ASYMMETRIC EFFECTS OF CHANGES IN OIL PRICE VOLATILITY AND WORLD ECONOMIC POLICY UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

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1. Introduction

This paper examines the inflationary process in developing countries, with particular emphasis on the asymmetric effects of oil price volatility and global economic policy uncertainty on inflation dynamics. Using quarterly data from 1994 to 2022 for 74 developing economies, the study investigates the proximate sources of inflation identified in the literature. These include the exchange rate, as emphasized by the fiscal view; the output gap; monetary expansion; oil price changes, which capture cost-push shocks; economic policy uncertainty, which reflects uncertainty shocks; lagged inflation, which highlights the inertial

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component of price dynamics (Loungani and Swagel, 2001); and interest rates, which capture the role of monetary policy.

The literature suggests that inflation in developing countries is often rooted in fiscal imbalances. Such imbalances can generate inflationary pressures either through excess money supply (Sargent and Wallace, 1981) or through balance-of-payments crises and exchange rate depreciation (Liviatan and Piterman, 1986). Other contributions, such as Razin and Sadka (1987) and Bruno and Fisher (1990), highlight the link between inflation and the government budget constraint, underscoring the fiscal foundations of price instability. Classic contributions by Friedman (1968) and Sargent and Wallace (1981) further demonstrate that large and persistent fiscal deficits can profoundly shape the trajectory of inflation in developing economies.

Previous research has examined the role of oil price shocks and economic policy uncertainty in shaping inflationary dynamics across both developed and developing economies (Istiak and Alam, 2019; Anderl and Caporale, 2023; Wong, 2015; Salisu and Isah, 2017; Musa et al., 2022; Chen, 2009; Ali et al., 2023; Bawa et al., 2020; Kocaarslan et al., 2020; Yang et al., 2023). Using different empirical approaches, these studies generally emphasize the importance of accounting for nonlinear and asymmetric effects.

Istiak and Alam (2019), applying the Kilian and Vigfusson (2011) framework, identify asymmetric responses of inflation expectations to oil price and policy uncertainty shocks, distinguishing between positive and negative disturbances as well as pre- and post-financial crisis periods. Their results suggest that since the global financial crisis, the Federal Reserve's increased emphasis on output stabilization has left inflation expectations less anchored, making them more susceptible to rapid adjustments following oil price spikes.

Similarly, Anderl and Caporale (2023) employ a nonlinear autoregressive distributed lag (NARDL) model to assess the asymmetric impacts of economic policy uncertainty (EPU) and oil price uncertainty (OPU) on inflation. Using monthly data from the 1990s to 2022 across developed and emerging economies, they demonstrate that the magnitude of both EPU and OPU shocks is larger when asymmetries are explicitly modeled. Notably, they find that negative EPU shocks exert a stronger inflationary influence than OPU shocks, reflecting the role of monetary policy uncertainty. The authors argue that enhancing transparency and timeliness of monetary policy communication could help anchor expectations and mitigate these effects.

In contrast, Wong (2015) shows that while inflation expectations, as captured by the Michigan Survey of Consumers, are sensitive to oil price shocks, they play only a limited role in transmitting such shocks to actual inflation. Structural break analysis further suggests that after the mid-1990s, inflation expectations may have ceased to significantly influence the propagation of oil price shocks, pointing to a weakening of this transmission channel.

Salisu and Isah (2017) revisit the oil price–stock price nexus for oil-exporting and oil-importing economies by explicitly addressing nonlinearities and heterogeneity. Employing a nonlinear Panel ARDL framework—an extension of Shin et al. (2014)—they allow for asymmetric responses to positive and negative oil price changes as well as variation across country groups. Their analysis demonstrates that while stock prices in both oil exporters and importers respond asymmetrically to oil price shocks, the effect is considerably stronger in importing economies. Out-of-sample forecasts further confirm that incorporating asymmetries improves predictive performance only for import-dependent countries. These findings highlight the importance of differentiating between exporters and importers when assessing the oil price–stock market relationship.

Extending the analysis to firm-level dynamics, Musa et al. (2022) investigate Nigerian oil and gas companies during 2009Q1–2016Q3 using ARDL and NARDL models. Their results show that both positive and negative oil price shocks exert a positive long-run effect on stock prices, with broadly symmetric responses in the short run. Similarly, Abu-Bakar and Masih (2018) examine the global oil price–inflation nexus. They find no long-run association under the linear ARDL specification, but the NARDL model reveals evidence of asymmetric pass-through, underscoring the importance of nonlinear frameworks.

At the cross-country level, Chen (2009) analyzes 19 industrialized economies and documents a decline in oil price pass-through to inflation over time. He attributes this weakening effect to exchange rate appreciations, more proactive monetary policy responses, and higher trade openness. Ali et al. (2023) reach complementary conclusions for Egypt, showing that while the short-run pass-through of world oil prices to domestic inflation is symmetric and limited, long-run effects are nonlinear and asymmetric. In particular, declining oil prices reduce inflation more strongly than rising prices increase it.

Bawa et al. (2020) focus on Nigeria and apply the NARDL approach to data from 1999Q1–2018Q4. Their findings indicate that oil price increases significantly raise headline, core, and food inflation, reinforcing the evidence of asymmetric inflationary effects of oil shocks in developing economies.

López-Villavicencio and Pourroy (2019) employ state-space models to examine the pass-through of oil price changes to consumer prices across a broad sample of countries from 1970 to 2017. By controlling for self-selection bias and endogeneity, and by distinguishing between positive and negative price shocks, they compare explicit inflation-targeting (IT) countries with a control group. Their results indicate that pass-through effects are stronger in IT countries, but that adopting IT reduces asymmetry in the transmission of oil price shocks, thereby helping to stabilize inflation dynamics.

Other studies extend this line of inquiry by analyzing how oil price shocks and economic policy uncertainty affect a wider range of macroeconomic outcomes.

Aimer and Lusta (2021), for example, assess the asymmetric effects of oil prices on economic policy uncertainty (EPU) using a nonlinear ARDL framework with data from 1997 to 2021. Their findings confirm a long-run equilibrium relationship between oil prices and EPU, with evidence that negative oil price shocks exert a stronger and more persistent effect than positive ones.

Similarly, Kocaarslan et al. (2020) investigate the asymmetric interactions among oil prices, oil price uncertainty, interest rates, and unemployment within a cointegration framework. Their results suggest that higher oil prices increase unemployment, while declines in oil prices have no significant effect. In addition, reduced oil price uncertainty lowers unemployment, whereas heightened uncertainty does not exert a measurable impact. They also find that unemployment rises in response to lower interest rates, while increases in rates have little effect, underscoring the complex and asymmetric labor market responses to energy and monetary shocks.

Yang et al. (2023) focus on China, employing a multiple-threshold nonlinear ARDL model to capture the asymmetric effects of oil price shocks on different categories of economic policy uncertainty. Their analysis shows that the asymmetries are more pronounced in the long run, with trade policy uncertainty emerging as the most sensitive category.

At a broader level, Nusair and Al-Khasawneh (2023) examine the G7 economies using quantile regression to analyze monthly data from 1985 to 2021. They find that oil price and EPU shocks have significant asymmetric effects on stock market returns, with the magnitude and direction of the impact varying according to market conditions. Overall, their results show a positive relationship between oil prices and stock returns, alongside a negative relationship between EPU and stock performance.

The structure of the paper is as follows. Section 2 outlines the econometric methodology, while Section 3 describes the data sources and variable construction. Section 4 presents the empirical results and discussion, and Section 5 provides robustness checks to validate the findings. Finally, Section 6 concludes with key insights and policy implications.

2. *Econometric Method*

The primary objective of this study is to investigate the effects of oil price volatility and global economic policy uncertainty on the sources of inflation in developing countries. To achieve this, we employ a nonlinear panel autoregressive distributed lag (NARDL) model, following Salisu and Isah (2017). Their framework captures within-group differences between oil price and stock prices in oil-exporting and oil-importing countries by allowing for heterogeneity across cross-sections. The nonlinear panel ARDL can be viewed as the panel extension of the Shin et al. (2014) model and is analogous to the non-stationary heterogeneous panel data approach.

Our modeling choice is further motivated by Wadud et al. (2022), who applied a panel NARDL to analyze the asymmetric effects of economic policy uncertainty on Australian housing and apartment prices over the period 2001–2021. In addition to the nonlinear specification, we also examine the linear relationship between oil price volatility, policy uncertainty, and inflation dynamics using the conventional ARDL framework.

The panel model used in this study examines the effects of the oil price volatility and of the World Economic Policy Uncertainty on inflation, conditioned on some control variables (exchange rate, output gap, money growth and interest rate) and is written as follows in equation (1):

$$\begin{aligned} inflation_{it} = {} & \beta_1 oilpvolt_{it} + \beta_2 wui_{it} + \beta_3 lex_{it} + \beta_4 output_{it} \\ & + \beta_5 lbmgwth_{it} + \beta_6 tx_{it} + \alpha_i + \varepsilon_{it} \end{aligned} \tag{1}$$

where *inflation* represents inflation calculated from the Consumer Price Index (CPI), *oilpvolt* is the oil price volatility, *wui* is the World Economic Policy Uncertainty measured by the World Uncertainty Index (WUI), *lex* is the logarithm of exchange rate, *output* is the deviation of the logarithm of GDP from its potential level, *lbmgwth* is the money growth, *tx* is the monetary policy interest rate, α_i is the heterogeneous fixed effects or individual fixed effects, and ε_{it} is the error terms.

2.1. Symmetric Panel ARDL: In this section, we examine the linear relationship between oil price volatility, World Economic Policy Uncertainty, and inflation. By assuming a symmetric response of inflation to changes in both oil price volatility and economic policy uncertainty, we adopt the symmetric specification of the linear panel ARDL model, following Salisu and Isah (2017). The symmetric panel ARDL is expressed as in equation (2).

$$\begin{aligned} \Delta inflation_{it} = {} & \theta_{0i} + \theta_{1i} inflation_{i,t-1} + \theta_{2i} oilpvolt_{i,t-1} + \theta_{3i} wui_{i,t-1} + \theta_{4i} lex_{i,t-1} \\ & + \theta_{5i} output_{i,t-1} + \theta_{6i} lbmgwth_{i,t-1} + \theta_{7i} tx_{i,t-1} \\ & + \sum_{j=1}^{p-1} \gamma_{ij} \Delta inflation_{i,t-j} + \sum_{j=0}^{q-1} \delta_{1ij} \Delta oilpvolt_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{2ij} \Delta wui_{i,t-j} + \sum_{j=0}^{q-1} \delta_{3ij} \Delta lex_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{4ij} \Delta output_{i,t-j} + \sum_{j=0}^{q-1} \delta_{5ij} \Delta lbmgwth_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{6ij} \Delta tx_{i,t-j} + \mu_i + \varepsilon_{it} \end{aligned} \tag{2}$$

$$i = 1,\ 2, \ldots,\ N \qquad t = 1,\ 2, \ldots,\ T$$

where *inflation* represent the inflation; *oilpvolt* denotes the oil price volatility, *wui* represents the World Economic Policy Uncertainty measured by the World Uncertainty Index (WUI), *lex* is the log of exchange rate, *output* is the output gap, *lbmgwth* is the money growth; *tx* is the monetary policy interest rate; μ_i the group-specific effect, and ε_{it} is the error terms.

