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# Price risk of agricultural products: Evidence from Vietnam robusta coffee

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**Abstract:** This article aims to investigate factors influencing the price volatility of domestic Robusta coffee in Vietnam. By using monthly data from January 2023 to March 2025 and the Autoregressive Distributed Lag (ARDL) approach, this study shows that Robusta coffee futures price and weather conditions have positive impacts on the price risk of domestic Robusta coffee, while there is no evidence on the role of input costs, international coffee price and exchange rate. The empirical outcomes totally support the price discovery of futures and the increasingly important role of climate for changes in agricultural products' prices. Moreover, this study offers some suggestions for policy makers and coffee producers to efficiently manage price risks of Robusta coffee in the Vietnam domestic market.

*Keywords:* Price risks, agricultural products, Robusta coffee, Vietnam.

## 1. Introduction

Price risk, which refers to the uncertainty surrounding future prices of agricultural outputs, is one of the most severe and systemic risks which agricultural producers have to face in developing countries like Vietnam where agricultural exports play a pivotal role in rural livelihoods and national trade performance (UNCTAD, 2019). To be precise, Vietnam is the world's largest producer of Robusta coffee with billions of USD in annual export revenue. The coffee sector supports the livelihoods of about 600,000 farming households, mostly located in the Central Highlands. However, Vietnam's coffee prices have shown greater volatility, reflecting higher instability of the domestic market (Nguyen & To, 2017), and then exacerbating psychological distress among farming communities, manifesting in sleep disturbances, anxiety, and symptoms of depression. In addition, price volatility also disrupts the broader coffee value chain and threatens long-term production sustainability (Dana et al., 2018).

In fact, Vietnam Robusta coffee has still experienced repeated "boom and bust" cycles since it is more susceptible to a wide range of factors such as climate-related shocks (United States Department of Agriculture, 2024), supply-side risks (Bunn, 2015), and speculative activity in commodity derivatives markets (Silveira et

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al., 2017). There are studies on the impact of climate change on coffee yields and the exported coffee price (Bunn, 2015), the relationship between Vietnam's coffee export prices and global coffee prices from 2008 to 2014 (Nguyen & To, 2017), the coffee value chain in Kon Tum province (Hoang & Dang, 2017), and the impact of socio-economic factors on the income of coffee-growing households in Gia Lai province (Luong & Thai, 2024). It can be seen that the issue of domestic price risk has not received comprehensive research attention within the Vietnamese context yet, and the application of quantitative methods to Vietnam Robusta coffee remains limited.

Therefore, this study aims to address this research gap by assessing the key determinants of domestic price risk in the Vietnam market. To be precise, this research employs the Autoregressive Distributed Lag (ARDL) approach with monthly secondary data on five main factors, including (i) Urea fertilizer as a cost factor; (ii) The international coffee price as the global market and trade factor; (iii) Climate change as the environmental factor; (iv) The futures price as speculation and future market factor; and (v) The exchange rate as macroeconomic and currency factor, during the period from January 1, 2023, to March 31, 2025. While results and domestic prices are mainly determined by Robusta coffee futures price and weather conditions, the Urea price, international coffee price and exchange rate have no significant effect on domestic Robusta coffee's price volatility in Vietnam. The research results contribute to enrich literature review on the price discovery role of commodities futures as well as the increasingly important role of weather conditions for determining coffee prices. In practice, this finding offers updated insights into Vietnam Robusta coffee's fluctuations in price and the impacts of factors such as climate and commodities futures on the price of Robusta coffee in Vietnam, which is significant for stakeholders across the coffee value chain, including farmers, exporters, and policymakers.

## 2. Literature review and developing hypotheses

According to the United States Department of Agriculture (2024), the domestic price volatility of Vietnam Robusta coffee is influenced by a wide range of factors, including climate change, input costs and international trade policies. These factors interact in complex ways to shape both the supply side and market dynamics of the coffee industry.

