-run shock.

The long-run findings indicate that the effect of interest rates on inflation is positive and statistically significant, indicating that increased lending rates are linked with a sustained inflationary pressure. This observation represents the cost-side transmission of interest rates, especially in the economies that have an increased cost of production and transfer the cost to consumers. However, contrarily, long-term growth in GDP has no major impact on inflation, which means that demand-side growth forces are not the main determinants of inflation but structural, monetary, and external forces.

Commodity prices at the international level, especially food and crude oil prices, show theoretically consistent tendencies in the long-run, but their statistical significance is not significant. It is an indication that even though global price shocks do affect domestic inflation dynamics, their overall effects are dependent on the structure of the domestic market, policy reactions, and the extent of dependence on imports in the long term. The inflation is also positively correlated with exchange rate depreciation, which further supports the role of imported inflation in open economies.

The findings demonstrate the topicality of demand-side pressures and external shocks in the short run because GDP growth, as well as the choice of price variables, influence inflation in the short term. Nevertheless, these short-term fluctuations are eliminated over time, and this is attested by the error-correcting mechanism. On the whole, the research results imply that inflation in the economy under analysis is mainly cost-push and externally caused, with little long-run impact

on output growth. It has significant policy implications for macroeconomic stabilization policies, especially in developing and emerging market economies.

Policy Recommendations

Based on the empirical findings, several policy-relevant recommendations emerge: The exceptionally good and significant long-run relationship between interest rates and inflation points to the fact that monetary tightening can be undertaken conventionally as an insufficient measure to check inflation. The policymakers must thus improve the transmission mechanism of the monetary policy such that the interest rate changes can affect the inflation expectation and not just raise the cost of production and financing. This can be done by enhancing the depth of financial markets and bringing down structural inflexibilities in credit markets. Since the prices of international food and crude oil affect the level of inflation, the reduction of vulnerability to the world price fluctuations of commodities should be the priority of policymakers.

It can accomplish this by diversifying energy, strategic food stocks, and using effective subsidies on vital commodities during the season of global price spikes. Global food price shocks can be alleviated by strengthening domestic agricultural productivity to pass through into domestic inflation. Stabilization of exchange rates: This aims to maintain the exchange rates at the intended level by implementing a market-based policy to stabilize these positions and to eliminate any imbalance in the exchange rates. In terms of exchange rate stabilization, to ensure that the exchange rates remain at the desired level, through the use of a market-oriented policy is used that will stabilize the position in the exchange rates and removing the imbalance in the exchange rates. The positive correlation between exchange rate depreciation and inflation brings out the significance of exchange rate stability in regulating inflation. Although keeping the exchange rate fixed may

not be practical, the current volatility must be kept at a low level by implementing sound foreign exchange management, amassing sufficient foreign reserves, and maintaining consistency in the macroeconomic policies, which will boost investor confidence.

The fact that the GDP growth is not important in the long run implies that economic growth is not an automatic driver of sustained inflation. Thus, the policymakers will be able to engage in growth-promoting policies, such as infrastructure development, investment in human capital, and growth in the industrial sector, without excessive apprehension regarding the inflationary impacts in the long term, as long as there is an increase in the capacity of the supply side along with the demand. The coordinated policy framework was updated by the ADCO Company and is currently in progress. Lastly, the findings underscore the necessity of integration of policies among the monetary, fiscal, and trade authorities. The instrumentation of inflation should not be pegged on the adjustment of interest rates but should be underpinned by fiscal moderation, supply-side reforms, and trade policies, which lessen the level of import dependency and strengthen the domestic resilience.

Future Research

Although this research gives solid support on the factors that cause inflation, some research opportunities in the future are still available: To begin with, future research can broaden the analysis by adding structural breaks associated with major economic crises, price shocks in commodities, or changing of policy regimes, which can change inflation dynamics over time. Second, the present research is based on annual data. It might be beneficial to use higher-frequency data in future analyses (quarterly/monthly data) to observe more subtle short-run inflationary effects and relate the policy. Third, other variables may be incorporated, like money

supply, fiscal deficit, public debt, or inflation expectation, which would give a more elaborate inflation model, especially from a monetary perspective. Fourth, panel ARDL or PMG estimators could be used to conduct comparative panel studies of many more countries than have been done previously to determine heterogeneity in inflation dynamics in economies with varied structural features. Lastly, it is possible to use a nonlinear ARDL or asymmetric model in future research to discuss the issue of whether inflation reacts to positive vs. negative shocks in commodity prices, exchange rates, or economic growth in different countries for comparison.

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