For each cross-section, the long run slop coefficients are computed as $-\theta_{2i}/\theta_{1i}$, $-\theta_{3i}/\theta_{1i,}$ $-\theta_{4i}/\theta_{1i}$, $-\theta_{5i}/\theta_{1i}$, $-\theta_{6i}/q_{1i}$, $-\theta_{7i}/\theta_{1i}$ since in the long run, it is assumed that $\Delta inflation_{i,t\text{-}j} = 0$, $\Delta oilpvolt_{i,t\text{-}j} = 0$, $\Delta wui_{i,t\text{-}j} = 0$, $\Delta lex_{i,t\text{-}j} = 0$, $\Delta output_{i,t\text{-}j} = 0$, $\Delta lbmgwth_{i,t\text{-}j} = 0$, and $\Delta tx_{i,t\text{-}j} = 0$.

To include an error correction term, equation (2) is re-specified in equation (3):

$$\begin{aligned}\Delta inflation_{it} = \lambda_i \upsilon_{i,t-1} &+ \sum_{j=1}^{p-1} \gamma_{ij} \Delta inflation_{i,t-j} \\ &+ \sum_{j=0}^{q-1} \delta_{1ij} \Delta oilpvolt_{i,t-j} + \sum_{j=0}^{q-1} \delta_{2ij} \Delta wui_{i,t-j} \\ &+ \sum_{j=0}^{q-1} \delta_{3ij} \Delta lex_{i,t-j} + \sum_{j=0}^{q-1} \delta_{4ij} \Delta output_{i,t-j} \\ &+ \sum_{j=0}^{q-1} \delta_{5ij} \Delta lbmgwth_{i,t-j} + \sum_{j=0}^{q-1} \delta_{6ij} \Delta tx_{i,t-j} + \mu_i + \varepsilon_{it}\end{aligned} \tag{3}$$

$$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$$

where

$$\begin{aligned}\upsilon_{i,t-1} = inflation_{i,t-1} - \phi_{0i} - \phi_{1i} oilpvolt_{i,t-1} - \phi_{2i} wui_{i,t-1} - \phi lex_{i,t-1} \\ - \phi_{4i} output_{i,t-1} - \phi_{5i} lbmgwth_{i,t-1} - \phi_{6i} tx_{i,t-1}\end{aligned}$$

is the linear error correction term for each; the parameter λ_i is the error-correcting speed of adjustment term for each unit which is also equivalent to θ_{1i}. The parameters ϕ_{0i}, ϕ_{1i}, ϕ_{2i}, ϕ_{3i}, ϕ_{4i}, ϕ_{5i}, and ϕ_{6i} are computed as $-\theta_{0i}/\theta_{1i}$, $-\theta_{2i}/\theta_{1i,}$ $-\theta_{3i}/\theta_{1i}$, $-\theta_{4i}/\theta_{1i}$, $-\theta_{5i}/\theta_{1i}$, and $-\theta_{6i}/\theta_{1i}$, respectively.

2.2. Asymmetric Panel ARDL: In this study, we employ the nonlinear ARDL (NARDL) framework to investigate the short- and long-run asymmetric effects of oil price volatility and World Economic Policy Uncertainty on the sources of inflation in developing countries. The incorporation of asymmetry is motivated by the possibility that inflation may respond differently to increases and decreases in oil price volatility and economic policy uncertainty (Wadud et al., 2022). To capture this, oil price volatility and policy uncertainty are decomposed into positive and negative partial sums of changes, allowing the model to account for potentially divergent effects of upward and downward movements. Accordingly, the asymmetric panel ARDL specification enables us to identify whether inflation dynamics in developing countries react in a non-uniform manner to positive versus negative shocks. The resulting framework is presented in equation (4).

$$\begin{aligned}\Delta inflation_{it} = {} & \theta_{0i} + \theta_{1i} inflation_{i,t-1} + \left(\theta_{2i}^{+}\, oilpvolt_{i,t-1}^{+} + \theta_{2i}^{-} oilpvolt_{i,t-1}^{-}\right) \\ & + \left(\theta_{3i}^{+}\, wui_{i,t-1}^{+} + \theta_{3i}^{-} wui_{i,t-1}^{-}\right) + \theta_{4i} lex_{i,t-1} + \theta_{5i} output_{i,t-1} \\ & + \theta_{6i} lbmgwth_{i,t-1} + \theta_{7i} tx_{i,t-1} + \sum_{j=1}^{p-1} \gamma_{ij} \Delta inflation_{i,t-j} \\ & + \sum_{j=0}^{q-1} \left(\delta_{1ij}^{+} \Delta oilpvolt_{i,t-j}^{+} + \delta_{1ij}^{-} \Delta oilpvolt_{i,t-j}^{-}\right) \\ & + \sum_{j=0}^{q-1} \left(\delta_{2ij}^{+} \Delta wui_{i,t-j}^{+} + \delta_{2ij}^{-} \Delta wui_{i,t-j}^{-}\right) + \sum_{j=0}^{q-1} \delta_{3ij} \Delta lex_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{4ij} \Delta output_{i,t-j} + \sum_{j=0}^{q-1} \delta_{5ij} \Delta lbmgwth_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{6ij} \Delta tx_{i,t-j} + \mu_i + \varepsilon_{it} \end{aligned} \tag{4}$$

$$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$$

where $oilpvolt_{it}^{+}$ and $oilpvolt_{it}^{-}$ denote, respectively, the positive and negative change of the oil price volatility and wui_{it}^{+} and wui_{it}^{-} denote, respectively, the positive and negative change of the World Economic Policy Uncertainty.

The ratios $-\theta_{2i}^{+}/\theta_{1i}$ and $-\theta_{2i}^{-}/\theta_{1i}$ are the long-run coefficients for $oilpvolt_{it}^{+}$ and $oilpvolt_{it}^{-}$, respectively, and $-\theta_{3i}^{+}/q_{1i}$ and $-\theta_{3i}^{-}/\theta_{1i}$ are the long-run coefficients for wui_{it}^{+} and wui_{it}^{-}, respectively.

On the one hand, these changes are computed, respectively, as positive and negative partial sum decompositions of the oil price volatility changes as defined in equations (5) and (6):

$$oilpvolt_{it}^{+} = \sum_{j=1}^{N} \Delta oilpvolt_{itj}^{+} = \sum_{j=1}^{N} \max(\Delta oilpvolt_{itj}, 0) \tag{5}$$

$$oilpvolt_{it}^{-} = \sum_{j=1}^{N} \Delta oilpvolt_{itj}^{-} = \sum_{j=1}^{N} \min(\Delta oilpvolt_{itj}, 0) \tag{6}$$

On the other hand, these changes are computed, respectively, as positive and negative partial sum decompositions of the World Economic Policy Uncertainty changes as defined in equations (7) and (8):

$$wui_{it}^{+} = \sum_{j=1}^{N} \Delta wui_{itj}^{+} = \sum_{j=1}^{N} \max(\Delta wui_{itj}, 0) \tag{7}$$

$$wui_{it}^{-} = \sum_{j=1}^{N} \Delta wui_{itj}^{-} = \sum_{j=1}^{N} \min(\Delta wui_{itj}, 0) \tag{8}$$

The error correction version of equation (4) is specified as follows in equation (9):

$$\begin{aligned}\Delta inflation_{it} = {} & \tau_i \xi_{i,t-1} + \sum_{j=1}^{p-1} \gamma_{ij} \Delta inflation_{i,t-j} \\ & + \sum_{j=0}^{q-1} \left(\delta_{1ij}^{+} \Delta oilpvolt_{i,t-j}^{+} + \delta_{1ij}^{-} \Delta oilpvolt_{i,t-j}^{-} \right) \\ & + \sum_{j=0}^{q-1} \left(\delta_{2ij}^{+} \Delta wui_{i,t-j}^{+} + \delta_{2ij}^{-} \Delta wui_{i,t-j}^{-} \right) + \sum_{j=0}^{q-1} \delta_{3ij} \Delta lex_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{4ij} \Delta output_{i,t-j} + \sum_{j=0}^{q-1} \delta_{5ij} \Delta lbmgwth_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{6ij} \Delta tx_{i,t-j} \end{aligned} \tag{9}$$

$$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$$

where $\xi_{i,t-1}$ is the error correction term allowing to capture the long run equilibrium in the asymmetric panel ARDL specified in equation (9) and, the parameter t_i is the speed of adjustment term that measures how long it takes the system to converge to the long run equilibrium in the presence of a shock.

3. Data

We used quarterly data from 1994 to 2022 to examine the effect of oil price volatility and World Economic Policy Uncertainty on the sources of inflation in 74 developing countries.[1] The key macroeconomic variables—consumer price index (CPI), exchange rate, nominal GDP, monetary policy interest rate, and monetary aggregates (broad money)—are obtained from the International Financial Statistics (IFS) database of the International Monetary Fund (IMF). Inflation is calculated from the CPI and measured as the average percentage change in the index. The exchange rate variable (*lex*) is expressed in logarithmic form, while the output gap (*output*) is measured as the deviation of the logarithm of GDP from its potential level. Money growth (*lbmgwth*) is defined as the growth rate of the logarithm of broad money, and the monetary policy interest rate (*tx*) is used in levels.

Data on monthly Brent crude oil prices (USD per barrel, not seasonally adjusted) and global natural gas prices (USD per million metric British thermal

[1] Albania, Algeria, Angola, Armenia, Azerbaijan, Bangladesh, Belarus, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African, Chad, Chile, China, Colombia, Costa Rica, Côte d'Ivoire, Croatia, Czech, Dominican, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Jamaica, Jordan, Kenya, Kuwait, Lao, Madagascar, Malawi, Mali, Mexico, Moldova, Mongolia, Morocco, Nepal, Niger, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Romania, Saudi Arabia, Senegal, Singapore, South Africa, Sudan, Thailand, Tunisia, Türkiye, Uganda, Ukraine, Uruguay and Zambia.

units, not seasonally adjusted) are sourced from the Federal Reserve Bank of St. Louis. Oil price volatility (*oilpvolt*) and gas price volatility (*gaspvolt*) at quarterly frequency are constructed as the standard deviation of monthly Brent and natural gas prices, respectively.