*Firstly,* the cost-push inflation theory argues that increases in input costs such as urea fertilizer shift the supply curve inward, leading to higher prices and lower output. In fact, urea is a primary and essential source of nitrogen for coffee plant growth, leading to the fact that an increase in urea prices leads to a rise in production costs. If coffee farmers cannot afford these costs, they may reduce fertilizer usage, leading to lower yields and decreased coffee supply. Nguyen and Do (2015) argue that optimized use of compound fertilizers significantly increased both yields and profitability. For instance, applying 2,100 kg of compound fertilizer per hectare raises coffee yields by 21 per cent and net profits by VND 62.52 million per hectare per year. However, applying chemical fertilizers more than recommended levels can raises sustainability concerns (Tiemann et al., 2018) which can negatively impact crop yields and coffee prices in the next year. Therefore, the research proposes the first hypothesis as following:

*H1: An increase in Urea price has a positive impact on Robusta coffee's domestic price volatility in Vietnam.*

*Secondly,* the law of one price and international price transmission states that domestic prices are not set in isolation but are aligned with international benchmarks, adjusted for exchange rates and trade costs, due to export orientation, import dependence, arbitrage mechanisms, and currency effects. In fact, Vietnam is increasingly integrated into global markets, leading to price convergence between domestic and international markets. Since the domestic price reflects the international price minus export-related costs, such as transportation, insurance and tariffs, domestic prices will also increase to align with the more profitable export market. Therefore, as global prices move, domestic arbitrageurs adjust local prices to maintain profit opportunities, ensuring domestic markets stay aligned with global price signals. Dang et al. (2020) argue that international coffee prices have a significant effect on Vietnam's coffee export prices, while the reverse is not true, indicating an asymmetric relationship where global prices drive domestic ones. Therefore, the research proposes the second hypothesis as follows:

*H2: An increase in international benchmark prices for Robusta coffee has a positive impact on Robusta coffee' domestic price volatility in Vietnam.*

*Thirdly,* price volatility in agricultural products like coffee is strongly influenced by climate variability, particularly temperature increases and drought events. To be precise, droughts can reduce soil moisture and hinder coffee tree flowering and fruit development, while excess rainfall can damage roots, reduce bean quality, and cause crop losses, leading to a decrease in supply and a sharp upward pressure on prices. In addition, unusual heatwaves or cold spells can increase plant stress and pest/disease prevalence, which further threatens productivity. According to Dinh et al. (2020), a 1°C increase in temperature potentially lowers output by up to

14 per cent for Vietnam Robusta coffee. Moreover, Pham et al. (2019) indicate that irregular rainfall and prolonged droughts, notably those linked to El Niño events, directly deplete irrigation resources in the Central Highlands, leading to substantial yield losses and increased domestic price volatility. Therefore, the research proposes the third hypothesis as follows:

*H3: Extreme weather has a positive impact on Robusta coffee' domestic price volatility in Vietnam.*

*Fourthly,* the coffee futures markets play a critical role in shaping the price risk of domestic coffee market through several key interrelated mechanisms, including derivative markets' role of price discovery and speculative trading. To be precise, futures markets serve as the primary mechanism for price discovery by aggregating different kinds of information such as supply-demand expectations, weather conditions and macroeconomic factors. Sudden shocks can immediately trigger significant price fluctuations in futures markets, thereby heightening uncertainty for domestic coffee producers and exporters. In addition, speculative activities in these futures markets can amplify price fluctuations, leading to increased uncertainty for producers and exporters. Similarly, Wulandari et al. (2019) and Dang et al. (2020) confirm a strong linkage between volatility in futures prices and spot market volatility. Therefore, the research proposes the fourth hypothesis as follows:

*H4: An increase in Robusta coffee futures prices has a positive impact on Robusta coffee' domestic price volatility in Vietnam.*

*Finally*, the purchasing power parity (PPP) suggests that exchange rate changes affect the relative prices of traded goods. Since most global commodity prices are denominated in U.S. dollars (USD), a depreciation of domestic currencies against the USD can lead to an increase in the domestic price of many imported inputs (such as urea fertilizer, pesticides, and machinery). This currency conversion effect leads to uncertain and fluctuating input costs and commodities. Conversely, an appreciation of domestic currencies can reduce export incentives (Nguyen & Trinh, 2019), leading to excess domestic supply and downward pressure on prices. These dynamics introduce additional price swings in the domestic market. The relationship between exchange rate volatility and trade or commodity pricing has been extensively studied with various findings. Xie et al. (2008) argue that while a country's own exchange rate may exert a negative impact, cross exchange rate effects can be positive or insignificant. Therefore, the research proposes the fifth hypothesis as follows:

*H5: An increase in the exchange rate has a positive impact on Robusta coffee' domestic price volatility in Vietnam.*