Global economic policy uncertainty is proxied by the *World Uncertainty Index* (*wui*), developed by Ahir, Bloom, and Furceri (2018). The WUI is constructed on a quarterly basis for 143 countries using the frequency of the word "uncertainty" in Economist Intelligence Unit (EIU) country reports. Specifically, it measures the percentage of occurrences of "uncertain" (and its variants) in each report, scaled by multiplying by 1,000,000. Higher values indicate greater uncertainty. For example, a value of 200 implies that references to "uncertainty" account for 0.02 percent of the approximately 10,000 words in a typical EIU report. In this study, WUI serves as the measure of World Economic Policy Uncertainty.

For robustness, we also incorporate the macroeconomic and financial uncertainty indexes of Jurado, Ludvigson, and Ng (2015). These indexes quantify economic uncertainty based on implied forecast errors for real economic activity, derived from a factor model utilizing hundreds of economic and financial series. Consistent with the quarterly frequency of our dataset, we use the three-month forecast horizon measure.

Descriptive statistics for all variables are presented in Tables 1 and 2 of the Appendix, while the correlation coefficients are reported in Table 3.

4. Results and Discussion

4.1 Preliminary Tests: Before estimating the NARDL model, we conducted several preliminary diagnostic tests, including the Dumitrescu and Hurlin panel causality test for heterogeneous panels, the cross-section dependence test, panel unit root tests, and panel cointegration tests.

The Dumitrescu and Hurlin panel causality test (Table 4, Appendix) focuses on inflation sources and the two key variables of interest—oil price volatility and World Economic Policy Uncertainty. The results indicate that oil price volatility Granger-causes inflation at the 5% significance level, while World Economic Policy Uncertainty Granger-causes inflation at the 1% significance level. The optimal number of lags was determined by minimizing the average Akaike and Bayesian information criteria (AIC and BIC).

Next, we applied the cross-section dependence test (Pesaran, 2003) across all variables. The null hypothesis of cross-sectional independence was rejected for most series, except for the exchange rate and monetary policy interest rate (Table 5, Appendix). Based on these outcomes, we performed unit root tests under two scenarios: assuming cross-sectional dependence for most series, and independence for exchange rate and interest rate.

For the latter, we used first-generation panel unit root tests—Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003), abbreviated as LLC and IPS (Table 6, Appendix). The LLC test indicates that the exchange rate is stationary in levels, I(0), while the IPS test shows that the interest rate is also I(0). To account for cross-sectional dependence, we further applied second-generation panel unit root tests, namely Breitung (2000) and Pesaran (2006). Breitung's test suggests that inflation is stationary in first differences with trend [I(1)], the exchange rate is I(1) without trend, and both oil price volatility and World Economic Policy Uncertainty are I(0). In contrast, Pesaran's (2006) test finds all series stationary at level, I(0), except for oil price volatility.

Finally, to assess long-run relationships, we employed three panel cointegration tests: Kao (1999), Pedroni (1996), and Westerlund (2007). The results (Table 7, Appendix) consistently reject the null hypothesis of no cointegration at the 1% level. We therefore conclude that a stable long-run relationship exists among inflation, oil price volatility, and the exchange rate.

4.2 ARDL Modeling Results: Beyond the primary objective of this study—to analyze the asymmetric panel ARDL effects of oil price volatility and World Economic Policy Uncertainty on inflation in developing countries between 1994Q1 and 2022Q4—we also investigate the symmetric panel ARDL specification over the same period. The corresponding results are reported in Table 8 of Appendix.

Following the empirical literature on dynamic panel data models, we employ both the Pooled Mean Group (PMG) and the Mean Group (MG) estimators (Pesaran and Smith, 1995; Pesaran et al., 1999). The PMG estimator constrains the long-run slope parameters to be homogeneous across countries while allowing short-run dynamics to remain heterogeneous. In contrast, the MG estimator permits country-specific parameters in both the short and long run by estimating individual regressions for each country and then computing unweighted averages. To determine the appropriate estimator, we perform a Hausman test of long-run homogeneity. Although both PMG and MG are consistent, PMG is more efficient under the null of long-run homogeneity.[2]

According to the Hausman test results (Table 8, Appendix), the PMG estimator is preferred. The error-correction terms are negative and statistically significant at the 1% level across specifications (columns 1–5, Table 8), confirming convergence to long-run equilibrium.

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[2] The PMG restricts long-run equilibrium to be homogenous across countries, while allowing heterogeneity for the short-run relationship. The short-run relationship focuses on the country specific heterogeneity, which might be caused by different responses of stabilization policies, external shocks or financial crises for each country. The MG estimator allows for heterogeneity in the short-run and long-run relationship. To be consistent, this estimator is appropriate for a large number of countries. For a small number of *N*, this method is sensitive to permutations of non-large model and outliers (Favara, 2003).

Regarding the long-run relationship, oil price volatility has a negative effect on inflation in developing countries, though the effect is only weakly significant (column 3, Table 8, Appendix). In other specifications (columns 1, 2, 4, and 5), the long-run effect is positive but statistically insignificant. In the short run, however, oil price volatility exerts a positive and significant effect on inflation at the 10% level (columns 1 and 4, Table 8). By contrast, World Economic Policy Uncertainty does not display a statistically significant impact on inflation in either the short or long run. This result is consistent with earlier findings such as Wong (2015), who notes that while inflation expectations in the Michigan Survey of Consumers respond to real oil price shocks, broader measures of policy uncertainty may not have the same effect.

Turning to control variables, the results indicate that exchange rate movements, money growth, and monetary policy interest rates contribute to reducing inflation in the long run (see columns 1, 2, and 5 of Table 8 for exchange rate and money growth, and columns 1, 4, and 5 for the interest rate). In the short run, money growth significantly reduces inflation, while the monetary policy interest rate exerts a positive and significant effect, suggesting short-run price pressures from policy tightening.

4.3 NARDL Modeling Results: The results of the asymmetric panel ARDL estimations of oil price volatility and World Economic Policy Uncertainty on inflation in developing countries from 1994Q1 to 2022Q4 are reported in Table 9 of Appendix. Columns 1–5 present the Pooled Mean Group (PMG) estimators, while columns 6–10 report the Mean Group (MG) estimators. A Hausman test is conducted to compare the two approaches. Since all test probabilities exceed the 5% significance level, we do not reject the null hypothesis of long-run homogeneity. Consequently, we retain the PMG estimators (columns 1–5) as the most consistent and efficient.

The PMG estimators confirm that oil price volatility and World Economic Policy Uncertainty exert asymmetric effects on inflation in developing countries, particularly in the long run. The error-correction terms are negative and statistically significant at the 1% level, indicating stable adjustment toward equilibrium. The results show that positive shocks to oil price volatility significantly increase inflation in the long run (columns 1, 3, 4, and 5 of Table 9, Appendix), while negative shocks significantly reduce it over the same horizon.

These findings are consistent with prior studies documenting asymmetric oil price–inflation dynamics. Abu-Bakar and Masih (2018) provide evidence of a long-term association and asymmetric pass-through between global oil prices and inflation. Ali et al. (2023) similarly identify a pass-through from world oil prices to domestic inflation in Egypt, while Bawa et al. (2020) demonstrate that oil price increases drive headline, core, and food inflation in Nigeria. Musa et al. (2022) further show that oil and gas stock prices respond positively to oil price shocks in the long run. In addition, Salisu and Isah (2017) find that stock prices in both oil-exporting and oil-importing countries exhibit asymmetric responses to oil price changes, with stronger effects observed in oil-importing economies.

The results in column 3 of Table 9 indicate that positive changes in World Economic Policy Uncertainty reduce inflation in developing countries at the 10% significance level in the long run. By contrast, in the short run, neither positive nor negative changes in oil price volatility significantly affect inflation. However, negative shocks to World Economic Policy Uncertainty are associated with higher inflation at the 5% level, while positive short-run changes remain insignificant.

A comparison of coefficients reveals that the long-run effect of positive changes in World Economic Policy Uncertainty is nearly sixty times larger in magnitude (absolute value) than that of oil price volatility, underscoring the dominant role of policy uncertainty in shaping inflation dynamics in developing countries. This finding aligns with Anderl and Caporale (2023), who show that both economic policy uncertainty (EPU) and oil price uncertainty (OPU) shocks have greater estimated effects when asymmetries are considered, with negative EPU shocks exerting the strongest influence by also capturing aspects of monetary policy uncertainty. Similarly, Istiak and Alam (2019) document asymmetric effects of oil price and policy uncertainty on inflation expectations across positive and negative shocks, as well as across pre- and post-financial crisis periods.

The results further show that the exchange rate (columns 1, 2, and 5, Table 9), money growth (columns 1, 2, and 5), and the monetary policy interest rate (columns 1, 2, 4, and 5) significantly increase inflation in the long run in developing countries. In the short run, the monetary policy interest rate also exerts a positive and significant effect on inflation, while money growth reduces inflation significantly. By contrast, the exchange rate has no significant short-run impact, and the output gap remains insignificant in both the short- and long-run.

5. *Robustness Check*

To verify the robustness of our results, we conduct two sets of alternative specifications. First, we replace oil prices with natural gas prices, another key petroleum product. Second, we substitute the World Economic Policy Uncertainty index with the macroeconomic and financial uncertainty measures proposed by Jurado et al. (2015). The corresponding results are reported in Tables 10–13 of Appendix. As in the baseline analysis, we perform the Hausman test to determine the preferred estimator between the PMG and MG methods.

In Table 10, we employ gas price volatility as a proxy for oil price volatility and use the macroeconomic uncertainty index of Jurado et al. (2015) as the measure of uncertainty. In Table 11, gas price volatility is again used as a proxy for oil price volatility, but the financial uncertainty index of Jurado et al. (2015) is applied instead. Both tables are used to assess the robustness of the linear effects of oil price volatility and economic uncertainty on inflation in developing countries.

Based on the Hausman test results, we retain the PMG estimators from equations 1–5 of Table 10, while for Table 11 we retain the PMG estimators for equations 1–4 and the MG estimator for equation 10. The long-run results confirm a positive and statistically significant effect of oil price volatility on inflation (columns 1 and 5 of Table 10; columns 1, 4, and 10 of Table 11). However, the negative long-run effect observed in column 3 of Table 8 is not supported in the corresponding columns of Tables 10 and 11.