## 3. Methodology

### *3.1. Measuring variables*

*Firstly,* price risk of Vietnam Robusta coffee (DOP) is measured by daily logarithmic returns which effectively capture price movements and volatility over time, as in the following formula:

$$DOP_t = ln\left(\frac{Price\ of\ domestic\ Robusta\ coffee\ in\ Vietnam_{\ t}}{Price\ of\ domestic\ Robusta\ coffee\ in\ Vietnam_{t-1}}\right)$$

*Secondly,* changes in urea price volatility (URE) which represents input price movement, are measured by the daily log return of urea fertilizer prices.

$$URE_t = ln\left(\frac{Price\ of\ urea_{\ t}}{Price\ of\ urea_{t-1}}\right)$$

*Thirdly,* change in the international benchmark price (INP) is measured as the daily log return of global prices of Robusta coffee (USD/ton), reflecting global benchmark price changes.

$$INP_t = ln\left(\frac{Global\ price\ of\ Robusta\ coffee_{\ t}}{Global\ price\ of\ Robusta\ coffee_{t-1}}\right)$$

*Fourthly,* to assess the extent of weather conditions, this research uses the Standardized Precipitation-Evapotranspiration Index (SPEI). SPEI is calculated based on the non-exceedance probability of the differences between precipitation and potential evapotranspiration, adjusted using a three-parameter log-logistic distribution which accounts for common negative values (Vicente-Serrano et al., 2010). A SPEI value below -1 indicates moderate to severe drought, while values above +1 signify wet conditions. Therefore, in case of using SPEI as a variable for weather condition, the expected sign for the impact of SPEI on the domestic price of Vietnam Robusta is negative.

*Fifthly,* fluctuations in Robusta coffee futures price (FTP) are computed as the absolute value of daily log returns of Robusta future price on ICE.

$$FTP_t = ln\left(\frac{Price\ of\ Robusta\ coffee\ futures_{\ t}}{Price\ of\ Robusta\ coffee\ futures_{t-1}}\right)$$

*Finally,* exchange rate fluctuations (FX) are calculated by the daily log return of the USD/VND nominal exchange rate, obtained from the State Bank of Vietnam and official financial data platforms.

$$FX_t = \ln\left(\frac{\text{USD/VND nominal exchange rat}_{\ t}}{\text{USD/VND nominal exchange rat}_{t-1}}\right)$$

Table 1 describes dependent and independents variables which are used in this research.

Table 1: Descriptions of variables

| Variables | Abbreviations | Description | Data source | Expected sign |
|---|---|---|---|---|
| *Dependent variable* | | | | |
| Domestic robusta coffee price risk | DOP | Daily logarithmic returns of Robusta coffee price in Vietnam | giacaphe.com | |
| *Independent variables* | | | | |
| Input price volatility (Urea) | URE | Daily volatility of Urea fertilizer prices, used as a proxy for input cost risk | World Bank Commodity Prices Database | (+) |
| Changes in international benchmark price | INP | Daily logarithmic returns the international price of Robusta coffee (ICE Futures Europe) | International Exchange (ICE Europe), Bloomberg | (+) |
| Weather conditions | SPEI | Standardized Precipitation - Evapotranspiration Index measuring drought conditions in the Central Highlands | Climate Data Store (CDS), SPEI base v2.7. | (-) |
| Fluctuations in robusta coffee futures price | FTP | Price volatility of Robusta coffee futures contracts, representing global speculative influence | ICE Futures Europe | (+) |
| Exchange rate fluctuations (USD/VND) | FX | Daily logarithmic returns exchange rate between the US Dollar and Vietnamese Dong | State Bank of Vietnam (SBV) | (+) |

*Source*: Authors.

### *3.2. Data collection*

While domestic Robusta coffee prices are obtained from https://giacaphe.com, climate risk which is proxied by the Standardized Precipitation-Evapotranspiration Index (SPEI) is sourced from the Climate Data Store (CDS). Moreover, international coffee prices and urea fertilizer prices are drawn from the World Bank. In addition, information on futures contract prices for Robusta coffee is gathered from ICE Futures Europe, while daily exchange rate data (USD/VND) are retrieved from State Bank of Vietnam (SBV).

### *3.3. Data analysis*

This study employs the Autoregressive Distributed Lag (ARDL) modeling framework as proposed by Pesaran et al. (2001) to investigate the short-run and long-run dynamics between key potential determinants and the domestic price of Vietnam Robusta coffee. ARDL is chosen because this model particularly suitable for small sample sizes (27 months for this research) and allows for the decomposition of the effects of each independent variable into short-run impacts and long-run equilibrium effects. The general form of the ARDL model used in this study is specified as follows:

$$\Delta DOP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1^i \Delta DOP_{t-i} + \sum_{j=0}^{q_1} \beta_1^j \Delta URE_{t-j} + \sum_{j=0}^{q_2} \beta_2^j \Delta INP_{t-j} + \sum_{j=0}^{q_3} \beta_3^j \Delta SPEI_{t-j} + \sum_{j=0}^{q_4} \beta_4^j \Delta FTP_{t-j} + + \sum_{j=0}^{q_5} \beta_5^j \Delta FX_{t-j} + \lambda_1 DOP_{t-1} + \lambda_2 URE_{t-1} + \lambda_3 INP_{t-1} + \lambda_4 SPEI_{t-1} + \lambda_6 FTP_{t-1} + \lambda_6 FX_{t-1} + \varepsilon_t$$

Where: $\Delta$ denotes the first-difference operator; $\alpha_1^i$ and $\beta_k^j$ capture the short-run dynamics; $\lambda_k$ coefficient reflect the long-run relationships; $p$ and $q_k$ are the optimal lag lengths selected based on model selection criteria (AIC, BIC); $\varepsilon_t$ is the white noise error term.

There are six steps to be executed. The first step in the time series analysis is to test the stationary of data using an ADF unit root test proposed. A none-rejection of the null hypothesis suggests that the time series under consideration is non-stationary. Next, it is essential to determine the optimal lag length prior to conducting the cointegration test by using information criteria such as the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), or the Hannan-Quinn Criterion (HQC). Consequently, the ARDL model is estimated using the selected lag structure. Then, to assess the existence of a long-run equilibrium relationship among the variables, the bounds testing procedure for cointegration is employed. According to Pesaran et al. (2001), if the F-statistic exceeds the upper bound, cointegration is confirmed. Next, the long-run coefficients are estimated, and an Error Correction Model (ECM) is derived from the ARDL specification. A statistically significant and negative ECT coefficient provides further evidence of a stable long-run relationship. Finally, robustness check of the model is executed through the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. Besides, this research uses fully modified ordinary least squares (FMOLS) and canonical cointegrating regression (CCR) to

validate the consistency and robustness of long-run relationships.

## 4. Results

Table 2 shows that the mean values of all variables are close to zero, suggesting limited average fluctuations. The domestic price (DOP) is notably positively skewed (2.527765) and has an extremely high kurtosis value (8.403122), indicating a distribution with frequent extreme values. In contrast, the international benchmark price (INP) has slight negative skewness and moderate kurtosis, implying more balanced distributions. In addition, weather (SPEI) shows the highest standard deviation (1.012076), indicating strong volatility, while the exchange rate (FX) has the smallest variation (0.000756). Robusta coffee futures price (FTP) and domestic Robusta coffee price (DOP) exhibit relatively stable behaviors with low variance (0.005507 and 0.007391, accordingly).

Table 2: Descriptives statistics of variables

| | DOP | URE | INP | SPEI | FTP | FX |
|---|---|---|---|---|---|---|
| Mean | 0.012526 | -0.010186 | 0.037892 | -1.50E-16 | 0.020052 | 0.001542 |
| Median | 0.010263 | -0.014706 | 0.035521 | -0.149633 | 0.018788 | 0.001348 |
| Maximum | 0.037686 | 0.166068 | 0.146568 | 1.704205 | 0.032879 | 0.003276 |
| Minimum | 0.006470 | -0.216126 | -0.085756 | -1.151408 | 0.012897 | 0.000425 |
| Std. Dev. | 0.007391 | 0.101802 | 0.056711 | 1.012076 | 0.005507 | 0.000756 |
| Skewness | 2.527765 | 0.044305 | -0.236054 | 0.411255 | 0.687422 | 0.261139 |
| Kurtosis | 8.403122 | 2.219842 | 2.418378 | 1.628632 | 2.838529 | 2.203250 |
| Jarque-Bera | 61.59612 | 0.693560 | 0.631316 | 2.876818 | 2.155802 | 1.021033 |
| Probability | 0.000000 | 0.706961 | 0.729309 | 0.237305 | 0.340309 | 0.600185 |
| Sum | 0.338208 | -0.275017 | 1.023077 | -5.69E-15 | 0.541407 | 0.041638 |
| Sum Sq. Dev. | 0.001420 | 0.269457 | 0.083620 | 26.63175 | 0.000789 | 1.49E-05 |
| Observations | 27 | 27 | 27 | 27 | 27 | 27 |

*Source*: Eview 12.