Regarding uncertainty, the long-run effects are significant and confirmed under Table 10, but become insignificant in columns 2 and 10 of Table 11. In the short run, the effects of oil price volatility are generally confirmed but remain statistically insignificant in both tables, except for column 4 of Table 11, where the effect is negative but still insignificant. The short-run effects of uncertainty are also weak: column 3 of Table 10 confirms the earlier results, but the effect is insignificant as in Table 8, while columns 4 and 5 of Table 10 show a negative and insignificant effect. Similarly, the effects in Table 11 are negative and insignificant.

With respect to the asymmetric effects of changes in oil price volatility and World Economic Policy Uncertainty on inflation in developing countries, the results in Tables 12 and 13 suggest that the evidence of asymmetry is only partially robust. Specifically, positive shocks to gas price volatility significantly increase inflation in the long run (columns 1 and 5 of Table 12; columns 1, 3, and 4 of Table 13). By contrast, negative shocks generally reduce inflation in the long run, though the effects are statistically insignificant (columns 1, 4, and 5 of Table 12; columns 1, 3, and 4 of Table 13). Exceptions include column 8 of Table 12, where the effect is positive but insignificant, and column 10 of Table 13, where the effect is positive and significant. In the short run, both positive and negative shocks to gas price volatility are mostly positive and insignificant, apart from columns 4 and 10 of Tables 12 and 13, respectively.

Regarding uncertainty, the long-run results show that both positive and negative shocks generally exert positive but insignificant effects on inflation (columns 2, 4, and 5 of Table 12; columns 2 and 4 of Table 13), with the exception of column 3 in Table 13, where the effect is negative and statistically significant. In the short run, shocks to macroeconomic uncertainty (Table 12) have no significant impact, while shocks to financial uncertainty (Table 13) significantly increase inflation, though the effect is negative in sign.

Taken together, these findings suggest that while some asymmetric effects are consistent and robust—particularly the long-run inflationary impact of positive gas price shocks—other results vary across specifications, indicating only partial robustness overall.

6. Conclusion

This study examines the asymmetric effects of oil price volatility and World Economic Policy Uncertainty on inflation in 74 developing countries over the period 1994Q1–2022Q4. As a first step, we explored the linear relationship using an autoregressive distributed lag (ARDL) framework. The results indicate that oil price volatility has a weakly negative effect on inflation in the long run but a weakly positive effect in the short run. By contrast, the linear impact of World Economic Policy Uncertainty on inflation is not statistically significant in either the short or long run.

When allowing for asymmetries within a nonlinear ARDL (NARDL) framework, the results reveal clear evidence of asymmetric effects, particularly in the long run. Positive shocks to oil price volatility significantly raise inflation, whereas negative shocks significantly reduce it. Similarly, positive shocks to World Economic Policy Uncertainty reduce inflation in the long run, while in the short run negative shocks increase inflation significantly, and positive shocks remain insignificant. Notably, the estimated long-run effect of positive changes in World Economic Policy Uncertainty is nearly sixty times greater in magnitude than that of oil price volatility, underscoring the dominant role of policy uncertainty in shaping inflation dynamics.

Overall, these findings highlight the importance of considering asymmetries when analyzing the drivers of inflation in developing countries. Accounting for the differential impacts of positive and negative shocks to oil price volatility and policy uncertainty provides a deeper understanding of the inflationary process and offers valuable insights for the design of more effective monetary and fiscal policies.

Policy implications emerge from these results. Policymakers in developing countries must recognize that inflationary responses to shocks are not uniform. Traditional measures that focus primarily on stabilizing commodity markets may be insufficient unless paired with policies that mitigate the effects of global uncertainty. Strengthening communication strategies, enhancing policy credibility, and improving fiscal and monetary coordination could reduce the transmission of uncertainty shocks into inflationary pressures.

This study also contributes to the literature by jointly analyzing oil price volatility and World Economic Policy Uncertainty in a large panel of developing countries within a nonlinear ARDL framework. While earlier work has primarily emphasized either oil price shocks or policy uncertainty in isolation, our results highlight the importance of considering both factors simultaneously and capturing their asymmetric effects.

At the same time, there are limitations. The use of aggregate measures may mask country-specific differences, such as the role of exchange rate regimes, fiscal frameworks, or institutional credibility, in shaping inflation dynamics. Moreover, data constraints restrict the analysis to broad inflation measures, leaving sectoral dynamics unexplored.

Finally, the study opens avenues for future research. Further work could investigate the heterogeneous effects across country groups (e.g., oil exporters vs. oil importers), assess the role of domestic policy institutions in moderating these asymmetries, or examine sectoral inflation responses—particularly for food, energy, and core inflation. Comparative studies involving advanced economies would also shed light on whether the asymmetric inflationary effects of oil price volatility and policy uncertainty are unique to developing countries or more universal.

Overall, the findings underscore the need for policymakers to account for the asymmetric and dominant role of policy uncertainty alongside commodity price volatility when designing inflation management strategies in developing economies.

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APPENDIX

Table 1
SOURCES OF VARIABLES

Variable	Description	Source
inflation	Calculated from the consumer price index (CPI)	www.data.imf.org/
oilpvolt	Oil price volatility	https://fred.stlouisfed.org/
wui	World Uncertainty Index	www.worlduncertaintyindex.com/data
lex	Log(Exchange Rates)	www.data.imf.org/
output	Deviation of the log of GDP from its potential level	www.data.imf.org/
lbmgwth	Broad money growth	www.data.imf.org/
tx	Monetary policy interest rate	www.data.imf.org/
gaspvolt	Gas oil price volatility	https://fred.stlouisfed.org/
mu	Macroeconomics uncertainty	com/macro-and-financial-uncertainty-indexes
fu	Financial uncertainty	com/macro-and-financial-uncertainty-indexes

Source: Author.

Table 2
DESCRIPTIVE STATISTICS

Variable **Obs.**	**Mean**	**Std. Dev.**	**Med.**	**Skewness**	**Kurtosis**	**Min**	**Max**
inflation							
8510	−4.4081	463.7311	0.2713	−92.1990	8503.782	−42773.1	290.3516
oilpvolt							
8584	3.4975	3.4470	2.2264	2.0379	7.2634	0.1429	17.4686
wui							
8584	0.0593	0.0581	0.0437	1.8938	8.6031	0	0.5400
lex							
8584	3.4699	2.8644	3.2425	−0.6404	7.0387	−17.9824	9.9156
output							
3951	−3.54e-10	0.0955	0.0012	−0.7310	17.2784	−1.1952	0.8053
lbmgwth							
5198	0.0026	0.0044	0.0020	−0.9062	75.2738	−0.1024	0.0411
tx							
3916	8.3353	11.5977	5.5	10.0365	222.2119	0.0100	350.5300
gaspvolt							
8584	0.41094	0.4288	0.2731	2.4414	9.8910	0.0181	2.4779
mu							
8584	0.78972	0.1151	0.7550	1.8319	6.4909	0.6656	1.2666
fu							
8584	0.94951	0.1519	0.9239	0.4599	2.4118	0.7225	1.3954

Source: Author’s calculations.

Table 3
CORRELATION COEFFICIENT

	inflation	***lex***	***oilpvolt***	***wui***	***output***	***lbmgwth***	***tx***	***gaspvolt***	***mu***	***fu***
inflation	1.0000									
lex	−0.1819	1.0000								
oilpvolt	−0.0534	0.0675	1.0000							
wui	−0.0311	0.0559	0.0414	1.0000						
output	−0.0092	−0.0166	0.0498	−0.0043	1.0000					
lbmgwth	0.2541	−0.2511	−0.0326	−0.1241	0.2579	1.0000				
tx	0.6385	−0.2194	−0.0993	−0.0163	0.1075	0.3409	1.0000			
gaspvolt	0.1244	−0.0648	0.1633	−0.1003	0.0894	0.0738	0.1007	1.0000		
mu	0.0168	0.0184	0.4551	−0.0010	−0.1539	−0.0345	−0.0746	0.2413	1.0000	
fu	0.0290	0.0372	0.4664	0.0059	−0.0563	−0.0614	−0.0279	0.1020	0.7712	1.0000

Source: Author’s calculations.

Table 4
DUMITRESCU AND HURLIN PANEL CAUSALITY TEST IN HETEROGENEOUS PANELS

H0: Oil Price Volatility Does Not Granger Cause Inflation			
	AIC (k = 1)	**HQIC (k =1)**	**BIC (k = 1)**
W-Stat.	51.0114	51.0114	2.3846
Z bar-Stat.	15.2185	15.2185	−2.1613
Prob.	0.0000	0.0000	0.0307
H0: World Uncertainty Index Does Not Granger Cause Inflation			
	AIC (k = 8)	**HQIC (k = 1)**	**BIC (k = 1)**
W-Stat.	57.4725	57.4725	3.1887
Z bar-Stat.	21.7687	21.7687	0.6627
Prob.	0.0000	0.0000	0.5075
H0: Gas Price Volatility Does Not Granger Cause Inflation			
	AIC (k = 36)	**HQIC (k =36)**	**BIC (k = 3)**
W-Stat.	57.3200	57.3200	4.2455
Z bar-Stat.	21.6141	21.6141	4.3741
Prob.	0.0000	0.0000	0.0000
H0: Macroeconomics Uncertainty Does Not Granger Cause Inflation			
	AIC (k = 8)	**HQIC (k = 36)**	**BIC (k = 3)**
W-Stat.	66.6385	66.6385	2.5039
Z bar-Stat.	31.0611	31.0611	−1.7421
Prob.	0.0000	0.0000	0.0815
H0: Financial Uncertainty Does Not Granger Cause Inflation			
	AIC (k = 8)	**HQIC (k = 36)**	**BIC (k = 3)**
W-Stat.	48.9868	48.9868	3.3704
Z bar-Stat.	13.1659	13.1659	1.3009
Prob.	0.0000	0.0000	0.2927

Source: Author’s calculations.

Note: The Dumitrescu and Hurlin panel causality test was carried out using the Logarithm of consumer index price as a measure of inflation.

Table 5
CROSS-SECTION DEPENDENCE TEST

Variable	**CD-test statistic**	***p*-value**
inflation	110.61	0.000
oilpvolt	559.75	0.000
wui	53.12	0.000
lex	–	–
output	106.34	0.000
lbmgwth	51.36	0.000
tx	–	–
gaspvolt	559.75	0.000
mu	559.75	0.000
fu	559.75	0.000

Source: Author's calculations.

Table 6
PANEL UNIT ROOTS RESULTS (SECOND GENERATION TESTS)

Variables	First Generation Tests							
	Levin-Lin-Chiu (LLC)				**Im–Pesaran–Shin (IPS)**			
	Level		**First Difference**		**Level**		**First Difference**	
	None	**Trend**	**None**	**Trend**	**None**	**Trend**	**None**	**Trend**
lex	−6.19***	−4.13***	7.38	14.21	–	–	–	–
tx	–	–	–	–	−7.62***	−6.08***	−17.73***	−14.60***
	Second Generation Tests							
Variables	**Breitung**				**Pescadf**			
	Level		**First Difference**		**Level**		**First Difference**	
	None	**Trend**	**None**	**Trend**	**None**	**Trend**	**None**	**Trend**
inflation	0.27	−0.76	0.15	−17.34***	−3.96***	−4.07***	−5.85***	−6.03***
oilpvolt	−12.16***	−23.58***	−43.31***	−39.33***	2.61	1.70	2.61	1.70
wui	−13.73***	−9.367***	−15.10***	−23.92***	−3.33***	−3.44***	−5.86***	−5.94***
lex	5.15	−1.78**	−12.46***	−17.32***	−2.21***	−3.21***	−4.41***	−4.57***
output	–	–	–	–	−14.55***	−11.28***	−19.54***	−17.54***
lbmgwth	–	–	–	–	−10.59***	−13.88***	−30.88***	−32.64***
tx	–	–	–	–	−4.47***	−3.37***	−14.25***	−10.32***
gaspvolt	−17.53***	−19.30***	−51.31***	−34.62***	2.61	1.70	2.61	1.70
mu	−13.24***	−13.53***	−40.39***	−27.84***	2.61	1.70	2.61	1.70
fu	−9.07***	−11.71***	−34.31***	−26.44***	2.61	1.70	2.61	1.70

Source: Author's calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance respectively. For unit root test of Pesaran (2006), we reported *t*-bar for the time series except for output gap and interest rate for which we reported Z(*t*-bar).

Table 7
PANEL COINTEGRATION

Tests		Dependent and independent variables	
		inflation mu lex	
Kao		*Statistic*	*p-value*
	Modified Dickey-Fuller t	−3.0e+02	0.0000
	Dickey-Fuller t	−93.3499	0.0000
	Augmented Dickey-Fuller t	−63.7507	0.0000
	Unadjusted modified Dickey-Fuller	−3.0e+02	0.0000
	Unadjusted Dickey-Fuller t	−93.2999	0.0000
Pedroni		*Statistic*	*p-value*
	Modified Phillips-Perron t	−76.2274	0.0000
	Phillips-Perron t	−69.1252	0.0000
	Augmented Dickey-Fuller t	−66.0329	0.0000
Westerlund		*Statistic*	*p-value*
	Variance ratio	−7.5908	0.0000
Kao		*inflation gaspvolt lex*	
		Statistic	*p-value*
	Modified Dickey-Fuller t	−3.0e+02	0.0000
	Dickey-Fuller t	−93.3393	0.0000
	Augmented Dickey-Fuller t	−63.7448	0.0000
	Unadjusted modified Dickey-Fuller	−3.0e+02	0.0000
	Unadjusted Dickey-Fuller t	−93.2891	0.0000
Pedroni		*Statistic*	*p-value*
	Modified Phillips-Perron t	−76.3251	0.0000
	Phillips-Perron t	−68.7508	0.0000
	Augmented Dickey-Fuller t	−65.0132	0.0000
Westerlund		*Statistic*	*p-value*
	Variance ratio	−7.5682	0.0000
Kao		*inflation mu lex*	
		Statistic	*p-value*
	Modified Dickey-Fuller t	−3.0e+02	0.0000
	Dickey-Fuller t	−93.3513	0.0000
	Augmented Dickey-Fuller t	−63.7555	0.0000
	Unadjusted modified Dickey-Fuller	−3.0e+02	0.0000
	Unadjusted Dickey-Fuller t	−93.3014	0.0000

(continued)

Table 7 (continued)
PANEL COINTEGRATION

Tests		Dependent and independent variables	
		inflation mu lex	
Pedroni		*Statistic*	*p-value*
	Modified Phillips-Perron t	−75.6437	0.0000
	Phillips-Perron t	−68.1370	0.0000
	Augmented Dickey-Fuller t	−65.1567	0.0000
Westerlund		*Statistic*	*p-value*
	Variance ratio	−7.5398	
Kao		*inflation fu lex*	
		Statistic	*p-value*
	Modified Dickey-Fuller t	−3.0e+02	0.0000
	Dickey-Fuller t	−93.3607	0.0000
	Augmented Dickey-Fuller t	−63.7727	0.0000
	Unadjusted modified Dickey-Fuller	−3.0e+02	0.0000
	Unadjusted Dickey-Fuller t	−93.3105	0.0000
Pedroni		*Statistic*	*p-value*
	Modified Phillips-Perron t	−76.5338	0.0000
	Phillips-Perron t	−68.1022	0.0000
	Augmented Dickey-Fuller t	−64.9217	0.0000
Westerlund		*Statistic*	*p-value*
	Variance ratio	−7.4762	0.0000

Source: Author's calculations.

Table 8
RESULTS OF SYMMETRIC PANEL ARDL CHANGES OF OIL PRICE VOLATILITY AND WORLD ECONOMIC POLICY UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Pooled Mean Group				
	(1)	(2)	(3)	(4)	(5)
oilpvolt	**0.0004792**		**−0.002975***	**0.0021587**	**0.0001354**
	(0.001696)		**(0.001673)**	**(0.001595)**	**(0.001697)**
wui		**0.083555**	**−0.0558785**	**0.0936427**	**0.1017259**
		(0.090956)	**(0.098345)**	**(0.08466)**	**(0.090132)**
lex	**0.07156*****	**0.058075****		**−0.0025994**	**0.057736****
	(0.023898)	**(0.025433)**		**(0.024598)**	**(0.025190)**
output	**0.1136976**	**0.1813343**		**0.1216242**	**0.1114177**
	(0.124490)	**(0.125648)**		**(0.117280)**	**(0.126799)**
lbmgwh	**18.9062*****	**18.9294**			**18.9980*****
	(3.679892)	**(3.724795)**			**(3.699887)**
tx	**0.01656*****	**0.0164382**		**0.01966*****	**0.01659*****
	(0.002203)	**(0.002258)**		**(0.001905)**	**(0.002231)**
$\hat{\upsilon}_{i,t-1}$	**−0.7551*****	**−0.7408768**	**−0.6195*****	**−0.6934*****	**−0.7125*****
	(0.036248)	**(0.035261)**	**(0.028406)**	**(0.040978)**	**(0.046357)**
Δ*oilpvolt*	**0.0031***		**0.1711045**	**0.0085399***	**0.0121046**
	(0.001802)		**(0.166733)**	**(0.004888)**	**(0.007572)**
Δ*wui*		**0.3767512**	**−0.1359104**	**1.031651**	**1.866671**
		(0.273128)	**(2.605739)**	**(0.958909)**	**(1.475762)**
Δ*lex*	**−0.0052751**	**−0.3269511**		**1.765773**	**−1.237684**
	(0.358504)	**(0.484355)**		**(1.953598)**	**(0.930790)**
Δ*output*	**−0.0386958**	**−0.0654376**		**−0.0245919**	**0.1799309**
	(0.209260)	**(0.210250)**		**(0.240676)**	**(0.289205)**
Δ*lbmgwh*	**−25.498*****	**−25.656*****			**−14.14699***
	(8.625527)	**(8.406867)**			**(7.454941)**
Δ*tx*	**0.07533*****	**0.07553*****		**0.10135*****	**0.10853*****
	(0.011382)	**(0.011157)**		**(0.027477)**	**(0.033603)**
Constant	**−0.1072*****	**−0.0727*****	**−4.768721**	**0.10341*****	**−0.060018***
	(0.031650)	**(0.026982)**	**(5.111345)**	**(0.012160)**	**(0.031536)**
log.likelihood	528.489	515.7897	−7496.689	285.6001	556.4166
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test					
p-value $> \chi^2$					

(continued)

Table 8 (continued)
RESULTS OF SYMMETRIC PANEL ARDL CHANGES OF OIL PRICE VOLATILITY AND WORLD ECONOMIC POLICY UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Mean Group				
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
oilpvolt	−0.0029831 (0.006063)		1.383476 (1.438813)	−0.0002136 (0.005351)	−0.0040238 (0.010491)
wui		0.0394509 (0.446924)	112.4778 (114.7123)	1.745689 (1.484901)	1.959754 (1.60781)
lex	−0.1060974 (0.308208)	−0.4673874 (0.454834)		−2.542898 (2.468255)	−0.0083157 (0.493962)
output	0.7558704 (1.01356)	2.283728 (2.30399)		−0.4661799 (0.666290)	1.085302* (1.309182)
lbmgwh	15.00068 (9.935645)	25.73431 (20.09308)			25.25699 (15.31196)
tx	0.010075 (0.007589)	0.0053632 (0.007881)		0.0088429 (0.011855)	0.0104987 (0.013759)
$\hat{\upsilon}_{i,t-1}$	−0.8397*** (0.086294)	−0.8052*** (0.048951)	−0.6410901 (0.027831)	−0.7706*** (0.048974)	−0.7517*** (0.063981)
Δ*oilpvolt*	0.0019727 (0.003269)		−0.5059259 (0.527418)	0.013718** (0.006831)	0.0095062 (0.007491)
Δ*wui*		0.5631952 (0.435035)	−67.36864 (66.31896)	1.322821 (1.302722)	1.586509 (1.411358)
Δ*lex*	−0.7422434 (0.665881)	−0.2331709 (0.374173)		3.066432 (3.432995)	−0.9237326 (0.719005)
Δ*output*	0.3904051 (0.383874)	0.1694949 (0.306306)		0.4123122 (0.310715)	0.5655664 (0.420910)
Δ*lbmgwh*	−9.770579 (9.501546)	−21.155*** (7.119414)			−15.863*** (5.160337)
Δ*tx*	0.10416*** (0.017246)	0.09147*** (0.010103)		0.12278*** (0.036207)	0.11870*** (0.029019)
Constant	−0.2667946 (1.325699)	0.489309 (1.061711)	−13.38995 (13.94963)	0.3688075 (1.275245)	1.240362 (0.888825)
log.likelihood	–	–	–	–	–
Num. of group	35	32	74	35	32
Observations	2520	2083	8436	2520	2083
Hausman test	**1.79**	**8.18**	**1.85**	**4.49**	**5.55**
p-value $> \chi^2$	**0.8780**	**0.1466**	**0.3975**	**0.4810**	**0.4751**

Source: Author's calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance, respectively. Values in parenthesis are the standard errors. When the statistic of Hausman test is negative, we might interpret the result as strong evidence that the null hypothesis cannot be rejected. The equations shown in bold correspond to those retained after performing the Hausman test.