Table 3 indicates that domestic Robusta coffee price (DOP) is non-stationary at level I(0) but becomes stationary after first differencing I(1). Conversely, independent variables such as input price volatility (URE), international benchmark price (INP), weather (SPEI), Robusta coffee futures price (FTP), and exchange rate (FX) are found to be stationary at level I(0), or exhibit mixed integration orders across the two tests. In other words, the application of the ARDL bounds test is validated in this research.

Table 3: Unit root test

| | ADF | | PP | |
|---|---|---|---|---|
| Variables | I (0) | I (1) | I (0) | I (1) |
| DOP | -0.996890 | -7.998445*** | -4.851984*** | -16.55126*** |
| URE | -4.483286*** | -4.977123*** | -4.470984*** | -12.19815*** |
| INP | -5.577925*** | -6.679342*** | -5.574974*** | -22.46172*** |
| SPEI | -4.937699*** | -5.272632*** | -2.479858 | -5.271313*** |
| FTP | -3.105559** | -0.959339 | -3.094388** | -10.98896*** |
| FX | -4.314178*** | -5.514429*** | -3.837171*** | -9.436262*** |

*Notes:* ***, ** and * denote statistically significance at 1, 5 and 10%, respectively.
*Source*: Eview 12.

Table 4: Optimal lags of model according to different criteria

| Lag | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|
| Model | 1 | 1 | 1 | 0 | 0 |

*Source*: Eview 12.

Table 4 indicates that three criteria, including LR, FPE, and AIC reach their minimum value at lag 1, while lag 0 is chosen by two criteria such as SC and HQ. Hence, lag 1 is selected as the optimal lag, ensuring a balance between model complexity and predictive accuracy.

Table 5 shows that F-stats for F-Bound test of 13.09488 is significantly bigger than lower bound I(0) at all 1, 5 and 10 per cent (3.41, 2.62, and 2.26, respectively) as well as upper bound at all 1, 5 and 10 per cent (4.68, 3.79, and 3.35, respectively), leading to the rejection of the null hypothesis of no cointegration. Similarly, the T-bound test statistic of –5.962987 is also highly significant and exceeds the absolute value of the critical lower and upper bounds at all levels of significance. This confirms the existence of a statistically significant long-run relationship between domestic Robusta coffee price (DOP) and all independent variables such as input price volatility (URE), international benchmark price (INP), weather (SPEI), Robusta coffee futures price (FTP), and exchange rate (FX).

Table 5: Cointegration test

| Test | F-stats | Significance level | Lower bound I(0) | Upper bound I(0) |
|---|---|---|---|---|
| F-Bound test | 13.09488*** | 10% | 2.26 | 3.35 |
| | | 5% | 2.62 | 3.79 |
| | | 1% | 3.41 | 4.68 |
| T-Bound test | -5.962987*** | 10% | -2.57 | -3.86 |
| | | 5% | -2.86 | -4.19 |
| | | 1% | -3.43 | -4.79 |

*Notes:* ***, ** and * denote statistically significance at 1, 5 and 10%, respectively.

*Source*: Eview 12.

According to Table 6, in term of the long run cointegration relationship, Robusta coffee futures price (FTP) has a positive and statistically significant impacts on domestic Robusta coffee price (DOP), with a coefficient of 0.916758 at 1 per cent level (p = 0.0020), meaning that hypothesis 4 (H4) is accepted. Moreover, weather (SPEI) exhibits a negative coefficient of -0.002638 at 10 per cent level (p = 0.0888), suggesting that hypothesis 3 (H3) is also accepted. By contrast, other variables such as input price volatility (URE), international benchmark price (INP), and exchange rate (FX) are not statistically significant at conventional levels, meaning that hypotheses 1, 2 and 5 are all rejected. However, the international benchmark price (INP) and exchange rate (FX) display relatively large coefficients in magnitude, implying potential effects. In terms of short-run estimation, the error correction term (ECT) is statistically significant at the 1 per cent level, with a coefficient of –0.936535 and the expected negative sign. This suggests that approximately 94 per cent of any short-term deviation from the long-run equilibrium is corrected within a single period, thereby confirming both the existence and stability of the long-run relationship among the variables.

Furthermore, these relationships are robust and reliable since the plots of the cumulative sums (CUSUM) and squared cumulative sums (CUSUMSQ) remain within the 5 per cent significance bounds throughout the evaluation period from January 2023 to March 2025 (Figure 1).

Table 6: ARDL estimations

| Regressor | Coefficient | p-value |
|---|---|---|
| **Long run estimation** | | |
| URE | 0.003373 | 0.8052 |
| INP | -0.042349 | 0.1052 |
| SPEI | -0.002638* | 0.0888 |
| FTP | 0.916758*** | 0.0020 |
| FX | -2.495199 | 0.1255 |
| **Short run estimation – ARDL(1,0,0,0,0)** | | |
| ECT(-1) | -0.936535*** | 0.0000 |
| Constant | -0.000262 | 0.7824 |
| Diagnostics tests | | |
| Serial correlation LM | 0.002902[0.9576] | |
| Heteroscedasticity | 0.438129[0.5146] | |
| Normality | 1.123551[0.570196] | |

*Notes*: ***, ** and * denote statistically significance at 1, 5 and 10%, respectively.

*Source:* Eview 12.

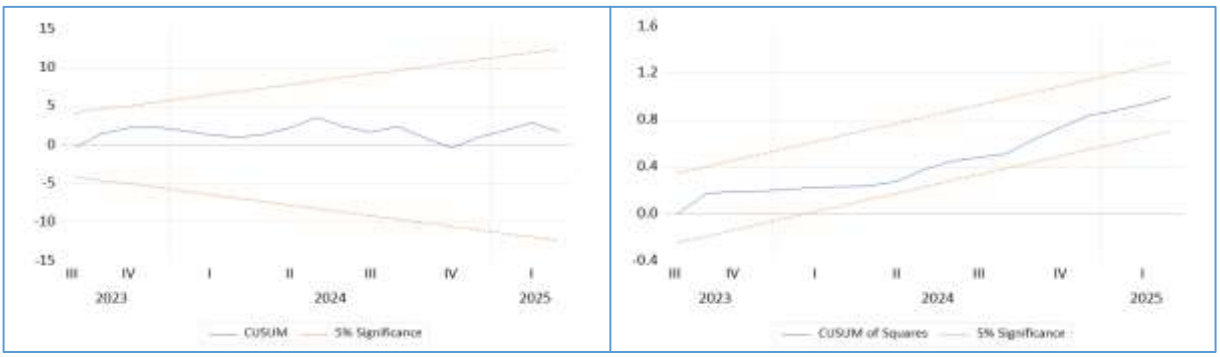


Figure 1: CUSUM and CUSUM squared test

*Source:* Eview 12.

Table 7: Robustness tests

| Regressor | FMOLS | CCR |
|---|---|---|
| URE | 0.008330 | 0.012147 |
| INP | -0.043325** | -0.057319 |
| SPEI | -0.002649** | -0.003112* |
| FTP | 0.782950*** | 0.769215** |
| FX | -2.487192* | -2.248336 |
| Constant | 0.002493 | 0.002940 |
| R-squared | 0.602516 | 0.571670 |

*Notes:* ***, ** and * denote statistically significance at 1, 5 and 10 per cent, respectively.
*Source:* Eview 12.

Robustness tests with Fully Modified Least Squares (FMOLS) and Canonical Cointegrating Regression (CCR) in Table 7, continue to confirm a statistically significant and positive effect of Robusta coffee futures price (FTP), and negative impact of weather (SPEI) on domestic Robusta coffee price (DOP) with high R-squared values (0.6025 in FMOLS and 0.5717 in CCR). In particular, the international benchmark price (INP) and exchange rate (FX) are found significant in the FMOLS model (-0.043325 with $p < 0.05$; and -2.487192 with $p < 0.1$, accordingly) but lose significance in the CCR model.

## 5. Discussion

The analysis of domestic Robusta coffee price volatility in Vietnam highlights a complex interplay of factors contributing to fluctuations in domestic Robusta price. To be precise, domestic coffee prices exhibit significant volatility which are strictly integrated with Robusta coffee futures and weather conditions, while there is no evidence on the impacts of changes in Urea price, international coffee price and exchange rate on domestic Robusta coffee's price volatility in Vietnam.