Table 9
RESULTS OF ASYMMETRIC PANEL ARDL CHANGES OF OIL PRICE VOLATILITY AND WORLD ECONOMIC POLICY UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Pooled Mean Group				
	(1)	(2)	(3)	(4)	(5)
oilpvolt$^+$	**0.00564*** (0.002154)**		**0.0048*** (0.002333)**	**0.0079*** (0.002060)**	**0.0057*** (0.002177)**
oilpvolt$^-$	**−0.00973** (0.004169)**		**−0.0268*** (0.004382)**	**−0.00840** (0.003987)**	**−0.01039** (0.004240)**
wui$^+$		**0.1339084 (0.119433)**	**−0.287249* (0.150084)**	**0.1034494 (0.115064)**	**0.108788 (0.121991)**
wui$^-$		**−0.0010893 (0.146352)**	**0.2369474 (0.181753)**	**−0.0026427 (0.142132)**	**0.0267926 (0.150335)**
lex	**0.07570*** (0.024243)**	**0.059935** (0.025548)**		**0.0020041 (0.024924)**	**0.06445** (0.025593)**
output	**0.0778494 (0.126151)**	**0.1598222 (0.125638)**		**0.109453 (0.118347)**	**0.032448 (0.128999)**
lbmgwh	**20.5005*** (3.782141)**	**19.0127*** (3.704558)**			**20.497*** (3.790233)**
tx	**0.01640*** (0.002224)**	**0.01667*** (0.002255)**		**0.0198*** (0.00193)**	**0.0167*** (0.002250)**
$\hat{\xi}_{i,t-1}$	**−0.7147*** (0.03623)**	**−0.7304*** (0.037451)**	**−0.6126*** (0.02831)**	**−0.6488*** (0.040772)**	**−0.6673*** (0.046335)**
Δ*oilpvolt*$^+$	**0.0004755 (0.001918)**		**0.1079311 (0.111421)**	**0.003745 (0.004410)**	**0.0080689 (0.007051)**
Δ*oilpvolt*$^-$	**−0.0009116 (0.007451)**		**−0.4298219 (0.431807)**	**0.0035638 (0.007652)**	**0.0060074 (0.009999)**
Δ*wui*$^+$		**0.3571272 (0.274561)**	**3.34346 (5.32475)**	**0.9447802 (0.773389)**	**1.76515 (1.252242)**
Δ*wui*$^-$		**0.4880446 (0.357692)**	**3.791769 (5.862716)**	**1.348774* (0.765976)**	**2.073917 (1.27542)**
Δ*lex*	**0.0897308 (0.374543)**	**−0.430885 (0.485652)**		**1.994554 (2.020181)**	**−1.044755 (0.859183)**
Δ*output*	**−0.1081748 (0.197578)**	**−0.0237482 (0.215398)**		**−0.1016465 (0.237872)**	**0.0739903 (0.277767)**
Δ*lbmgwh*	**−27.666*** (7.780929)**	**−22.860*** (6.397554)**			**−18.827*** (6.580183)**
Δ*tx*	**0.07419*** (0.011362)**	**0.07750*** (0.011386)**		**0.0957*** (0.025616)**	**0.1012*** (0.028934)**
Constant	**−0.1134*** (0.031171)**	**−0.0761*** (0.028011)**	**−4.73043 (5.076794)**	**0.0870*** (0.011914)**	**−0.07396** (0.030670)**
log.likelihood	588.8532	548.0973	−7405.385	387.0858	656.4611
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test					
p-value $> \chi^2$					

(continued)

Table 9 (continued)
RESULTS OF ASYMMETRIC PANEL ARDL CHANGES OF OIL PRICE VOLATILITY AND WORLD ECONOMIC POLICY UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Mean Group				
	(6)	(7)	(8)	(9)	(10)
oilpvolt^{+}	0.0042943 (0.003239)		2.022996 (2.073459)	0.0051095 (0.006147)	0.01155** (0.005321)
oilpvolt^{-}	−0.01805** (0.008495)		1.253014 (1.350201)	−0.015515* (0.008715)	−0.01789** (0.008944)
wui^{+}		0.3133343 (0.359729)	190.5496 (193.6818)	0.4205737 (0.480999)	0.5153986 (0.328540)
wui^{-}		−0.4989813 (0.541603)	49.37602 (48.42601)	−0.2612668 (0.587544)	0.1552588 (0.452348)
lex	−0.0251735 (0.320206)	−0.2081975 (0.379283)		−4.021312 (3.544251)	−0.1971765 (0.300452)
output	−0.1082465 (0.302148)	0.0382882 (0.254901)		−0.3712005 (0.426649)	−0.3717068 (0.354498)
lbmgwh	17.01296 (10.91505)	25.44465* (14.57999)			11.87362 (9.760632)
tx	0.0080263 (0.010198)	0.006402 (0.007602)		0.0162*** (0.005102)	0.0198*** (0.005770)
$\hat{\xi}_{i,t-1}$	−0.8877*** (0.061979)	−0.9665*** (0.108746)	−0.6395*** (0.027816)	-.83630*** (0.052519)	−0.8681*** (0.057024)
Δ*oilpvolt*$^{+}$	0.0050466 (0.005107)		−1.135382 (1.152196)	−0.0010438 (0.005076)	−0.0041937 (0.005322)
Δ*oilpvolt*$^{-}$	0.0071885 (0.004603)		−1.967967 (2.003868)	0.0042713 (0.007154)	0.0027656 (0.007904)
Δ*wui*$^{+}$		−1.912063 (1.977591)	−165.6005 (165.5821)	−0.0670154 (0.539116)	0.1638133 (0.530806)
Δ*wui*$^{-}$		−1.955902 (2.518424)	−142.5417 (141.7982)	0.5948 (0.378867)	0.5853581 (0.373502)
Δ*lex*	−0.4828056 (0.515609)	−0.5595888 (0.483943)		5.204009 (5.195267)	−0.6106961 (0.479870)
Δ*output*	−0.2229742 (0.312327)	0.0188226 (0.232153)		0.0880766 .2204031	0.0316553 (0.189714)
Δ*lbmgwh*	−25.523** (10.19235)	−34.36182* (19.20507)			−15.602*** (5.62669)
Δ*tx*	0.10055*** (0.015138)	0.09543*** (0.011245)		0.1111*** (0.029208)	0.1065*** (0.018603)
Constant	−0.4810671 (1.210889)	1.441643 (1.779708)	−15.18793 (15.76251)	−0.6546134 (1.586537)	0.0480972 (1.388767)
log.likelihood	–	–	–	–	–
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test	**6.73**	**4.12**	**6.57**	**4.96**	**5.92**
p-value $> \chi^2$	**0.3468**	**0.6607**	**0.0871**	**0.6653**	**0.6565**

Source: Author’s calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance, respectively. Values in parenthesis are the standard errors. When the statistic of Hausman test is negative, we might interpret the result as strong evidence that the null hypothesis cannot be rejected. The equations shown in bold correspond to those retained after performing the Hausman test.

Table 10
RESULTS OF SYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND MACROECONOMIC UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Pooled Mean Group				
	(1)	(2)	(3)	(4)	(5)
gaspvolt	**0.04554*****		**0.03534*****	**0.0152686**	**0.036369****
	(0.015137)		**(0.013550)**	**(0.014942)**	**(0.016496)**
mu		**0.12691*****	**−0.1308*****	**0.17694*****	**0.084181***
		(0.040686)	**(0.045252)**	**(0.043566)**	**(0.044819)**
lex	**0.07724*****	**0.057294****		**−0.0104028**	**0.07030*****
	(0.024021)	**(0.024318)**		**(0.023693)**	**(0.024851)**
output	**0.2038631***	**0.34881*****		**0.44628*****	**0.36438*****
	(0.120838)	**(0.129076)**		**(0.123120)**	**(0.129773)**
lbmgwh	**19.4871*****	**18.6207*****			**20.2333*****
	(3.682708)	**(3.725485)**			**(3.749301)**
tx	**0.01529*****	**0.01654*****		**0.01927*****	**0.01573*****
	(0.002268)	**(0.002224)**		**(0.001899)**	**(0.002285)**
$\hat{\upsilon}_{i,t-1}$	**−0.7550*****	**−0.7526*****	**−0.6218*****	**−0.7123*****	**−0.7492*****
	(0.036935)	**(0.036421)**	**(0.028844)**	**(0.039333)**	**(0.037431)**
Δ*gaspvolt*	**0.0389638**		**9.837065**	**0.0168507**	**0.0376633**
	(0.032571)		**(9.803929)**	**(0.040491)**	**(0.026852)**
Δ*mu*		**−0.1535628**	**−18.99162**	**−0.46040****	**−0.193080***
		(0.112296)	**(19.5596)**	**(0.179763)**	**(0.109961)**
Δ*lex*	**0.0598295**	**0.0811971**		**6.518557**	**0.0917305**
	(0.398236)	**(0.336411)**		**(5.82617)**	**(0.370365)**
Δ*output*	**−0.1359031**	**−0.1383838**		**−0.2895094**	**−0.2350343**
	(0.206135)	**(0.208352)**		**(0.199670)**	**(0.204371)**
Δ*lbmgwh*	**−26.818*****	**−25.728*****			**−26.838*****
	(9.097766)	**(9.30007)**			**(9.412988)**
Δ*tx*	**0.06916*****	**0.07862*****		**0.07676*****	**0.06987*****
	(0.011627)	**(0.011010)**		**(0.021526)**	**(0.010835)**
Constant	**−0.1313*****	**−0.1438*****	**−4.692397**	**0.024982****	**−0.1627*****
	(0.033806)	**(0.027869)**	**(5.080371)**	**(0.012149)**	**(0.032021)**
log.likelihood	536.7067	523.822	−7484.169	304.5602	563.9865
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test					
p-value $> \chi^2$					

(continued)