*Firstly,* changes in Robusta coffee futures price have a strong and positive impact on domestic Robusta coffee's price volatility in Vietnam. This finding strongly aligns with theoretical perspectives on the role of derivative markets in price discovery, suggesting that futures markets function as a primary channel through which price information is revealed, while speculative activities may amplify fluctuations in the spot market. This is totally consistent with conclusions of Wulandari et al. (2019) and Dang et al. (2020). As the only commodity exchange licensed by the Ministry of Industry and Trade, the Mercantile Exchange of Vietnam (MXV) is directly connected to more than 20 international commodity exchanges, including the Intercontinental Exchange (ICE) where Robusta coffee futures are listed. Large companies such as Simexco, Intimex, Tin Nghia, and Vinh Hiep frequently adopt short hedge positions in coffee futures contracts to manage exposure. Although the overall utilization of hedging remains limited, efforts by the Ministry of Agriculture and Rural Development and coffee association VICOFA to promote hedging knowledge and training among enterprises and farmers are increasingly evident. This growing institutional support may help explain why domestic Robusta coffee prices are strongly influenced by ICE futures prices.

*Secondly,* weather conditions have a negative impact on Robusta coffee's domestic price in Vietnam. This finding supports conclusions of Smith et al. (2020) that climate disruptions lead to a decrease in productivity, and also an increase in pests and plant diseases, causing uncertainty in the coffee price, as well as findings shown by Pham et al. (2019) and Dinh et al. (2022) on the impact of climate change on coffee output in the Central Highlands. In fact, dry weather conditions (lower SPEI) reduce coffee productivity, leading to a narrowing of domestic supply and pushing prices up. On the contrary, favorable weather conditions (higher SPEI) can stabilize output, reducing price pressure. Since 2023, the Central Highlands has experienced extreme weather conditions driven by the El Niño phenomenon. A severe rainfall deficit combined with prolonged high temperatures has caused widespread drought, leading to flower drop and reduced fruit set. As a result, Robusta coffee production in the 2023-2024 crop year declined by 10-20 per cent compared to previous years. This supply shortage, coupled with steady global demand, significantly pushes up both domestic and export prices of Robusta coffee.

*Thirdly*, there is no evidence on the impacts of fluctuations in Urea price, international coffee price and exchange rate on domestic Robusta coffee's price volatility in Vietnam. This finding does not support the cost-push inflation theory arguing that increases in input costs such as urea fertilizer leads to higher prices, the law of one price and international price transmission stating that domestic prices are aligned with international benchmarks, and the purchasing power parity suggesting that exchange rate changes affect domestic Robusta coffee's price. Similarly, research results are totally different from conclusions of Nguyen and Do (2015), Dang et al. (2020), and Nguyen and Trinh (2019) about the role of fertilizer usage, international coffee prices, and exchange rate, respectively. In fact, during the period from January 2023 to March 2025, domestic Robusta coffee prices in Vietnam were set by internal market fundamentals, particularly physical availability and purchasing competition among traders. An increase in domestic Robusta coffee prices was primarily driven by a severe supply shortage caused by prolonged drought and declining

yields in the Central Highland. Moreover, domestic purchase prices are mainly determined by referencing ICE Robusta futures prices, with adjustments for local factors such as bean quality and logistics costs.

## 6. Conclusions

By analyzing monthly data on the domestic price of Vietnam Robusta coffee through the Autoregressive Distributed Lag (ARDL) approach, this study shows a positive effect of weather conditions, futures prices on the domestic price risk of Vietnam Robusta coffee from January 2023 to March 2025 but there is no evidence on the impact of Urea fertilizer price, international coffee price, and exchange rates on domestic price of Vietnam Robusta coffee. This research potentially has important theoretical and practical contributions. In terms of theory, this paper provides support for theoretical perspectives on the role of derivative markets in price discovery by giving evidence of a positive effect of futures prices on the domestic price volatility of Vietnam Robusta coffee. As regards practical aspects, the results of this study have implications for policy makers, and coffee producers. For policymakers, developing early warning systems based on real-time climate data is vital to help soft commodity producers manage risks proactively. For producers, access to agricultural insurance and contract farming can reduce income volatility, while improved access to market, climate, and consumer information can strengthen their resilience. In the face of climate change and global integration, equipping farmers with risk management tools is essential for the coffee sector's sustainable development.

However, the study has certain limitations. Firstly, this study is constrained by limited temporal and spatial data coverage, which restricts the generalizability of its policy implications. Additionally, future research should integrate socio-political and trade-related variables to construct a more comprehensive framework for analyzing price risk in the coffee sector. These enhancements would offer both academic insights and practical guidance for long-term policy and business strategy development.