Table 10 (continued)
RESULTS OF SYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND MACROECONOMIC UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Mean Group				
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
gaspvolt	−0.0069376		3.750235	0.0834562	0.0373281
	(0.115041)		(3.703403)	(0.063495)	(0.095607)
mu		−0.1438744	37.94253	−0.3372706	−0.2301021
		(0.027869)	(39.27931)	(0.320131)	(0.263868)
lex	0.3149373	0.1373765		−1.192747	0.091004
	(0.699853)	(0.457667)		(1.160773)	(0.438523)
output	1.521676	−0.8685871		−0.9404056	0.0908952
	(1.370594)	(0.913897)		(0.972614)	(0.246228)
lbmgwh	10.67189	20.33294*			13.01951
	(10.93043)	(9.982683)			(7.99143)
tx	−0.0136089	0.008815		0.0057535	0.0041884
	(0.026340)	(0.007245)		(0.010552)	(0.010909)
$\hat{\upsilon}_{i,t-1}$	−0.6363***	−0.8703002	−0.6358***	−0.8756***	−0.9346***
	(0.161661)	(0.059706)	(0.028671)	(0.069494)	(0.074898)
Δ*gaspvolt*	−0.3372902		8.593658	0.0303468	0.0946369
	(0.312548)		(8.596075)	(0.056742)	(0.077849)
Δ*mu*		0.4916591	−44.05579	0.2308972	0.5312948
		(0.465559)	(45.01869)	(0.428307)	(0.573670)
Δ*lex*	1.140044	−0.3562066		7.609046	−0.4936624
	(1.290006)	(0.444395)		(7.426287)	(0.480479)
Δ*output*	0.5349883	0.2051527		0.1488327	−0.1758795
	(0.521042)	(0.314965)		(0.369406)	(0.229268)
Δ*lbmgwh*	−61.93489	−20.460***			−12.9068**
	(42.80886)	(6.030736)			(5.514999)
Δ*tx*	0.06601***	0.09297***		0.08135***	0.07990***
	(0.017115)	(0.010748)		(0.027307)	(0.010324)
Constant	6.981806	−0.6948163	−37.16028	−0.8191108	−2.240565
	(5.795034)	(1.413612)	(38.19739)	(1.963984)	(2.355463)
log.likelihood	–	–	–	–	–
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test	**6.32**	**5.44**	**2.77**	**9.01**	**10.56**
p-value $> \chi^2$	**0.2761**	**0.3641**	**0.2499**	**0.1085**	**0.1029**

Source: Author's calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance, respectively. Values in parenthesis are the standard errors. When the statistic of Hausman test is negative, we might interpret the result as strong evidence that the null hypothesis cannot be rejected. The equations shown in bold correspond to those retained after performing the Hausman test.

Table 11
RESULTS OF SYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND FINANCIAL UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Pooled Mean Group				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
gaspvolt	**0.04554*** (0.015137)**		**0.032473** (0.012812)**	**0.034570** (0.013835)**	0.04059*** (0.015102)
fu		**0.102609 (0.033299)**	**−0.1781*** (0.032753)**	**0.070268** (0.032456)**	0.081613** (0.033626)
lex	**0.07724*** (0.024021)**	**0.058947** (0.023686)**		**0.0023307 (0.023313)**	0.06810*** (0.023724)
output	**0.2038631* (0.120838)**	**0.269415** \(0.126522)**		**0.276795** (0.118768)**	0.30195 ** (0.127261)
lbmgwh	**19.4871*** (3.682708)**	**19.2707*** (3.636885)**			19.4938*** (3.630407)
tx	**0.01529*** (0.002268)**	**0.0167*** (0.002179)**		**0.01790*** (0.001896)**	0.01597*** (0.002216)
$\hat{\upsilon}_{i,t-1}$	**−0.7550*** (0.036935)**	**−0.7685*** (0.036147)**	**−0.6292*** (0.028705)**	**−0.7282*** (0.039642)**	−0.7681*** (0.036520)
Δ*gaspvolt*	**0.0389638 (0.032571)**		**9.614109 (9.574211)**	**−0.0108594 (0.035263)**	0.0307964 (0.023262)
Δ*fu*		**−0.0661331 (0.158219)**	**−35.68478 (36.52388)**	**−0.1468244 (0.179148)**	−0.1117786 (0.153003)
Δ*lex*	**0.0598295 (0.398236)**	**−0.1493592 (0.345507)**		**6.232068 (5.763319)**	−0.1008726 (0.359005)
Δ*output*	**−0.1359031 (0.206135)**	**−0.0655798 (0.202447)**		**−0.193559 (0.192851)**	−0.144257 (0.197275)
Δ*lbmgwh*	**−26.818*** (9.097766)**	**−21.835*** (5.509308)**			−24.379*** (6.76766)
Δ*tx*	**0.06916*** (0.011627)**	**0.08551*** (0.011269)**		**0.08492*** (0.021896)**	0.07699*** (0.010541)
Constant	**−0.1313*** (0.033806)**	**−0.1465*** (0.028199)**	**−4.592073 (5.023363)**	**0.05253*** (0.012135)**	−0.1662*** (0.031222)
log.likelihood	536.7067	524.7184	−7449.773	295.3585	561.6177
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test					
p-value $> \chi^2$					

(continued)

Table 11 (continued)

RESULTS OF SYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND FINANCIAL UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Mean Group				
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
gaspvolt	−0.0069376		6.952672	0.3849301	**0.250144****
	(0.115041)		(6.963875)	(0.246281)	**(0.119399)**
fu		0.3030634	−1.262427*	0.0919113	**0.4318286**
		(0.265478)	(0.677993)	(0.179364)	**(0.395590)**
lex	0.3149373	.0496067		−0.6719164	**−0.0618181**
	(0.699853)	(0.223703)		(0.462466)	**(0.206659)**
output	1.521676	1.017696		0.6905584	**0.7906726**
	(1.370594)	(1.040435)		(1.021196)	**(0.860196)**
lbmgwh	10.67189	−1.124437			**−5.868761**
	(10.93043)	(15.69309)			**(17.78917)**
tx	−0.0136089	0.00989***		0.010301**	**0.0128*****
	(0.026340)	0.0065835		(0.004468)	**(0.003936)**
$\hat{\upsilon}_{i,t-1}$	−0.6363***	−0.8464***	−0.6416***	−0.8265***	**−0.8405*****
	(0.161661)	(0.069571)	(0.028902)	(0.056026)	**(0.064078)**
Δ*gaspvolt*	−0.3372902		6.071936	−0.0098766	**0.0125437**
	(0.312548)		(6.036318)	(0.060448)	**(0.070115)**
Δ*fu*		−0.075628	−38.09919	−0.3028363	**−0.1901069**
		(0.148106)	(39.13146)	(0.209390)	**(0.181976)**
Δ*lex*	1.140044	−0.6797335		8.012116	**−0.5862443**
	(1.290006)	(0.458053)		(7.838952)	**(0.373948)**
Δ*output*	0.5349883	0.277538		0.2630825	**0.1998297**
	(0.521042)	(0.354299)		(0.333457)	**(0.339854)**
Δ*lbmgwh*	−61.93489	−17.3658**			**−20.724*****
	(42.80886)	(7.989391)			**(7.12164)**
Δ*tx*	0.06601***	0.09946***		0.09474***	**0.08542*****
	(0.017115)	(0.012169)		(0.024482)	**(0.010836)**
Constant	6.981806	−0.0837509	−6.679757	1.139044	**0.6801638**
	(5.795034)	(0.982135)	(7.549206)	(1.006838)	**(0.777219)**
log.likelihood	–	–	–	–	–
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test	**6.32**	**2.99**	**2.55**	**6.47**	**13.65**
p-value $> \chi^2$	**0.2761**	**0.7021**	**0.2789**	**0.2629**	**0.0338**

Source: Author's calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance, respectively. Values in parenthesis are the standard errors. When the statistic of Hausman test is negative, we might interpret the result as strong evidence that the null hypothesis cannot be rejected. The equations shown in bold correspond to those retained after performing the Hausman test.

Table 12

RESULTS OF ASYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND MACROECONOMIC UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Pooled Mean Group				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
gaspvolt$^+$	**0.07896*** (0.021219)**		0.08951*** (0.023302)	**0.0329728 (0.0227533)**	**0.07279*** (0.024126)**
gaspvolt$^-$	**−0.0220037 (0.028455)**		−0.0322588 .0240482	**−0.0312433 (0.0252363)**	**−0.033415 (0.028123)**
mu$^+$		**0.15334*** (0.042309)**	−0.1332*** (0.048068)	**0.1808259*** (0.0457567)**	**0.0819531* (0.047232)**
mu$^-$		**0.13161*** (0.042559)**	−0.1701*** (0.047613)	**0.1739694*** (0.0461801)**	**0.0684861 (0.047604)**
lex	**0.07173*** (0.023575)**	**0.059088** (0.024377)**		**−0.0049624 (0.0232143)**	**0.07361*** (0.024136)**
output	**0.1798929 (0.120495)**	**0.36772*** (0.129652)**		**0.4224798*** (0.1237839)**	**0.314507** (0.131639)**
lbmgwh	**19.6600*** (3.648326)**	**17.4682*** (3.718185)**			**20.0823*** (3.710709)**
tx	**0.01493*** (0.002244)**	**0.01659*** (0.002248)**		**0.0199015*** (0.001895)**	**0.01584*** (0.002278)**
$\hat{\xi}_{i,t-1}$	**−0.7687*** (0.042008)**	**−0.7608*** (0.040052)**	−0.6176*** (0.028961)	**−0.7310236*** (0.0456627)**	**−0.7699*** (0.046322)**
Δ*gaspvolt*$^+$	**0.0169438 (0.032884)**		10.2907 (10.28217)	**0.0042276 (0.0494639)**	**0.005514 (0.028902)**
Δ*gaspvolt*$^-$	**0.1148413 (0.085263)**		11.60833 (11.49525)	**0.1183709 (0.1054176)**	**0.1411433 (0.093705)**
Δ*mu*$^+$		**0.0261682 (0.268252)**	−17.48853 (17.75512)	**−0.2512196 (0.3318821)**	**0.0080128 (0.300236)**
Δ*mu*$^-$		**−0.0227816 (0.240244)**	−16.38326 (16.62923)	**−0.3037234 (0.3092827)**	**−0.0408215 (0.270069)**
Δ*lex*	**0.1816089 (0.431092)**	**−0.3179697 (0.475312)**		**4.376432 (4.136949)**	**−0.3419319 (0.504621)**
Δ*output*	**−0.0759826 (0.210543)**	**−0.2152205 (0.200420)**		**−0.2958237 (0.1887755)**	**−0.2467231 (0.192321)**
Δ*lbmgwh*	**−28.416*** (9.351481)**	**−24.417*** (9.391105)**			**−27.818*** (9.591298)**
Δ*tx*	**0.06714*** (0.012468)**	**0.07904*** (0.011204)**		**0.0738474*** (0.0224704)**	**0.07130*** (0.010928)**
Constant	**−0.1209*** (0.034001)**	**−0.1515*** (0.027521)**	−4.698405 (5.091235)	**0.0150938 (0.0114469)**	**−0.1678*** (0.034608)**
log.likelihood	561.9333	539.5451	−7377.115	353.6407	607.3898
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test					
p-value $> \chi^2$					

(continued)

Table 12 (continued)

RESULTS OF ASYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND MACROECONOMIC UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Mean Group				
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
gaspvolt$^+$	−0.2083605 (0.349622)		**−14.54439** **(14.41803)**	0.3328693 (0.283654)	0.4458072 (0.296139)
gaspvolt$^-$	−0.9865428 (1.276215)		**27.5885** **(27.54916)**	0.2799496* (0.118819)	0.2470873 (0.134231)
mu$^+$		−0.1583139 (0.216683)	**34.01437** **(34.88188)**	0.1291453 (0.151362)	0.1159534 (0.146329)
mu$^-$		−0.2625001 (0.270978)	**64.23921** **(65.72296)**	−0.1954178 (0.228177)	−0.2674449 (0.234904)
lex	0.2224158 (0.604095)	0.0531722 (0.402202)		−3.009749 (2.543154)	−0.0539153 (0.470585)
output	1.101923 (1.072991)	−0.2410725 (0.338962)		−2.020991 (1.933527)	−2.074629 (2.081973)
lbmgwh	−13.77327 (29.93003)	16.36363 (9.806226)			12.54308 (8.784451)
tx	0.0021533 (0.008971)	0.0090309 (0.007486)		0.01341*** (0.004674)	0.01475*** (0.003872)
$\hat{\xi}_{i,t-1}$	−0.9302*** (.1665855)	−0.8936*** (0.061158)	**−0.6327***** **(0.028933)**	−0.8721*** (0.062769)	−0.8912*** (0.065679)
Δ*gaspvolt*$^+$	0.0228356 (0.087905)		**31.51778** **(31.44424)**	−0.1012336 (0.108289)	−0.1418648 (0.098246)
Δ*gaspvolt*$^-$	−0.6731331 (0.542436)		**21.75728** **(21.6494)**	−0.1093815 (0.185541)	−0.138098 (0.195736)
Δ*mu*$^+$		0.1712627 (0.338093)	**116.7728** **(117.9177)**	−0.1957275 (0.123403)	−0.25865** (0.100927)
Δ*mu*$^-$		0.1690197 (0.340520)	**104.3657** **(105.3451)**	−0.1934608 (0.121705)	−0.25046** (0.103062)
Δ*lex*	0.6014801 (0.826496)	−0.7785917 (0.667408)		8.05928 (8.113422)	−0.6165429 (0.630339)
Δ*output*	0.1293454 (0.460372)	0.0651919 (0.240575)		0.3663251 (0.397686)	0.2479358 (0.365211)
Δ*lbmgwh*	−33.3764** (16.54353)	−13.079** (6.19157)			−16.350*** (5.410037)
Δ*tx*	0.055272** (0.025145)	0.09294*** (0.010853)		0.07416*** (0.026879)	0.06955*** (0.011146)
Constant	1.355214 (3.613383)	−1.381646 (1.797034)	**−46.52259** **(47.52641)**	0.6530173 (1.392421)	0.4388943 (1.14679)
log.likelihood	–	–	–	–	–
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test	**3.92**	**8.53**	**15.06**	**7.40**	**9.85**
p-value $> \chi^2$	**0.6872**	**0.2018**	**0.0046**	**0.3885**	**0.2756**

Source: Author's calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance, respectively. Values in parenthesis are the standard errors. When the statistic of Hausman test is negative, we might interpret the result as strong evidence that the null hypothesis cannot be rejected. The equations shown in bold correspond to those retained after performing the Hausman test.

Table 13
RESULTS OF ASYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND FINANCIAL UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Pooled Mean Group				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$gaspvolt^{+}$	**0.07896*****		**0.09235*****	**0.06780*****	0.08166***
	(0.021219)		**(0.021741)**	**(0.020592)**	(0.022226)
$gaspvolt^{-}$	**−0.0220037**		**−0.0323199**	**−0.0041585**	0.0048957
	0.0284556		**(0.024398)**	**(0.025585)**	(0.028404)
fu^{+}		**0.15195*****	**−0.1667*****	**0.087665****	0.10753***
		(0.035270)	**(0.035331)**	**(0.034749)**	(0.036689)
fu^{-}		**0.069467****	**−0.2157*****	**0.0172974**	0.0146184
		(0.034839)	**(0.035728)**	**(0.034269)**	(0.036074)
lex	**0.07173*****	**0.051203****		**0.0058185**	0.06364***
	(0.023575)	**(0.023308)**		**(0.022393)**	(0.022735)
output	**0.1798929**	**0.1510921**		**0.1521047**	0.1398015
	(0.120495)	**(0.123325)**		**(0.113489)**	(0.121107)
lbmgwh	**19.6600*****	**19.2204*****			19.1315***
	(3.648326)	**(3.600251)**			(3.511003)
tx	**0.01493*****	**0.01733*****		**0.0183593**	0.01608***
	(0.002244)	**(0.002145)**		**(0.001835)**	(0.002152)
$\hat{\xi}_{i,t-1}$	**−0.7687*****	**−0.7793*****	**−0.6249*****	**−0.7526*****	−0.8141***
	(0.042008)	**(0.037345)**	**(0.028635)**	**(0.04817)**	(0.054385)
$\Delta gaspvolt^{+}$	**0.0169438**		**10.22219**	**−0.0164969**	0.0339419
	(0.032884)		**(10.20281)**	**(0.051610)**	(0.042404)
$\Delta gaspvolt^{-}$	**0.1148413**		**9.987378**	**0.0762497**	0.2649557
	(0.085263)		**(9.850044)**	**(0.136276)**	(0.241178)
Δfu^{+}		**−.47787*****	**0.483469**	**−0.4635*****	−0.347487
		(0.107099)	**(0.306655)**	**(0.154354)**	(0.275892)
Δfu^{-}		**−0.4710*****	**14.04778**	**−0.4573*****	−0.332729
		(0.105592)	**(13.51444)**	**(0.150915)**	(0.268706)
Δlex	**0.1816089**	**−0.3341741**		**4.458695**	−0.1590081
	(0.431092)	**(0.383692)**		**(3.952207)**	(0.380326)
$\Delta output$	**−0.0759826**	**−0.0203371**		**−0.0958778**	0.0334277
	(0.210543)	**(0.204887)**		**(0.200521)**	(0.228604)
$\Delta lbmgwh$	**−28.416*****	**−19.392*****			−24.786***
	(9.351481)	**(4.723414)**			(6.703989)
Δtx	**0.06714*****	**0.08633*****		**0.07332*****	0.07419***
	(0.012468)	**(0.011564)**		**(0.022552)**	(0.010587)
Constant	**−0.1209*****	**−0.1310*****	**−4.728831**	**0.04994*****	−0.1576***
	(0.034001)	**(0.024207)**	**(5.163046)**	**(0.011847)**	(0.036437)
log.likelihood	561.9333	553.6078	−7347.754	361.8346	635.7616
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test					
p-value $> \chi^2$					

(continued)

Table 13 (continued)

RESULTS OF ASYMMETRIC PANEL ARDL CHANGES OF GAS PRICE VOLATILITY AND FINANCIAL UNCERTAINTY ON INFLATION IN DEVELOPING COUNTRIES

	Mean Group				
	(6)	(7)	(8)	(9)	(10)
gaspvolt$^+$	−0.2083605 (0.349622)		−10.04509 (9.902403)	−0.3607702 (0.465198)	**−0.3458784 (0.504423)**
gaspvolt$^-$	−0.9865428 (1.276215)		28.49155 (28.42737)	0.29632*** (0.110428)	**0.257176** (0.113167)**
fu$^+$		0.1122287 (0.290383)	−4.878027 (4.254233)	0.137317 (0.121690)	**0.1891353 (0.134298)**
fu$^-$		0.0698017 (0.351138)	−4.431293 (3.594327)	0.1216313 (0.236419)	**0.16836 (0.254915)**
lex	0.2224158 (0.604095)	0.206654 (0.566403)		−2.402241 (1.694292)	**−0.2982399 (0.207891)**
output	1.101923 (1.072991)	0.2295361 (0.483541)		−0.2943283 (0.472563)	**−0.0666553 (0.246060)**
lbmgwh	−13.77327 (29.93003)	16.3946 (10.4454)			**7.64461 (7.178814)**
tx	0.0021533 (0.008971)	−0.010392 (0.027710)		0.01229*** (0.004543)	**0.01486*** (0.003581)**
$\hat{\xi}_{i,t-1}$	−0.9302*** (0.166585)	−0.57887** (0.276076)	−0.6386*** (0.029189)	−0.8764*** (0.055757)	**−0.9088*** (0.056422)**
Δ*gaspvolt*$^+$	0.0228356 (0.087905)		25.93467 (25.80542)	0.0697006 (0.119373)	**0.0689323 (0.112319)**
Δ*gaspvolt*$^-$	−0.6731331 (0.542436)		12.77216 (12.56754)	−0.0189487 (0.114941)	**−0.0154323 (0.104898)**
Δ*fu*$^+$		0.2754115 (0.634533)	18.76124 (19.43026)	−0.7527*** (0.223586)	**−0.8204*** (0.204093)**
Δ*fu*$^-$		0.4364963 (0.774678)	33.20814 (33.71862)	−0.7374*** (0.226443)	**−0.8026*** (0.212645)**
Δ*lex*	0.6014801 (0.826496)	2.438335 (3.155286)		7.582001 (7.342312)	**−0.4871346 (0.375033)**
Δ*output*	0.1293454 (0.460372)	1.485045 (1.516734)		0.2475145 (0.309916)	**0.1233774 (0.228832)**
Δ*lbmgwh*	−33.3764** (16.54353)	9.66502 (25.11904)			**−14.144*** (4.731953)**
Δ*tx*	0.055272** (0.025145)	0.09852*** (0.013949)		0.08359*** (0.024645)	**0.07081*** (0.009646)**
Constant	1.355214 (3.613383)	−7.621069 (7.194894)	−2.62492 (3.526158)	1.349979 1.035362	**0.8239389 (0.560316)**
log.likelihood	–	–	–	–	–
Num. of group	32	32	74	35	32
Observations	2083	2083	8436	2520	2083
Hausman test	**3.92**	**6.71**	**7.26**	**6.89**	**18.49**
p-value $> \chi^2$	**0.6872**	**0.3485**	**0.1227**	**0.4405**	**0.0179**

Source: Author's calculations.

Note: ***, **, * denote 1, 5 and 10% levels of significance, respectively. Values in parenthesis are the standard errors. When the statistic of Hausman test is negative, we might interpret the result as strong evidence that the null hypothesis cannot be rejected. The equations shown in bold correspond to those retained after performing the Hausman test.