## References


Bunn, C., Läderach, P., Rivera, O. O., & Kirschke, D. (2015). A bitter cup: Climate change profile of global production of Arabica and Robusta coffee. *Climatic Change*, *129*, 89-101. https://doi.org/10.1007/s10584-014-1306-x

Dana, J., Gilbert, C. L., & Shim, E. (2018). Hedging agricultural commodity price risk in developing countries. *United Nations Conference on Trade and Development (UNCTAD)*. https://econpapers.repec.org/scripts/showcites.pf?h=repec:trn:utwpde:0819

Dang, T. T., Zhang, C., Nguyen, T. H., & Nguyen, N. T. (2020). Assessing the influence of exchange rate on agricultural commodity export price: Evidence from Vietnamese coffee. *Journal of Economics and Development*, *22* (2), 297-309. https://doi.org/10.1108/JED-02-2020-0014

Dinh, T. L. A., Aires, F., & Rahn, E. (2022). Statistical analysis of the weather impact on Robusta coffee yield in Vietnam. *Frontiers in Environmental Science, 10,* 820916. https://doi.org/10.3389/fenvs.2022.820916

Hoang, V. H., & Dang, V. M. (2017). Research on coffee value chain in Kon Tum Province. *Journal of Science and Technology, University of Danang, 2*(111), 6–11. https://jst-ud.vn/jst-ud/article/view/7444

Luong, M. T., & Thai, A. H. (2024). The impact of socio-economic factors on the income of coffee growing households in Dak Doa District, Gia Lai Province. *Tay Nguyen Science Journal, 18*(2), 85–92. https://doi.org/10.5281/zenodo.12704144

Nguyen, T. T. V., & Trinh, T. T. D. (2019). The impact of exchange rate volatility on exports in Vietnam: A bound testing approach. *Journal of Risk and Financial Management*, 12 (6). https://doi.org/10.3390/jrfm12010006

Nguyen, V. M., & Do, T. N. (2015). Effects of compound fertilizer on growth, yield and economic efficiency of Robusta coffee in basalt soil of Dak Lak Province. *Vietnam Journal of Agricultural Science, 7,* 1–9. https://vjol.info.vn/index.php/hvnn/article/view/31569

Nguyen, V. P., & To, T. K. H. (2014). Testing cointegration between Vietnam's coffee export price and world coffee price during the period from 2008 to 2014. *Ho Chi Minh City Open University Journal of Science, 9*(2), 80–87. https://vjol.info.vn/index.php/DHM-KTQTKD/article/view/57027

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289–326. http://www.jstor.org/stable/2678547

Pham, Y., Reardon-Smith, K., Mushtaq, S., & Cockfield, G. (2019). The impact of climate change and variability on coffee production: A systematic review. *Climatic Change, 156*(4), 609–630. https://doi.org/10.1007/s10584-019-02538-y

Silveira, G. M., Lima, J. E., Alves, M. C., & Burnquist, H. L. (2017). Effects of crop reports and speculative trading on the volatility of coffee futures contracts. *Emerging Markets Finance and Trade, 53*(10), 2272–2287. https://doi.org/10.1080/1540496X.2016.1205976

Tiemann, T., Aye, T. M., Dung, N. D., Tien, T. M., Fisher, M., de Paulo, E. N., & Oberthür, T. (2018). Crop nutrition for Vietnamese robusta coffee. *Better Crops, 102* (3), 20-23. https://doi.org/10.24047/BC102320

UNCTAD. (2019). Trade and Development Report 2019. https://unctad.org/publication/trade-and-development-report-2019

United States Department of Agriculture. (2024). Coffee: World markets and trade. USDA Foreign Agricultural Service. https://www.fas.usda.gov/sites/default/files/2024-12/coffee.pdf

Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multi-scalar drought index sensitive to global warming: The standardized precipitation evapotranspiration index (SPEI). *Journal of Climate, 23*(7), 1696–1718. https://doi.org/10.1175/2009JCLI2909.1

Wulandari, A. E., Harianto, H., Arifin, B., & Suwarsinah, H. K. (2019). The impact of futures price volatility on the spot market: Case of coffee in Indonesia. *Jurnal Organisasi dan Manajemen, 15*(1), 1–15. https://doi.org/10.33830/jom.v15i1.5.2019

Xie, J., Kinnucan, H. W., & Myrland, Ø. (2008). The effects of exchange rates on export prices of farmed salmon. *Marine Resource Economics, 23*(4), 439–457. https://doi.org/10.1086/mre.23.4.42629462